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INQUIRY INTO RATIONALE FOR, AND IMPACTS OF, NEW DAMS AND OTHER WATER INFRASTRUCTURE IN NSW

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Australia's National
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Inquiry into the rationale for, and impacts of, new dams and other water infrastructure in NSW

Parliament of NSW Committee No. 7 – Planning and Environment

CSIRO Submission 20/730

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Introduction

CSIRO welcomes the opportunity to provide input to the inquiry of the NSW Legislative Council Portfolio Committee for Planning and Environment into the rationale for, and impacts of, new dams and other water infrastructure in NSW. CSIRO would be happy to discuss any aspect of this submission with the Committee.

For more than 100 years, CSIRO has been Australia's mission-led national science agency, collaborating across the innovation system. CSIRO's primary objectives, guided by the *Science and Industry Research Act*, are to:

1. Conduct and encourage the uptake of world-class scientific research;
2. Mobilise and develop the best talent for the benefit of Australia;
3. Manage national research infrastructure for the nation;
4. Ensure the sustainability of CSIRO.

As part of its role, CSIRO provides independent, expert, technical advice to governments and communities, as appropriate, to inform relevant policy processes and program activities. In the context of this inquiry, CSIRO would like to specifically address Terms of Reference (e) regarding *water infrastructure technologies that provide enhanced environmental outcomes*. This submission seeks to provide the Committee with an overview of managed aquifer recharge / water banking research, including the potential opportunities that this research offers to address water security needs.

CSIRO response to the Terms of Reference (TOR)

With regards to TOR (e) *water infrastructure technologies that may promote enhanced environmental outcomes,* CSIRO offers the following comments:

Managed Aquifer Recharge (MAR) and water banking overview

Managed Aquifer Recharge (MAR) or water banking uses injection wells and infiltration basins to intentionally recharge water into aquifers for later water recovery and use. MAR can support water use for environmental outcomes, as well as municipal water supplies and agricultural irrigation.

MAR offers the potential to assist communities with enhancing their water security. The principle is quite 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 already have a draw down, that storage space for water banking already exists. This is like an underground reservoir or dam that doesn't need to be built, with the additional benefit that it is protected from evaporation. Aquifers that contain large volumes of groundwater add resilience to communities from the effects of drought.

CSIRO research over the past 20 years 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. An overview of CSIRO's MAR related research is available here: https://research.csiro.au/mar/.

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.

