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INDEPENDENT STRATEGIC ANALYSIS OF AUSTRALIA'S GLOBAL INTERESTS

Strategic Analysis Paper

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The Forgotten Resource: Groundwater in Australia[1]

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Key Points

- Water that is found below the earth's surface is referred to as groundwater.
- Groundwater use is increasing and it is the main source of water for much of Australia's dry interior.
- Recent research suggests that groundwater replenishment rates may be slower than previously assessed.
- Australian groundwater characteristics may not be typical of the global norm highlighting the need for research and management in order to secure long-term availability.
- The role of the National Centre for Groundwater Research and Training is to advance our understanding of Australia's groundwater resources, and to train the next generation of groundwater researchers.

"Many groundwater systems are poorly understood, as are their connections to ecosystems, so we do not know the full potential for groundwater in Australia even though pressures on the resource are growing"

From: Andrew Herczeg in *Science and Solutions for Australia: Water*.

[1] The content of this Strategic Analysis Paper had been drawn extensively from the Australian National Centre for Groundwater Research and Training website: www.groundwater.com.au.

Summary

The Australian National Centre for Groundwater Research and Training (NCGRT) defines groundwater very simply as water that is found below the earth's surface. It is found in vast quantities filling the spaces between grains of soil or rock. Australia being geologically an old continent has groundwater reserves that are tens of thousands, even hundreds of thousands of years old. The Great Artesian Basin in central Australia is the largest aquifer of its kind in the world, covering 22% of Australia, and containing water that is more than a million years old. In Australia the importance of groundwater is pronounced given that it is the driest inhabited continent on Earth and surface-water resources are limited over large areas. It does, however, possess vast reserves of groundwater. This nationally significant resource demands careful, long-term planning and management, informed by a sound understanding of the characteristics of each aquifer.

Source: http://www.bom.gov.au/water/groundwater/index.shtml

Analysis

A recent FDI Strategic Analysis Paper discussed the global implications of groundwater in the context of recent research by an international group of hydrologists from the Universities of Victoria, Texas, Calgary and Gottingen. It presented a broad overview of the state of global groundwater, highlighting renewal rates and the possibility that rates of replenishment may be slower than previously thought. The research also provided a much needed audit of global ground water resources updating the existing, 40 year old models. Of particular significance is

the finding that the replenishment rate of aquifers can vary greatly, highlighting the need for responsible, long-term management based upon specific knowledge of individual aquifers.

The importance of global groundwater notwithstanding, for Australia, the above findings are of particular relevance to our appreciation of Australian groundwater and its management. Australia has a reputation as the driest continent but it does possess vast reserves of groundwater. These reserves differ significantly from those typically found in other parts of the world as they are found in arid and low rainfall localities. This combined with the scale of the reserves makes Australia's groundwater globally unique and therefore, reinforces the need for responsible, well-informed management.

The availability and quality of this water varies greatly regionally, however, current estimates indicate that it supplies one third of the nation's fresh water consumption and in recent decades its use had more than doubled. It is inevitable that our dependence upon groundwater will increase as our population grows, as agriculture and industry expands and with the possible influences of climate change.

Groundwater in Australia

Groundwater has been referred to as the forgotten resource. Despite the fact that groundwater, as stated, currently accounts for over 30 per cent of Australia's water consumption, we simply do not know enough about this vital water resource, and how to manage it.

The CSIRO publication *Science and Solutions for Australia: Water* sites the following key messages in regard to Australia ground water:

- Groundwater use is increasing and it is the main source of water for much of Australia's dry interior.
- Groundwater shares many of the sustainability issues of surface water, with the added complication the over-use may not be detected for several decades because of the slow renewal and movement of the resource.
- Groundwater resources are strongly connected to surface water supplies, and many of Australia's ecosystems, plants and animals depend upon groundwater for their survival.
- The sustainable extraction limit of an aquifer is usually much less than the rate of annual recharge or renewal. Pumping aquifers causes groundwater levels to fall, affecting ecosystems, river discharge, and increasing salinity.

In the past groundwater was regarded as a resource to be mined, much like a mineral resource. It is now, however, generally managed as a renewable resource, recognising that it is recharged from rainfall and discharges from rivers, lakes, the oceans, and through vegetation. Consequently, groundwater management faces many of the same sustainability issues of surface water. Ecosystems depend on the discharging groundwater, and over-extraction of groundwater can lower water tables or the pressure of water, which impacts upon the

dependent ecosystems and on other users. The main problem that arises with groundwater management in Australia is that aquifer recharge rates are notoriously difficult to measure and estimate. In the large aquifers it may take decades for the water table or water pressure response to spread across the whole aquifer. There are added difficulties of groundwater being hidden below the below the surface and moving slowly so that over-use may take many years to detect. The complex movement and interactions of different layers of water can be hard to detect but they have a direct effect on the sustainable use of the resource, such as by protecting fresh groundwater from being polluted by nearby saline layers. Many groundwater systems are complex and poorly understood, as are their connections to the wider environment. Ultimately, we do not know the full potential of groundwater in Australia even though pressures on the resource are growing.

Figure 1. below provides an outline representation of the variety of aquifers and their productivity across Australia. The most productive aquifers are shown in dark blue and green.

