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Ms Amanda Jones
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Department of Planning, Industry and Environment
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Via email: nsw.waterstrategy@dpie.nsw.gov.au

Dear Ms Jones

RE: NSW Water Strategy

CSIRO welcomes the opportunity to provide input to the consultation process in relation to the draft NSW Water Strategy available at: https://www.industry.nsw.gov.au/water/plans-programs/strategy. Our submission attached follows recent discussions with the NSW Government and local councils in Central West and New England in relation to Managed Aquifer Recharge (MAR), water banking and related topics such as brackish groundwater desalinisation, wastewater recycling, regional water security and drought.

Over the past 20 years CSIRO has supported Australia's implementation of MAR by using alternative urban water sources (such as stormwater runoff and recycled water) for irrigation and drinking water supplies. For an overview of CSIRO's MAR research please see: https://research.csiro.au/mar/. In our submission we seek to address Priority Action 6.7 of the draft NSW Water Strategy to "Investigate and enable managed aquifer recharge" and the components of this Action described on page 122 regarding the scientific assessment of feasibility and implications of MAR. Our submission provides an overview of MAR research, including the potential opportunities that this research offers to address water security needs.

We would like to reaffirm our interest in continuing to explore opportunities for CSIRO to collaborate on the implementation of the NSW Water Strategy, particularly in relation to MAR, and options for demonstrating its feasibility and cost effectiveness to address water security needs in NSW. Specifically, CSIRO is interested in developing pilot projects in collaboration with NSW DPIE, Regional Growth NSW Development Corporation and local councils in the areas around the NSW Special Activation Precincts (Parkes and Moree). Dubbo would also be a suitable pilot site to explore.

Should you require any further information from CSIRO or wish to discuss any aspect of our submission please contact Ms Caroline Seagrove, NSW State Relationship Manager, on [redacted] or email caroline.seagrove@csiro.au

Yours sincerely

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Managed Aquifer Recharge (MAR) and water banking overview

Managed Aquifer Recharge (MAR), also known as water banking, is the term for techniques that include injection wells and infiltration basins to intentionally recharge water into aquifers for later recovery or beneficial use. MAR can support water use for environmental outcomes as well as municipal water supplies, agricultural irrigation and other industrial uses.

MAR offers the potential to assist communities with achieving water security. The principle is simple: recharge aquifers when water is cheap and plentiful, such as during periods of high rainfall, so there is a 'bank' of water to recover during drought when water is scarce and expensive. In aquifers that are depleted, that storage space for water banking already exists. This is like an underground reservoir or dam that does not need to be built, with the additional benefit that it is protected from evaporation. The use of aquifer storage to bolster groundwater resources adds resilience to communities from the negative effects of drought and reduces pressure on surface water supplies.

Since the 1990s, there has been considerable progress in MAR in Australia with stormwater and wastewater for urban water supply. See a snapshot of MAR types in Australia in 2017 in the figure below.

