COMMUNITY & PROJECT PARTNERS

The Hinds Drains Working Party (HDWP) recommended the concept of a Hekeao/ Hinds MAR trial in their 2016 report to the AZC. Their membership includes Te Rūnanga o Arowhenua, Fish & Game, Forest and Bird, the Department of Conservation and local landowners. The AZC appointed a MAR Working Group and then MAR Governance Group to initiate the trial. In 2019, The Hekeao Hinds Water Enhancement Trust (HHWET) was formed to lead the trial from pilot to catchment scale. HHWET Trustees are appointed by Te Rūnanga o Arowhenua, Fish & Game, Environment Canterbury, Ashburton District Council, Hinds Drainage District, MHV Water, RDRML, Federated Farmers, Ashburton District irrigation companies, and the Ashburton Community. Funding contributions and specialised technical support have been provided by project partners including Provincial Growth Fund, Ministry for Primary Industries, Environment Canterbury, Rangitata Diversion Race Management Ltd, Ashburton District Council, MHV Water Ltd, Barrhill Chertsey Irrigation Ltd, Eiffelton Community Group Irrigation Scheme, Lincoln Agritech, WGA NZ, Fish and Game, Canterbury District Health Board, Tarbottons Contractors, and Carrfields Irrigation Ltd.

For more information about the Hekeao/Hinds MAR trial please visit www.hhwet.org.nz

FIGURE 4 – SOUTH HINDS RIVER (CENTRE), HEKEAO / SOUTH HINDS NEAR RIVER RECHARGE (LEFT), WITH SUPPLY VIA RANGITATA DIVERSION RACE (BACK RIGHT)

HEKEAO / HINDS MANAGED AQUIFER RECHARGE

INTRODUCTION

In the Ashburton District, water infrastructure (e.g., the Rangitata Diversion Race) and irrigation development has enabled world-leading agriculture and strong economic growth. However, a consequence of this activity has been declining water quality (e.g., nitrate-N and pathogens). Nitrate – N concentrations in excess of the NZ Drinking Water Maximum Acceptable Value (MAV) have been measured in Hekeao / Hinds Plains groundwater since the mid-1980s, with both shallow and deep groundwater concentrations increasing since this time (Figure 1). Since 2010, the Canterbury Water Management Strategy has enabled a collaborative process to rehabilitate and enhance ground and surface water eco-systems through an integrated approach and time-bound targets.

WHAT IS MAR?

Aquifer recharge happens both naturally and artificially every minute of every day and is the reason aquifers and spring- fed waterways exist at all. Recharge from rainfall, rivers, unlined water races and canals, and irrigation activities all act to continually recharge groundwater. These kinds of recharge lead to increases in water levels and act to influence the quality of water in the aquifer. Managed Aquifer Recharge (MAR) is the purposeful recharge of specifically clean water into an aquifer to both rehabilitate and enhance these natural processes. The aims of the Hekeao/Hinds MAR trial are to:

- Enhance groundwater quality (with particular emphasis on protecting drinking water supplies);
- Improve baseflows to spring-fed streams and rivers for ecological, cultural and social values; and
- Improve and sustainably manage groundwater storage (levels).

THE GOAL

Through Plan Change 2 to Canterbury's Land and Water Regional Plan the Ashburton Zone Committee (AZC) has proposed a combination of nutrient leaching reductions (36% by 2035), Farm Environment Plans, management of irrigated area and abstraction, and MAR to meet their target of median annual shallow groundwater nitrate-N concentrations < 6.9 mg/l by 2035.