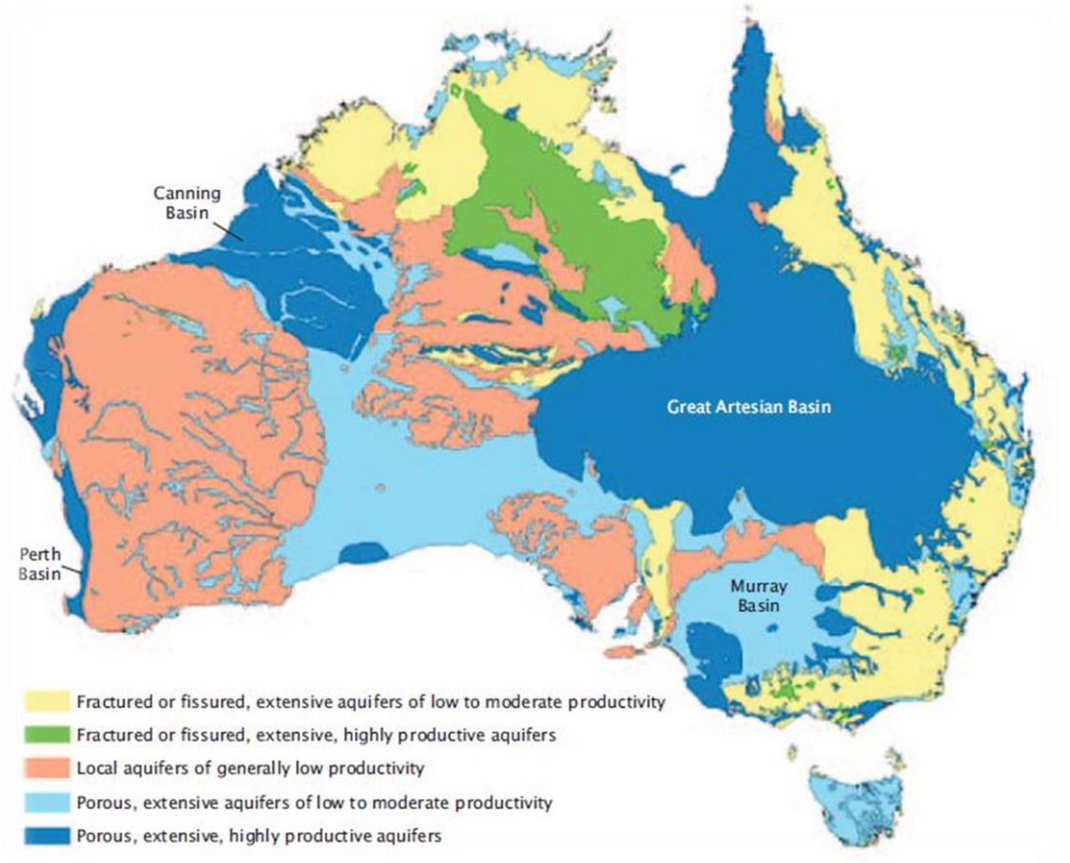

Figure 1. Map of Australia's groundwater resources. Source: Harrington N and Cook P, 2014, *Groundwater in Australia*, NCGRT.

Groundwater use is increasing as surface water resources become fully allocated, and as demand grows for water in drier regions in which groundwater is the predominant or, at times only resource. Groundwater is ubiquitously found beneath the surface but is only useable where the water is not too deep, where the rock or soil is permeable, and where it has suitable quality. A significant proportion of groundwater in Australia is unusable because of natural salinity.

National Centre for Groundwater Research and Training

The National Centre for Groundwater Research and Training (NCGRT) was established in 2009 as a joint funding initiative of the Australian Research Council and the National Water Commission. The role of NCGRT is to advance our understanding of Australia's groundwater resources, and to train the next generation of groundwater researchers. This Centre supports future policy and management decision-making for groundwater in line with the objectives of the National Water Initiative. The Centre is jointly funded under the Special Research Initiatives scheme.

The Centre provides scale, focus and coordination to Australia's groundwater research effort, building research capacity and providing outcomes of significant national benefit in a field which is vital for the nation's sustainability. It undertakes research in all aspects of groundwater and leads the training of the next generation of hydrogeologists and groundwater specialists, filling a significant gap in Australia's current resource management capabilities. Importantly, The NCGRT also explores the social and economic consequences of differing groundwater allocation models which could be applied to industrial, agricultural and urban stakeholders.

Conclusion.

Groundwater and its management are fundamentally important to the future sustainability of Australian's agriculture, industry and even its way of life. Sound, long-term planning, management and governance of such a precious and possibly fragile resource can only occur when decision making is informed by equally sound knowledge of the resource. It can be argued that currently, the body of knowledge informing Australian groundwater resource management is not sufficiently complete to ensure an appropriate level of confidence. The research necessary to attain the appropriate level of knowledge is likely to take years or decades to complete and the subsequent translation of this knowledge into policy. While it is acknowledged that in the past poor management approaches have led to over allocation in some areas.

Quoting again from the CSIRO publication *Science and Solutions for Australia: Water,* 'groundwater systems are hard to understand, being hidden below the surface and involving complex geological patterns. The principles are well understood, but applying those to characterise the unique situation of each aquifer is fraught with difficulty.' The consequence of not embracing this challenge, however, could be dire and irrevocable.

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