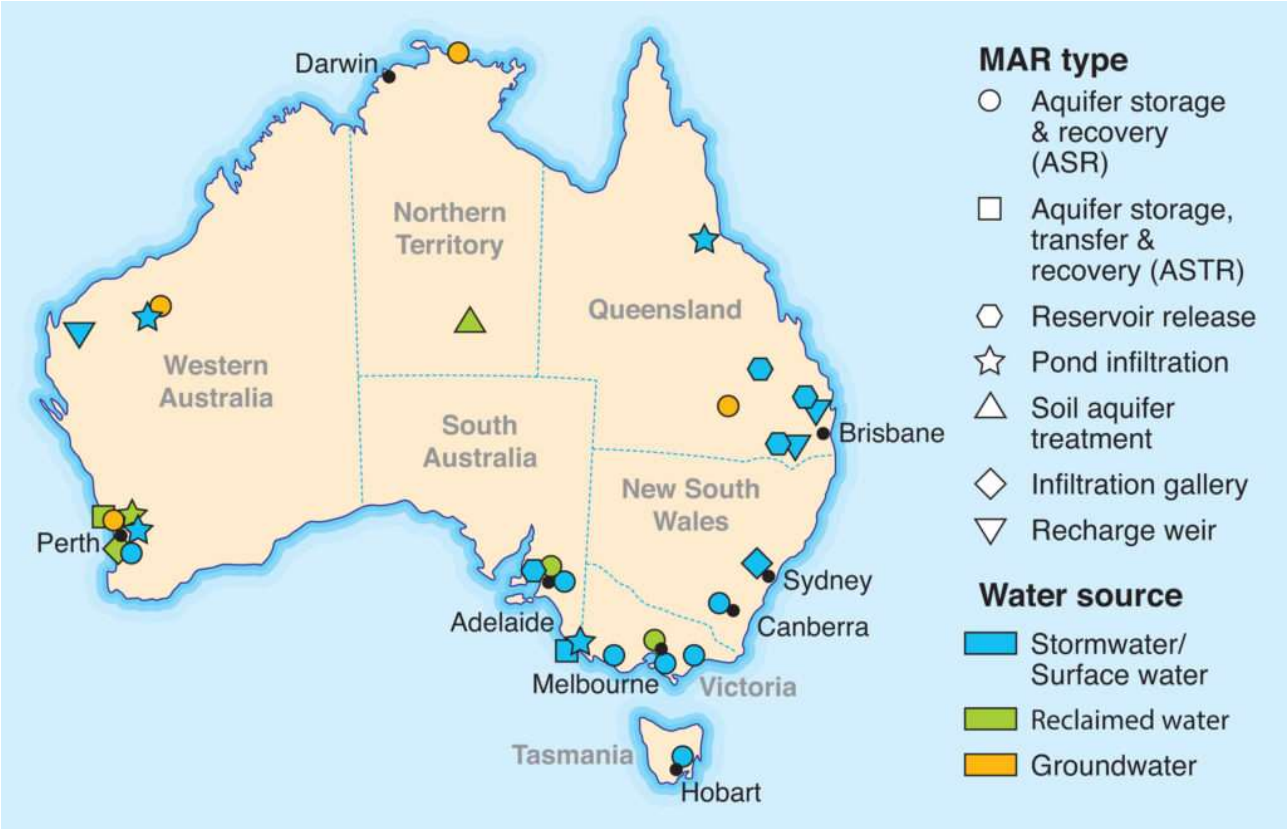

Figure 1 Snapshot of MAR in Australia in 2017. Image: CSIRO

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/Major-initiatives/Northern-Australia/Current-work/NAWRA). Progress has largely occurred where local governments or state water utilities have partnered with CSIRO and determined that the cost of investment for water security is less than the potential benefits. 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. CSIRO research has reported that the levelized costs of water supply by desalination to secure capital city supplies is more than ten times the normal cost of supply (Radcliffe, 2015). Investment in water security is much higher than simply increasing the available supply. This in turn allows a considerable opportunity where water banking will be economically favourable compared to other water security measures.

Opportunities for Australian regional towns to implement MAR for improved water security during drought still remain to be proven, requiring the establishment of demonstration projects. MAR could potentially be applied in regional areas as a conjunctive approach to surface and groundwater management to ensure security of water supply for social, economic and environmental outcomes.

Some limited examples in regional areas do exist where conjunctive use of surface and groundwater mass water storage projects have been successful. For example, groundwater replenishment by the Burdekin Water Boards, the first MAR scheme in Australia, has been in operation for over 50 years to secure irrigation supplies.

International experience in water banking

Water banking approaches have been adopted across the USA. For example, the Arvin Edison Water Bank in the Central Valley of California began in the 1960s to help irrigators and downstream municipalities manage water security and drought. This bank still operates today, and the underground water stored in the water bank will be invaluable during the current drought being experienced across the USA. Similarly, in

Arizona, the Arizona Water Banking Authority has 4,526 GL (as of July 2020) of water banked as a water security measure (Arizona Water Banking Authority 2020). Similar storage volumes of water could potentially be accessed across Australia.

Opportunities for water banking in NSW regional areas

CSIRO research on the climate change effects on groundwater recharge has estimated substantial decline in natural groundwater recharge will occur in the future (Barron *et al*., 2012). Generally, the percentage recharge decline would be 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% and 55%. This means that simply to retain the current resilience to drought would require a similar percentage increase in recharge in these areas – this is precisely where water banking could be explored as a way to improve water security.

Coastal capital cities have previously made large water security investments, mainly in desalination, but there are many regional cities and towns – as well as agricultural systems and other industries – that still require solutions to enhance water security in drought. 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 a groundwater allocation plan is already implemented (to manage water credits and debits).

Recent CSIRO investigations in the Murray-Darling Basin region estimated an additional aquifer storage potential of ~4 km^3 in surficial aquifers across the Basin (Gonzalez *et al*. 2020). This represents ~16% of the ~25 km^3 total accessible capacity of surface storages across the Basin Further investigations are needed to evaluate the viability of schemes, but it highlights the potential.

In the same study CSIRO used simulations to evaluate water banking in the Macquarie River catchment near Dubbo, NSW. CSIRO evaluated whether 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).

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. Water banking has the potential to provide drought resilience. The economic benefits and cost savings are potentially very significant. With a drying climate, there is declining water availability, decreasing groundwater recharge and an increasing demand for water. Infrastructure investments in water banking can provide an innovation in water storage in regional areas.

References

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