

Out of Sight, Out of Mind? The Use and Misuse of Groundwater in Perth, Western Australia

Ruth Morgan

School of Philosophical, Historical and International Studies, Monash University

Executive summary

- Groundwater supplies in Perth are under stress.
- About 80 per cent of all water used in Perth comes from underground.
- Groundwater is declining due to a drying climate, pine plantations, and excessive pumping.
- Despite the city's dependence on groundwater, there still is a lot to be learned about these reserves.
- The history of the use and misuse of groundwater in Perth shows how decades of complacency have taken their toll.

As many Australians sweat through some of the hottest conditions on record and battle raging bushfires, it is easy to forget that just two years ago many people were sandbagging their properties against rising floodwaters. Before those La Niña rains, many urban and rural Australians faced years of drought and tough water restrictions. When it comes to water in this country, it seems there is either too much, or too little.

In lean years, water from underground can make up the difference. Pastoralists in inland Australia rely heavily on the stores of freshwater in the Great Artesian Basin, while groundwater helps sustain farmers in the Murray-Darling Basin during dry periods.

Pumping groundwater is not just a source of water for rural Australians. In Perth, Western Australia, groundwater contributes about half of the suburban water supply. These reserves helped water managers avoid implementing the harsh restrictions recently experienced in other Australian cities. It is a dependence that has slowly increased over the past forty years as dwindling rains fail to fill the city's dams. Although the construction of two desalination plants have helped to ease some of this burden, groundwater remains a vital source for the Western Australian capital as 80 per cent of all water used in Perth comes from underground.

Perth's groundwater reserves, however, are in bad shape. The region's drying climate means that underground water is not being replenished as it once was. Meanwhile, largely uninterrupted and unfettered supplies of groundwater have allowed the people of Perth to use water profligately and to expect to be able to continue to do so. Groundwater extraction from the Gngangara Mound, for instance, has more than doubled over the past twenty years. Familiarity, then, has bred, if not contempt, at least indifference. A significant contributor to this state of mind is the very nature of groundwater, that it is hidden underground, subterranean, and therefore invisible. As Benjamin Franklin supposedly said, 'When the well runs dry, we will know the worth of water'. One of the problems with groundwater depletion is that, unlike the ebbing waterline of a dam or water tank, it is a process that is difficult to observe with the naked eye. Such is the hidden nature of this process that Spanish researchers described the global escalation of groundwater abstraction during the twentieth century as the 'silent revolution'.

Underneath the suburbs of Perth lie substantial quantities of groundwater that have accumulated there over many thousands of years. Rainwater and stormwater percolate through the sandy soils and porous limestone to slowly replenish these reserves, which also are fed by streams that drain into the ground.

It has been very easy for a magic pudding mentality to develop around groundwater in Perth, and the networks and infrastructure of water supply that have developed in the suburbs have played a significant role. Although the collective provision of water supplies provides substantial health and equity benefits for consumers, there are drawbacks to this system, too. Water consumers, as Maria Kaika argues, become alienated from the sources of their water supplies through large reticulated networks. Divorced from the centralised source of supply, they may come to expect more and more affordable water, and become increasingly unprepared for interruptions to their supply. This reticulated relationship with water is playing a role in shaping the so-called 'hydro-illogical' cycle of Australian water policy.

Examining the history of the use and misuse of groundwater in Perth can help to break from this frustrating cycle and shine a torch through what author Michael Pollan calls 'this fog of presentness'. In doing so, histories of groundwater can help make visible the resources and challenges that have been invisible or ignored for too long.

Water in the nineteenth century

The first Governor of the Swan River Colony and its most avid campaigner, James Stirling, assured prospective settlers of the ample water supplies that could be found in the freshwater lagoons near the Swan River. Sustained by a shallow water table, these waterscapes were part of a chain of wetland lakes that ran along the coast, forming the basis of important seasonal food chains and paths for Nyoongar movement around the region.