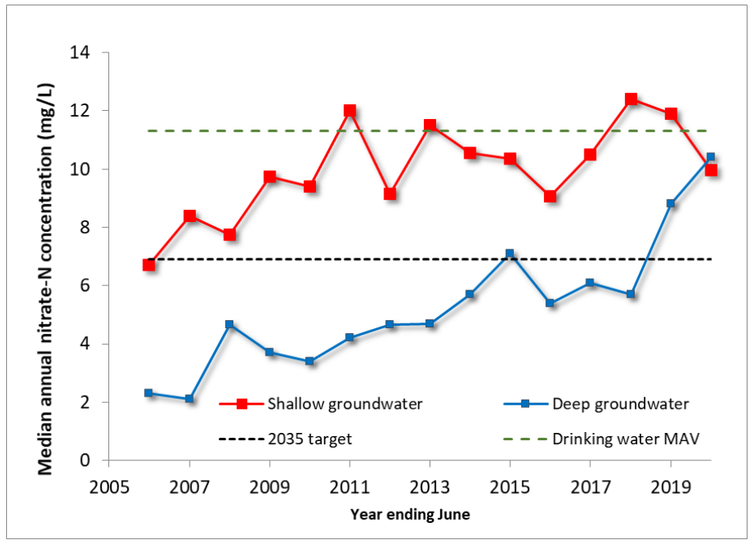

FIGURE 1 - HEKEAO / HINDS PLAINS MEDIAN ANNUAL NITRATE-NITROGEN CONCENTRATIONS

HEKEAO/HINDS PLAINS & MAR SITES

The Hekeao / Hinds Plains lie between the Ashburton River to the north and the Rangitata River to the south (Figure 2). It has degraded groundwater quality with areas of high nitrate concentration. In addition, the catchment has long-term declining groundwater levels and coastal spring-fed drain flows. These are attributed to a combination of irrigators moving to more efficient irrigation systems, a reduction in the amount of unlined stockwater races, increases in groundwater pumping and changing weather patterns. MAR is intended to help the natural recharge processes (rainfall and river recharge) to manage the overall water balance for the catchment and improve groundwater quality.

The Lagmhor Pilot Trial Site was constructed in 2016, utilising a forebay to drop out suspended sediment plus deep soakage enhancements in the recharge basin to test MAR operational performance concepts. A further 17 sites have been constructed since this time to test the performance of a variety of MAR concepts including basins connected to on-farm irrigation ponds, basins installed in lateral races, buried slotted pipes and near river recharge (Figure 2). Near River Recharge (NRR) is a form of MAR that focusses on the leaky gravels near (but not in) a natural river system. The Hekeao / South Hinds NRR site is supporting the upper river system as well as a Kōwaro / Canterbury mudfish wetland, native wetland plant regeneration and lizard habitat.

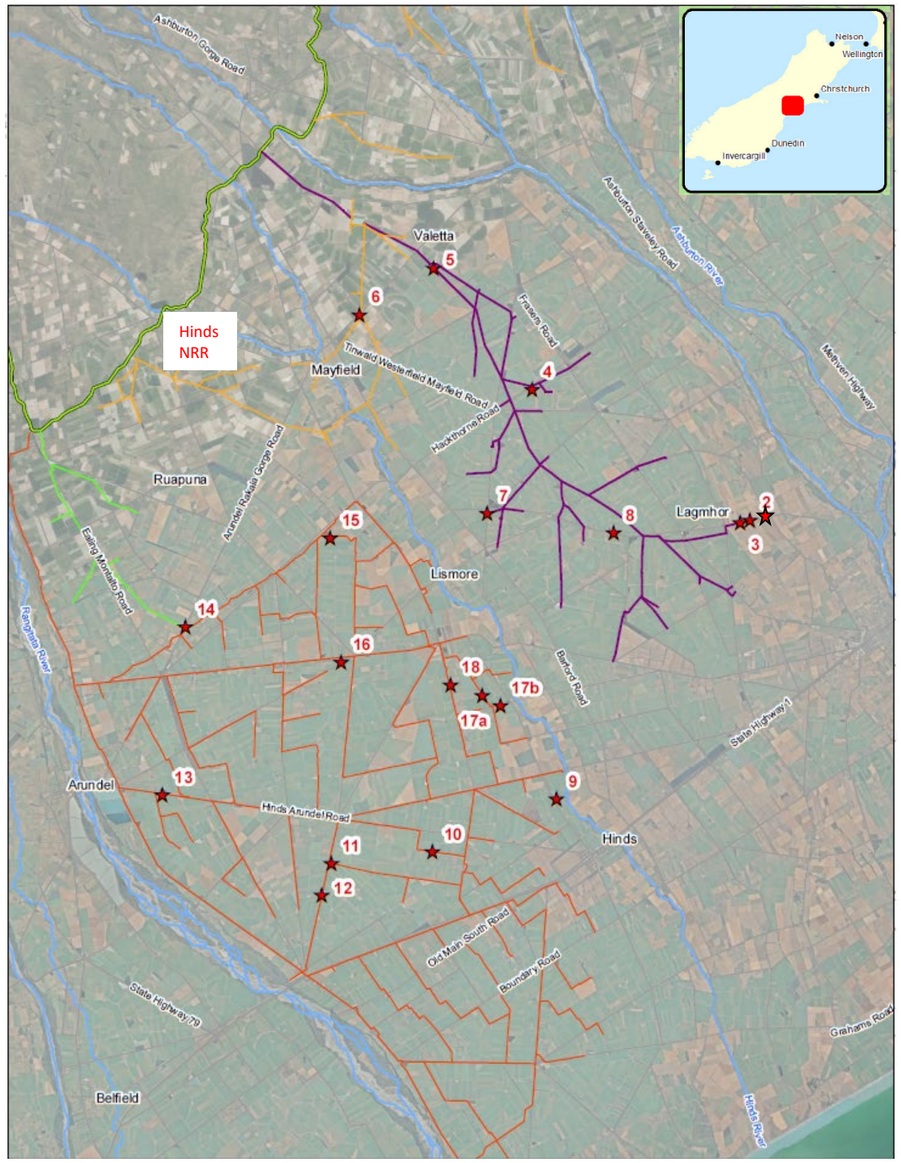

FIGURE 2- HEKEAO/ HINDS PLAINS AREA AND MAR SITES

MAR TRIAL RESULTS – FIRST FOUR YEARS

The MAR Trial has run successfully since June 2016. MAR water has been shown to significantly accelerate groundwater rehabilitation by increasing hydraulic gradient (and therefore groundwater speed) as well as by displacing immediately down-gradient groundwater and progressively mixing with surrounding groundwater further down-gradient. These results suggest that rehabilitation at a catchment scale is possible within a generation if the number and capacity of MAR sites is increased along with other PC2 rehabilitation measures. No alternative to MAR for meeting this objective has been identified.