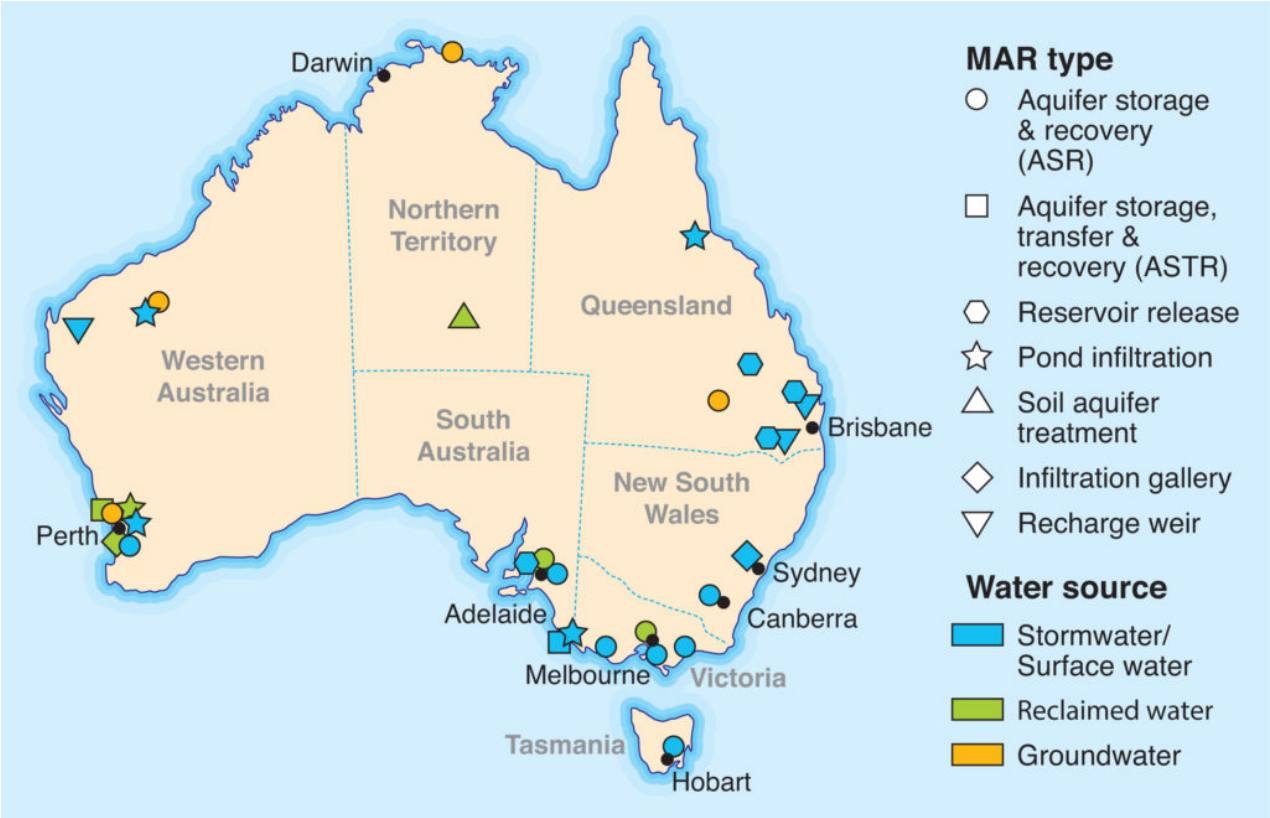

Figure 1 Snapshot of MAR in Australia in 2017. Image: CSIRO

To date, projects and results have been mostly localised in capital cities, with some more recent investigations across northern Australia as part of the Northern Australia Water Resource Assessment (https://www.csiro.au/en/research/natural-environment/water/NAWRA). Substantial progress has been

made where local governments or state water utilities have partnered with CSIRO to conduct assessments and determined that the potential benefits to water security outweighed the costs of investment. In some cases, federal government investment has been provided to deliver pioneering research focused on reducing the initial financial and technical risks associated with MAR projects.

Opportunities for NSW regional towns to implement MAR for improved water security during drought still remain to be proven and would be furthered through the establishment of successful, well documented demonstration projects. Indeed MAR could be applied as part of the NSW Water Strategy as a conjunctive approach to surface and groundwater management to ensure security of water supply for social, economic and environmental outcomes.

Some examples in regional areas in Australia exist where conjunctive use of surface water and groundwater storage projects have been successful. For example, groundwater replenishment by the Burdekin Water boards near Townsville in Queensland has been in operation since the 1960s to secure irrigation supplies predominantly for sugar cane. Another example of MAR for irrigation support of viticulture is found in the Angas-Bremer region of South Australia which has been in operation since the 1980s.

