

Groundwater Quality

Key points

- * The temperature and electrical conductivity of water is being used to refine understanding of surface water groundwater interaction
- * The focus is the recharge mechanism of the Wairau Aquifer
- * Hydrological research over the next 2 years is aimed at identifying whether Wairau River losses to groundwater vary with channel flow
- * Preliminary results indicate the way in which the Wairau River loses water to the Wairau Aquifer is complex
- * A long term objective is real time knowledge of the Wairau Aquifer recharge rate for management purposes
- * Geochemical indicators may play a part in this application

Why do we monitor groundwater quality?

Marlborough District Council monitor the quality of our underground water resources by taking seasonal samples at a fixed network of wells representing the main aquifers. The prime aim is to identify regional scale trends in groundwater quality, especially those that may affect human health. Monitoring the chemistry of groundwater also helps understand the mechanics of Marlborough aquifers and

assists with refining management limits. This years state of the environment score card focuses on the initial geochemical results from the Conders recharge array which are being used to identify the factors controlling Wairau Aquifer recharge.

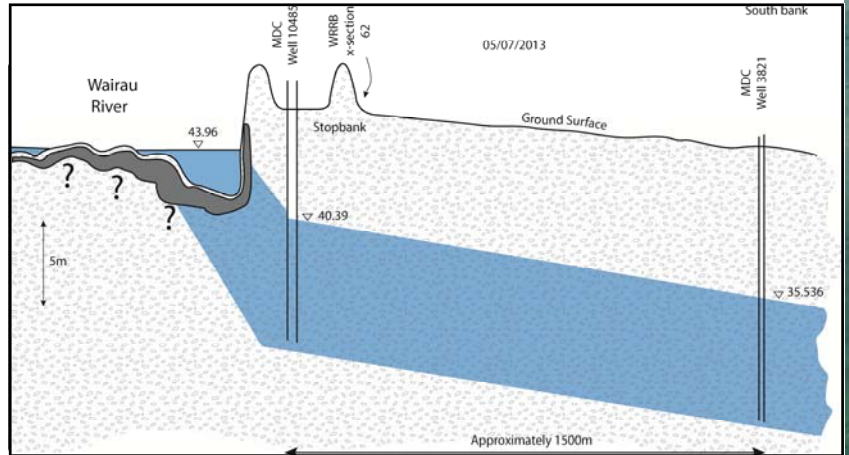


Figure 1 : New Conders Recharge Well

What are the priority issues and work projects?

Understanding which factors most influence the recharge process is more pertinent now than ever before. The Wairau Aquifer is fully committed with demand probably higher than it has historically been. There are signs of changes in the natural recharge rate, but it isn't clear whether this is due to human activities which can be managed, or natural processes. Research aimed at resolving this question is planned or underway.

The Conders recharge array of wells in the principal recharge area at Conders north-west of Renwick will provide much of the information. MDC drilled a new well close to the Wairau River in 2013 to observe the effect of floods on groundwater recharge rates (Figure 1 and red dot in Figure 2). Instruments measure groundwater level, temperature and conductivity which are compared with those of Wairau River water and groundwater at the longstanding MDC Conders well further away from the channel (blue dot in Figure 2).

Meaningful results won't be available until there are just periods of only rainfall, or a Wairau River flood affecting groundwater so the drivers of aquifer recharge can be isolated.

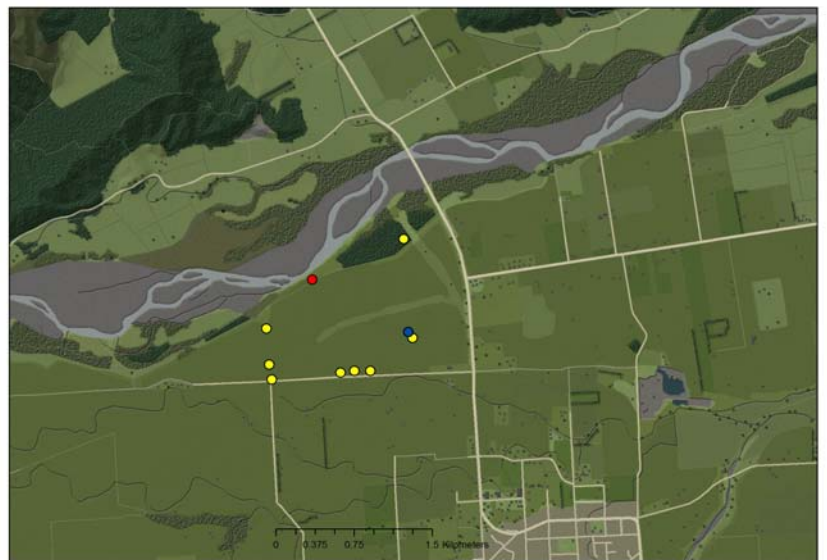


Figure 2 : Conders Recharge Array Wells

What other work is in progress?

MDC have established 3 new Wairau River flow sites to simultaneously measure losses to groundwater for medium sized floods. These sites at Wratts Road, SH6 and Rock Ferry will add to the existing Tuamarina site. Differences in flow will indicate where losses are occurring in real time, and most importantly whether they vary with Wairau River flow as this has implications for water management.

Wairau River flood flows dilute the concentration of dissolved solids which reduces the conductivity of river water. This happens instantaneously and the bigger the flow, the larger the fall in conductivity (Figure 3). River water conductivity is also lower in higher flow months than drier seasons for the same reason. (Figure 4).