Figure 3 provides an example of the MAR influence on down-gradient groundwater. Recharge flows (in hundreds of litres per second) are shown in yellow, with maximum recharge of approximately 140 l/s and significant periods in recent years of no recharge (due to supply constraints or prioritisation of available flow). Measured Nitrate-N concentrations are shown in purple, with an in-situ continuous nitrate-N sensor (in green) providing detailed monitoring until late 2019. This record shows nitrate-N at 6-7 mg/l immediately pre-MAR, reducing to 1.3-3.5 mg/l with MAR. Concentrations exceed 3 mg/l after a period of no MAR, but quickly drop back to below 3 mg/l once MAR resumes. Groundwater levels are presented in dark blue, with an 18 m increase in groundwater level once MAR began and reasonably quick level changes when MAR begins or stops. The down-gradient distance of measurable MAR influence depends on the amount of MAR and down-gradient aquifer properties. For the Pilot Site with recharge flows of approximately 100 l/s, water quality and level improvements have been measured 6-8 km down-gradient.

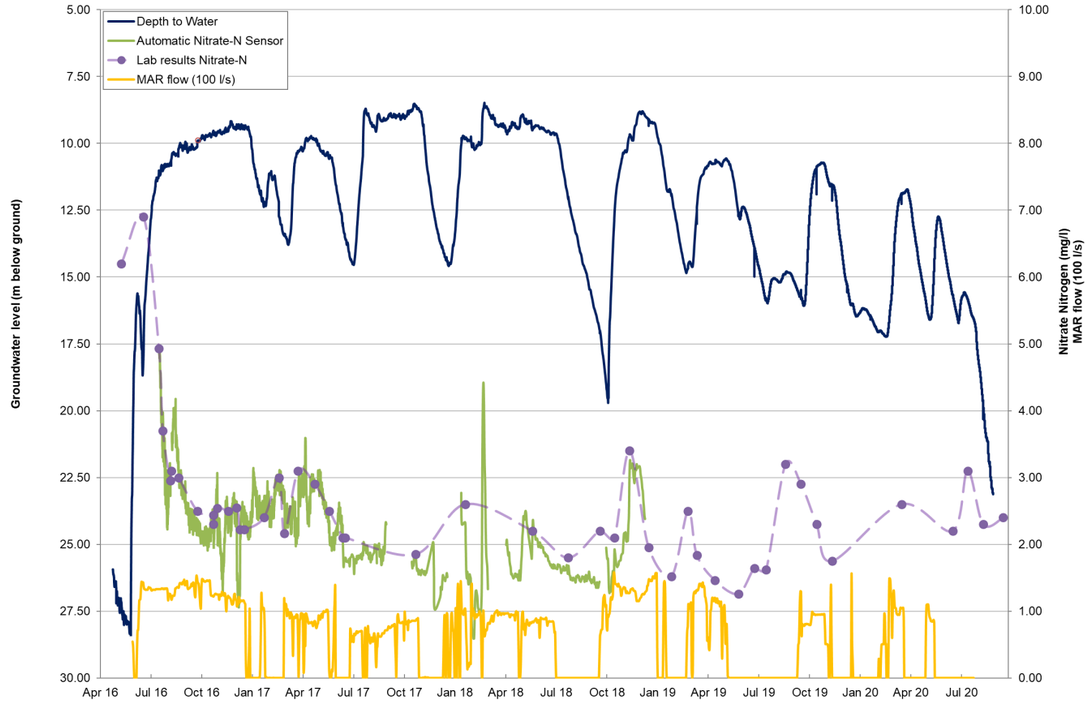

FIGURE 3- MAR Pilot Site recharge and bore BY20/1052 monitoring (1 km down-gradient)

NEXT STEPS

Significantly increased monitoring in the last year is enabling the targeting of MAR sites and flow to the areas of highest nitrate-N concentration. This will reduce MAR scale and cost while increasing overall rehabilitation and enhancement rate. Decreasing background concentrations from improved on-farm nutrient management will take many years to show up in most groundwater monitoring wells due to slow particle travel, but once this is detected the MAR component can be proportionally reduced (at least for water quality purposes). Current planning remains focussed on the PC2 2035 goals, though this may change as a result of progress reviews or externalities (e.g., MfE Essential Freshwater package implementation).