Opportunities for water banking in NSW regional areas

CSIRO research on the climate change effects of groundwater recharge has estimated substantial decline in natural groundwater recharge will occur in the future (Barron *et al.*, 2012). Generally, the percentage recharge decline is approximately double the percentage of mean rainfall decline. In some areas in southern Australia where groundwater demand is already near the sustainable yield, the decline in groundwater recharge is estimated to be between 14 per cent and 55 per cent. This means that to simply retain the current level of water security would require a similar percentage increase in recharge in these areas – this is precisely where water banking could be explored as part of the NSW Water Strategy. Coastal capital cities have previously made large water security investments, mainly in seawater desalination, but there are many regional cities and towns – as well as agricultural systems and other industries – that need greater water security. From CSIRO experience with MAR, opportunities for water banking are most favourable in aquifers that contain fresh groundwater (and hence have a high water recovery efficiency), have low groundwater hydraulic gradients and inter-aquifer leakage (minimising banked water loss), and where MAR can be accommodated within exiting groundwater management plans (e.g. to manage volumes and ensure access to recharged water). Reductions in surface water availability are also likely as a result of reduced rainfall across most of NSW due to climate change. Regions that currently rely on surface water may therefore also benefit from water banking as an alternative source of water during extended drought periods (which are also more likely under climate change).

Recent CSIRO investigations in the Murray-Darling Basin region estimated an additional aquifer storage potential of ~4 km^3 in surficial aquifers near major watercourses across the Basin (Gonzalez *et al*. 2020). This represents ~16 per cent of the ~25 km^3 total accessible capacity of surface storages across the Basin. For NSW, this equates to a potential 2,000 GL of aquifer storage (with a salinity of <3000 mg/L total dissolved solids) or 1,300 GL (for salinity<1500 mg/L total dissolved solids) for locations < 5 km from a river. Further work is needed to explore the feasibility of this.

In the same study, simulations of water banking appear very favourable, such as in the Macquarie River catchment near Dubbo, NSW. Water can be purchased from the existing water market when cheap and recovered when expensive, hence no new water extractions would be required. These results indicated that peak aquifer storage could be accessed with a recharge capacity of 6 GL/month supplying water with a market value >AUD$30M which is roughly double the estimated levelised cost of a water bank supply (Gonzalez *et al.* 2020). Similar opportunities are likely to exist in other regions. CSIRO's experience in other states has revealed that demonstration projects will be key to implementing Action 6.7 of the NSW Water Strategy, as they are important for gaining experience in operation and in governance, and in

communicating broadly on performance, costs, and impacts. The economic drivers for water banking are already indicated by significant increases in trading prices during droughts. However, incentives for improving water security would need to include developing clearly defined rights to recover recharged water during drought and demonstrating no impediment to the access and use of the recharged volume. Demonstration projects that are well designed, monitored and managed are needed to give confidence that water banking is effective, and that it can be managed so that it is fair to all water users, sustains the environment and creates economic benefit.

Concluding remarks

Water security to achieve environmental, social and economic outcomes requires long term planning, taking account of population growth, agricultural and industrial development and climate change. Further research is required to prove up the opportunity across NSW of aquifer storages, so that conjunctive use of surface and groundwater can fulfil the promise of water banking for drought resilience.

The economic benefits and cost savings are potentially very significant. Given there is declining water availability, decreasing groundwater recharge and increased demand for water, water banking could provide an innovation in mass water storage as part of the NSW Water Strategy.

References

Barron OV, Crosbie RS, Charles SP, Dawes WR, Ali R, Evans WR, Cresswell R, Pollock D, Hodgson G, Currie D, Mpelasoka F, Pickett T, Aryal S, Donn M & Wurcker B (2012): Climate Change Impact on Groundwater Resources in Australia. National Water Commission Waterlines #67. https://publications.csiro.au/rpr/download?pid=csiro:EP121194&dsid=DS1

Gonzalez D, Dillon P, Page D & Vanderzalm J (2020): The Potential for Water Banking in Australia's Murray–Darling Basin to Increase Drought Resilience, Water, 12, 2936; https://doi.org/10.3390/w12102936