For most of the nineteenth century, the people of Perth relied on natural springs and household wells for their water supplies. Their proximity to cesspits meant that drinking water often was contaminated and diseases spread easily. The association of nearby swamplands

with disease as well as demands for fertile land and flood management prompted a series of drainage programs that transformed the hydrology of the Swan Coastal Plain.

A campaign for better quality water supplies in the 1880s resulted in the beginnings of a reticulated network in the city, supplied by the construction of Victoria Reservoir in the Darling Ranges in 1891. Although local critics lauded dams as symbols of civilisation, this infrastructure proved inadequate for the rapid growth of Perth during the goldrushes of the 1890s and led to a 'water famine' in 1897. Little improvement was made after Federation, and in the 1920s angry voters complained about their unreliable water supplies, vividly comparing what did flow to 'liquid sausage meat'. Despite these protests, significant changes were not forthcoming and artesian water continued to provide most of Perth's water into the 1940s.

Watering the suburbs

With the completion of several major dams soon after the Second World War, the easy access to affordable scheme water, combined with anxieties about cleanliness, hygiene and green gardens, led to a rapid escalation of water consumption in Perth households during the 1950s and 1960s. And the water authorities were only too happy to oblige their demands: Australian engineers and governments shared an institutional culture that fostered a 'predict and provide' approach to the development of water services.

The city's dams, however, could not sustain the escalating demands of a population growing in size and prosperity. International efforts to further global hydrological studies in the early 1960s had encouraged Australian endeavours to undertake the long-awaited measurement of the continent's water resources. In Western Australia, explorations of the Swan Coastal Plain around Perth revealed extensive stocks of water below the ground, the Gngangara Mound in the north, and the Jandakot Mound in the south. Less than a hundred years earlier, the Government Geologist had argued it would be 'hopeless to expect to procure Artesian water near Perth' and recommended a scheme for supplying water from the streams of the Darling Ranges. The water authorities now believed that these reserves could be cheaply utilised to supply the suburbs.

By the mid-1970s, these aquifers provided about 10 per cent of Perth's water supply and experts predicted the city's reliance on this source would grow. When harsh water restrictions and higher water prices were introduced later in the decade, many households responded by installing private bores or wells in their backyards. The only cost was sinking the well and keeping it maintained. By installing these private supplies, these households essentially gained access to virtually unlimited water for garden use, and, as a result, bore ownership in Perth trebled between 1976 and 1982.

Water authorities welcomed this boom in bore ownership: as half the average household consumption of scheme water was being used in the garden, bores alleviated the burden on public supplies. But, as not one of these bores was licensed, metered, or monitored, water use skyrocketed. One 1985 report estimated that a household with a domestic bore consumed over seven times the amount of water of a household dependent on public supplies.

By the end of the 1970s, then, both scheme water supplies and private supplies in Perth were being drawn from the subterranean treasure trove of groundwater beneath the suburbs. The public and private utilisation of these groundwater reserves helped to perpetuate the belief of consumers in the endless supplies of plentiful, cheap water that sustained their profligate water culture.

Competition and concern

Not everyone was enamoured with these developments. Market gardeners south of the Swan River at Jandakot, for instance, challenged government bans on their chemical and fertiliser use that were introduced to protect the groundwater reserves beneath their farms. Others around Wanneroo reacted similarly when the government restricted the availability of water licenses during the 1980s. No longer able to access the groundwater freely, market gardeners were concerned that the licenses would dramatically increase their costs of production.

Meanwhile, in the 1960s ecologists estimated that over half of the wetlands of the Swan Coastal Plain had been lost already, and they predicted that the public and private abstraction of large amounts of groundwater would endanger those that remained. They expected the draw on groundwater would threaten sensitive communities of flora and fauna, not least the migratory waterbirds that depended on them. These concerns were realised in 1991 when large tracts of banksia woodland perished, prompting the water authorities to curb their pumping.

Mixed messages

With daytime water restrictions in place since 1994, the state government produced the *Perth Groundwater Atlas* in 1997. It was designed to help households determine whether they were ideally located to sink their own bore. Obtaining private water supplies was a community service, as it alleviated pressure on the development of public water infrastructure and helped to lower the water table in urbanised areas. This move was met with staunch criticism from the Conservation Council, which argued that excessive garden irrigation promoted the leaching of fertilisers and pesticides into Perth's sandy soil that might pollute underground reserves. Besides, in some coastal suburbs the use of household bores already had led to saltwater intrusion and rendered these backyard investments useless.