What have we learnt?

The groundwater response at the Conders well 1.5 kilometres inland from the channel is more complicated. There is a rapid rise in groundwater conductivity but while coincidental, the cause is likely to be local rainfall leaching soil based materials to the water table which increases conductivity for a short time (Figure 5).

It is thought there is a base groundwater conductivity that varies slowly due to the moderating effect of aquifer storage. There is a time delay of months between peak temperatures in the river and groundwater, and a lag is likely to affect conductivity (Figure 6). Superimposed on top of this are short term fluctuations in conductivity.

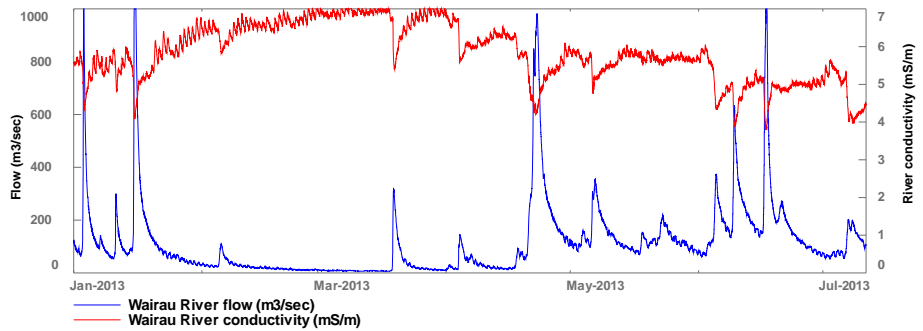


Figure 3 : Wairau River conductivity versus flow

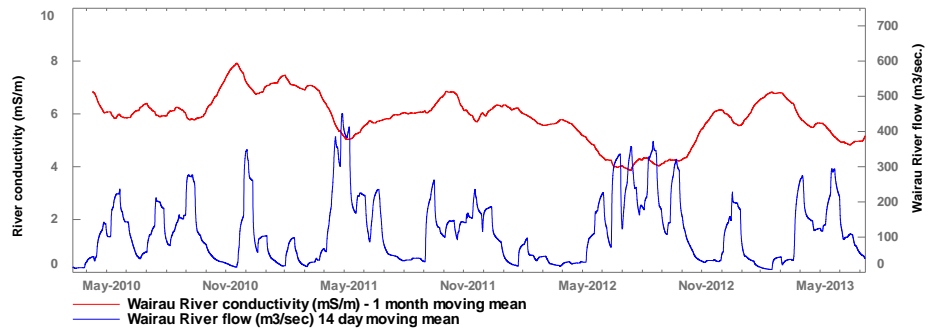


Figure 4 : Wairau River seasonal flow versus conductivity

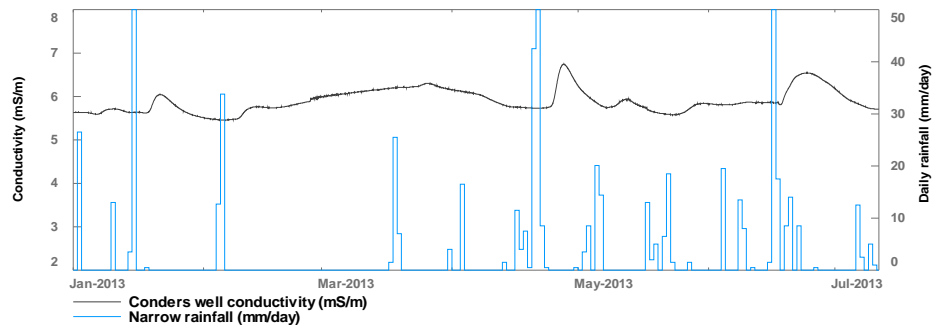


Figure 5 : Rainfall versus groundwater conductivity

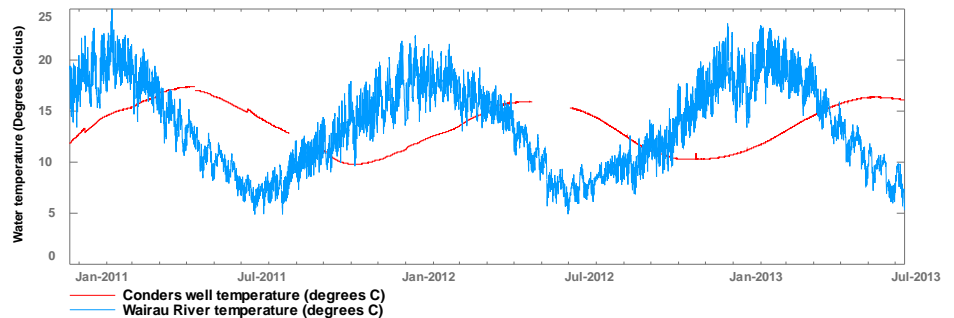


Figure 6 : Temperature lag

What is planned for the future?

MDC will measure groundwater temperature at the recharge array wells in contrasting seasons to map the incursion of the river recharge plume. In winter this will represent colder Wairau River water with a warmer anomaly in summer. Wells will also be sampled for the gas argon to further delineate the recharge plume. Results will be reported to MDC over the next 2 years as they come to hand or firm conclusions are reached.

For more information on Groundwater Quality go to

www.marlborough.govt.nz

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