

PART 2: Answers provided by Dr Peter Dillon and Dr Wendy Timms to the supplementary questions

Supplementary Questions to the International Association of Hydrogeologists

1. In your submission you say NSW is behind the rest of Australia when it comes to Managed Aquifer Recharge. What should NSW be doing over the next five years to assess Managed Aquifer Recharge as a viable water source for NSW communities?

The three essential actions are for mapping of MAR opportunities, investing in demonstration projects, and in providing a regulatory regime that enables MAR to contribute to water supply and water security within the framework of water allocation plans.

Firstly, mapping of Managed Aquifer Recharge (MAR) opportunities is warranted for all areas where water supplies need expanding or securing. This would normally be a role for a state government water resources management department. For the Broken Hill Water Supply this has already been done by Geoscience Australia. Such mapping is needed for locations where water supplies are impacted by drought, changing climate and changing demand for water, due to new industries, agriculture or urban demand. It needs to consider and map the sources of water available for recharge, such as rivers, urban stormwater, wastewater treatment plants, and associated water produced by extractive industries. It also needs to map the hydrogeology of the areas considered, in order to determine the suitability of aquifers to receive and store water and the ambient groundwater quality. (Fresh water can be stored in fresh and even brackish aquifers and recovered, but highly saline aquifers are unsuitable.) Most of the hydrogeological facets have already been mapped but relevant composites are not yet assembled. Such maps would help establish the viability of projects before proponents commence investigations and demonstration recharge projects commence.

Localised efforts in NSW have included an assessment of Hawkesbury- Upper Nepean area adjacent Sydney (Dillon, *et al* 2004; and Parsons *et al* 2006), and a study of the NSW Central Coast (Molloy *et al* 2009). <http://www.clw.csiro.au/publications/waterforahealthycountry/2009/wfhc-MAR-policy-design-milestone3.3.1.pdf> However these cover only a tiny fraction of the state that is unrepresentative of most of rural NSW and approaches to mapping have subsequently improved.

Secondly there is a need for demonstration MAR projects of various types to enable experience in design, operation, monitoring and governance. Experience in the rest of Australia has shown that government run projects give government agencies greater appreciation of technical and governance issues, so that when water utilities, industry, farmers or farmer collectives take it up, there is confidence that agencies have the technical skills to understand and regulate operations and the economic outcomes of demonstration projects give confidence to future proponents. A Broken Hill MAR scheme at the well-studied Talyawalka site would be an excellent example. MAR projects for inland areas of water stress have also been proposed for the Namoi and Mooki Rivers for example. A pre-feasibility study for managed aquifer recharge in Sydney coastal aquifers, including the Botany catchment, has identified opportunities summarised in this paper.

http://www.connectedwaters.unsw.edu.au/sites/all/files/Badenhop_Timms_2009_IAH_Symposium_MAR_in_Sydney_Coastal_Sand_Aquifers.pdf

<http://www.connectedwaters.unsw.edu.au/research/projects/managed-aquifer-recharge-botany-aquifer>

In 2007 the University of NSW campus at Kensington implemented a stormwater recharge scheme in part of the Botany aquifer. <https://newsroom.unsw.edu.au/news/pit-makes-splash> Note that this early project does not meet the requirements of the 2009 Australian Guidelines for Managed Aquifer Recharge, as there was no risk assessment undertaken and no monitoring was planned or is undertaken to assure aquifer protection.

Thirdly, there is a need for a regulatory regime that provides appropriate investment incentives, such as providing high security water entitlements for those who bank water in aquifers, and subject to hydrogeological constraints, the rights to transfer such water entitlements. This means embedding MAR in catchment and aquifer water allocation plans to reinforce existing objectives. A “deemed to comply apply” approach by adopting the Australian Guidelines for MAR will ensure health and environmental protection according to procedures already endorsed by NSW Government through COAG. The demonstration projects will assist NSW Government officers get up to speed on this.

2. What are the positive and negative impacts or issues relating to Managed Aquifer Recharge?

On the positive side – increased water supplies, increased water security, improved water quality, improved protection of groundwater-dependent ecosystems, aquifer restoration to higher valued uses, avoidance of saline intrusion in coastal aquifers, reducing evaporation losses and increasing productive use of water, avoidance of mosquitoes in storing water on the surface, smaller surface water dams to achieve the same water supply outcomes, and reduced costs for water supply and water security.

On the negative side – there needs to be a level of governance such as water accounting and water quality monitoring to ensure MAR operations are not having adverse impacts on other surface water users (eg depleted flows in streams need licensing as for other forms of taking surface waters), prevention of excessive recharge and extraction by multiple MAR schemes in an area that could over-pressurise an aquifer or elevate water tables to unacceptable levels, or draw down groundwater to levels that adversely impact on other users. These should all be addressed in the plan for the recharge operation and controls, monitoring and contingency plans be put in place. Similarly recharge of even high quality water into an aquifer can cause geochemical reactions or introduce contaminants that may impact on the uses of recovered water and of other users of the aquifer. Again it is the duty of care of the recharge operator to have evaluated these issues and put in precautionary measures to avoid or mitigate risk, and for the regulator to have approved those plans.

The MAR Guidelines make clear how to assess the viability and degree of difficulty and hence inform proponents of the likely costs of managing these issues. Another issue to be addressed is clogging, which only impacts on the scheme operator and increases costs, but means to address this are available and there are hundreds of documented examples where these matters have been addressed adequately and economically. Hence the negative side is normally avoided by adequate investigations, and if the costs are shown to be too high to manage the risks the project would not proceed. The IAH Commission on Managing Aquifer Recharge has a web site where resources are available. www.recharge.iah.org

Ultimately, the water supply alternative with the highest benefit-cost ratio that meets the required quantity, quality, reliability, environmental and social acceptance criteria, should be adopted. In many cases reported in literature MAR has been substantially cheaper than all other available alternatives, especially where water security is a priority, surface supplies are erratic and evaporation rates are high, or where long pipelines or desalination plants are the only other alternatives.

3. Does there need to be more mapping work conducted on aquifers in NSW?

Yes. This is answered in Supplementary Question 1.

4. Is there a difference between “groundwater replenishment” and “managed aquifer recharge”? If so, what is the difference? Are there benefits for one over the other?

These terms are sometimes used interchangeably. Managed Aquifer Recharge has the specific meaning of intentionally increasing recharge for recovery or environmental benefit. Groundwater replenishment can refer to MAR or to natural groundwater recharge. The Groundwater Replenishment Program in Perth is Managed Aquifer Recharge.