Nevertheless, when the drought of 2001 struck, the state government offered households a financial incentive to install a bore. To date, about one in four Perth households have access to private supplies. Market gardeners, meanwhile, faced new restrictions on the expansion of their properties and found it necessary to sink deeper bores to reach the declining water table. Some also feared that the installation of meters on their bores would pave the way for the government to charge them for their water use. It was only in 2007 that backyard bore use was restricted to three days per week and a recent Department of Water report conceded that they do, indeed, draw a substantial amount of water from beneath the suburbs.

But it is not only the water authorities with whom the market gardeners have been tussling: over 20,000 hectares of pine plantations on the Gnangara Mound are guzzling groundwater, too. These pines were planted in the Wanneroo area in the 1920s to stimulate the state's softwood industry on what then were deemed to be useless soils. Despite struggling initially, the pines flourished to such an extent that researchers estimate that they are responsible for at least a third of the decline of the Mound's water levels. But the terms of a twenty-five year government agreement, signed in 2002, to provide timber for the production of laminated veneer lumber prevent accelerating a thinning of the plantation. This timeline provides some relief for those who enjoy the aesthetic and recreational aspects of the pine plantation, as well as for the endangered Carnaby's black cockatoos that forage there.

Drying out

As the drought of 2000-01 took its toll on the city's dams, groundwater again took up the slack, contributing over half of Perth's water supplies. Water from the Gnangara Mound also was pumped into Mundaring Weir to supply Kalgoorlie residents through the Golden Pipeline. It did not take long for this burden to take its toll on the already strained underground reserves and the wetlands that depend on them. Faced with the challenge of ecological triage, authorities pumped water into some areas like the Yanchep caves and Lake Jandabup in the hope that this might revive them.

Local Aborigines were especially critical of the mismanagement of the Gnangara Mound. Some elders lamented the passing of a time when they could travel through the pine plantation, find water and food in the swamps, and pick wildflowers. Neither the government nor water authorities had consulted the Nyoongar community about tapping the reserves of the Gnangara Mound during the 1970s. It was not until the mid-1980s that a survey of culturally significant places was undertaken, by which stage some participants considered it was too late. More recently, elders told researchers that it was 'meaningless' to identify individual sites of significance as the entire area was of spiritual and cultural importance.

It is little wonder, then, that many people in Perth and the southwest did not trust the government to safely manage the utilisation of a vast, untapped aquifer further south, the South-West Yarragadee. Ongoing questions about Perth's water security in a drying climate dominated the 2005 election, and a year later a seawater desalination plant was completed at Kwinana to supplement the city's water supplies. A second was finished in 2011.

New challenges, new directions

Late last year, scientists made a startling discovery: years of low rainfall, water abstraction, and thirsty pines had combined to produce a sinking effect in Perth suburbs. Geoscience Australia reported that some suburbs had sunk up to 6mm a year since the late 1990s. For conservationists, these findings confirmed their long held suspicions that environmental authorities had inadequately policed the water abstraction of market gardeners and the Water Corporation.

The state government recently announced the success of a trial to replenish the Gnangara Mound with treated wastewater. In the coming months, it will determine whether this recycled water will be added to public water supplies. It obviously hopes that Perth residents are more willing to stomach the plan than their Queensland counterparts in Toowoomba, who rejected a similar proposal in 2006. The prospect of recycling wastewater in Western Australia's capital presents an alternative vision to the evergreen possibility of piping water from the state's northwest.

Conclusion

Although Perth's groundwater reserves are the city's lifeblood, they have long been shrouded in mystery and uncertainty. In 2008, a CSIRO scientist explained to reporter Åsa Wahlquist:

There are still major questions about the recharge under different climate and land-use regimes, what the sustainable yield is, what the relationship between the fluctuations of those water levels and the environmental health is. So even a system like that on the doorstep of Perth, and half of the water supply of Perth, is not as well understood as we would wish it to be.

