Cotton Catchment Communities CRC

Queensland Murray Darling Committee Inc.

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Groundwater Knowledge and Gaps in the Queensland Murray Darling Committee Area

Border Rivers, Moonie and Lower Balonne catchments

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Executive Summary

This report covers the Border Rivers, Moonie and Lower Balonne catchments in the Queensland Murray Darling Committee, Inc., (QMDC) management area with the focus of determining priority groundwater projects. There are three major alluvial groundwater management issues in the QMDC management area. In the east the Dumaresq River is highly connected to the alluvial aquifers which are used for groundwater extraction by the irrigation sector. The groundwater model that covers these alluvial aquifers, and which was used as part of informing the water allocations between NSW and QLD, needs to be updated. There is new information in the form of longer hydrograph records, better understanding of river aquifer interactions, longer river flow records and new approaches to catchment water balance modelling that can all be integrated to give a better catchment water balance model for input into groundwater management decisions. The main issue for the irrigation industry is that overuse of groundwater from the Dumaresq River alluvia may influence river flows, including water released for downstream users.

In the west of the catchment from Goondiwindi to Mungindi, the irrigation districts overlie highly saline water at reasonably shallow depth. While the river irrigation water is of very good quality the shallow underlying aquifers are highly saline (approaching sea water salinity levels) and sometimes acid. Very little is known about how the deep drainage under the irrigated crops is affecting the shallow water table. Areas upslope of the alluvia, where red soils are used for dryland cropping, are also a potential source of groundwater discharge into the alluvia. There is considerable potential for the mobilisation of the saline groundwater if the deep drainage is not controlled.

In the far west of the QMDC management area the Lower Balonne region has been extensively investigated in recent years by the Cooperative Research Centre for Landscape Environments and Mineral Exploration (CRC LEME) and the Queensland Department of Natural Resources and Water (NRW). These projects have recorded extensive hydrogeological, geophysical and water quality data that have been integrated in a 3D geological model by Geoscience Australia using GOCAD (Ken Lawrie, personal communication). This model and its associate data are not in the public domain so it is not reviewed as part of this report. Efforts should be undertaken to place more information from the GOCAD model into the public domain so that visual and numerical outputs from the model can inform the debate about water management in the Lower Balonne region. All these data in a 3D visual environment should provide the ideal medium to illustrate the hydrogeology and the interconnection between surface and ground water. The 3D model should be used to convey to the wider community the complexity of the water dynamics of the area, and to help inform allocation and environmental management decisions.

Given the recent extensive work in the Lower Balonne, it is suggested that the focus should shift to other regions and similar scales of investigation to that done in the Lower Balonne be undertaken in order to generate similar quality baseline hydrogeological data.

Listed below are recommended projects that will advance our scientific understanding of the Dumaresq River catchment water balance.

- Update the Dumaresq River catchment water balance model.

  Current groundwater models which are used as part of the sustainable groundwater yield estimates are created using MODFLOW (MODular Groundwater Flow Model). This software does not model surface water inputs comprehensively. IQQM (Integrated Quantity Quality Models), which is used for surface water estimates, does not model groundwater contributions sufficiently. The two modelling approaches also use different time scales and have different grid/node resolution over the regions of interest, thus the outputs from one package do not link seamlessly with the other.

Given the highly coupled nature of the river and aquifers in the Dumaresq River catchment it is recommended that one of the newer fully coupled surface and ground water modelling environments be applied in this region. Queensland NRW has already applied a more comprehensive coupled surface and ground water modelling approach using MODHMS in coastal regions. This style of modelling needs to be applied in the Dumaresq River catchment.

- Compare cumulative rainfall departure data with NRW monitoring bore hydrographs.

  A comprehensive statistical analysis is needed comparing rainfall trends to groundwater behaviour. This is needed to isolate natural fluctuation from anthropogenic influences.

- Record deep drainage at the shallow water table using data loggers.

  Better estimates of deep drainage (both under irrigation and in native vegetation areas) are needed and deep drainage needs to be incorporated into regional surface and ground water models. We need to know how much water reaches the shallow groundwater systems and how much then reaches the deeper aquifers that are used for irrigation.

- Incorporate the recent Bureau of Rural Science (BRS) Border Rivers surface and ground water interaction survey results into the regional water balance models.

  The results of the BRS river aquifer interconnected investigation being undertaken by Baskaran, Ransley and Brodie will shortly be published. This research aims to improve our understanding of the interaction between rivers and the underlying aquifers and to quantify the success of various methods for monitoring the coupling between rivers and aquifers. Once released, this information needs to be integrated into future catchment management research.

- Measure the water chemistry, both major ions and isotopes, to explore the interaction between the Great Artesian Basin (GAB) and alluvial aquifers.

  Additional monitoring wells are needed near the Marburg Sandstone to help improve the understanding of the alluvial aquifer interaction with the GAB. This would improve the water balance modelling in this region as the link with the GAB had limited control in the present groundwater model.

- Incorporate farmer recorded rainfall data into water balance models.

  The rainfall gauging network used by the Bureau of Meteorology for recording rain is too coarse, resulting in substantial uncertainty in the rainfall contribution to catchment scale water balance modelling. Incorporating reliable farmer recorded rainfall data into regional water balance models could help reduce this uncertainty by improving the spatial information, providing qualitative and potentially quantitative information on localised storm events.

For the Border Rivers-Moonie catchments, in order to better model the impacts of deep drainage under irrigated crops and the potential for the mobilisation of shallow saline groundwater the following suggestions are given:

- Increase the number of groundwater monitoring wells.

  There are too few monitoring wells to accurately understand where and how the groundwater systems are recharged and where the water is migrating. There needs to be a series of monitoring wells placed in transects near the Barwon and Weir Rivers. Transects of monitoring wells are also needed near irrigated crops (ideally some monitoring boreholes should be placed in the centre of irrigated fields). Data loggers which record daily water levels and quality information are needed in these monitoring wells.

- Measure the major ion chemistry and relevant isotopes in all monitoring wells.

  The chemistry is needed to understand the migration and interaction of the groundwater with other water systems. It is also required to quantify the scale of any impacts if the saline water is mobilised.

- Undertake land geophysical surveying using a combination of frequency domain EM38, EM31 and EM34 or time domain TEM surveys.

  The geophysical surveys are important because the area to be investigated is vast, so it is difficult to know how representative the borehole locations are with respect to soil conditions and water quality. Calibrated geophysical surveys would allow the groundwater conditions to be monitored between the boreholes.

- Incorporate farmer recorded rainfall data into water balance models.

  The rainfall gauging network used by the Bureau of Meteorology for recording rain is too coarse, resulting in substantial uncertainty in the rainfall contribution in catchment scale water balance modelling, and especially deep drainage recharge over the wider catchment area. Incorporating reliable farmer recorded rainfall data into regional water balance models would reduce this uncertainty.

- Compare cumulative rainfall departure data with NRW monitoring bore hydrographs.

  A comprehensive statistical analysis is needed comparing rainfall trends to groundwater behaviour. From this analysis index maps can be developed to determine where aquifer behaviour is in or out of sync with respect to prevailing climatic conditions.

- Couple the groundwater chemistry to the groundwater flow modelling.

  To better understand the migration of zones of saline groundwater towards the fresh water zones the water chemistry needs to be coupled to the groundwater flow models.

- Improved surveying of the land surface, stream incision and the monitoring bores is needed.

  In order to model the influence of the groundwater on the land surface and the streams, the landscape, rivers, weirs and boreholes all need to be accurately surveyed. The lack of high resolution survey data was a major limitation encountered by Whiting (2007) when trying to build a MODFLOW model of the region.

- Incorporate the recent BRS Border Rivers surface and ground water interaction survey results into the regional water balance models.

  In the west of the catchment the Barwon/MacIntrye River is largely disconnected from the aquifer but there are some intervals that are connected. Understanding where the groundwater is discharging into the rivers is critical for understanding if the mobilisation of the saline groundwater will influence the river water quality to any significant extent.

- Explore the reuse of deep drainage water.

  In areas where the shallow groundwater is rising due to deep drainage, the re-use of the water could be explored. This assumes the shallow water is not too saline and the quantities are economically viable. This is a low priority.

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