Likewise, backyard bores remained unmonitored and excessive abstractions unpoliced. Despite these grey areas, there are two certainties: Perth households are among the highest water consumers in the nation; and they pay the least for the privilege.

Urban Australians may be detached from the processes of acquiring and delivering (ground)water. But numerous dry winters, 'water crises', and devastated wetlands since the 1970s cannot have been invisible to the people of Perth. Or, is it a case of out of sight, out of mind?

Selected Further Reading

Bill Bunbury, *Till the Stream Runs Dry: a history of hydrography in Western Australia*, Perth, Dept of Water, 2010.

CSIRO, *Water Yields and Demands in South-West Western Australia*, Perth, CSIRO Water for a Healthy Country Flagship, 2009.

Dept of Water, *Gnangara Groundwater Areas Allocation Plan*, Perth, Dept of Water, 2009.

Stuart Fisher, *Report on Consultations with the Combined Metropolitan Native Title Working Group regarding the Aboriginal Heritage Values of the Gnangara Water Mound*, Floreat, Fisher Research, 2005.

Joseph Gentilli and Hugo Bekle (eds), *Wanneroo – Joondalup – Yanchep: planning, people, environment*, Bassendean, City of Wanneroo, 1998.

Quentin Grafton and Karen Hussey (eds), *Water Resources Planning and Management*, Melbourne, Cambridge University Press, 2011.

Maria Kaïka, 'Interrogating the geographies of the familiar: domesticating nature and constructing the autonomy of the modern home', *International Journal of Urban and Regional Research*, vol. 28, 2004, pp.

- Marnie Leybourne and Andrea Gaynor (eds), *Water: histories, cultures, ecologies*, Crawley, UWA Press, 2006.
- Manuel Llamas and Pedro Martinez-Santos, 'Intensive groundwater use: a silent revolution that cannot be ignored', *Water Science and Technology Series*, 2005, vol. 51, no. 8, pp. 167-74.
- Edward McDonald, Bryn Coldrick and Will Christensen, 'The green frog and desalination: a Nyungar metaphor for the (mis-)management of water resources, Swan Coastal Plain, Western Australia', *Oceania*, vo. 78, 2008, pp. 62-75.
- Don McFarlane, *Context Report on Southwest Water Resources for Expert Panel Examining Kimberley Water Supply Options*, Canberra, CSIRO, 2005.
- Ruth A. Morgan, 'Dry horizons: the responses of Western Australian water managers to the enhanced greenhouse effect in the late 1980s', *History Australia*, vol. 8, no. 3, 2011, pp. 158-76.
- Ruth A. Morgan, *Running Out? An environmental history of water and climate in southwest Western Australia, 1829 to 2006*, PhD thesis, University of Western Australia, 2012.
- Ruth A. Morgan, 'A thirsty city: an environmental history of water supply and demand in Perth', *Studies in Western Australian History*, vol. 27, 2011, pp. 81-97.
- Ruth A. Morgan, 'Western water dreamers rise again with Colin Barnett's canal vision', *The Conversation*, 3 August 2012, <<http://theconversation.edu.au/western-water-dreamers-rise-again-with-colin-barnetts-canal-vision-8625>>.
- Rory O'Connor, Connie Bodney and Lorna Little, *Preliminary Report on the Survey of Aboriginal Areas of Significance in the Perth Metropolitan and Murray River Regions*, East Perth, Heritage Council of Western Australia, 1985.
- Tom Stannage, *The People of Perth: a social history of Western Australia's capital city*, Perth, Perth City Council, 1979.
- Sorada Tapsuwan, Zoe Leviston and David Tucker, *Sense of Place: Perth Community Attitudes Towards Places of Significance on the Gnangara Groundwater System*, Perth, Gnangara Sustainability Strategy, CSIRO, 2009.
- Patrick N. Troy (ed.), *Troubled Waters: confronting the water crisis in Australian cities*, Canberra, ANU Epress, 2008.
- Jac van der Gun, *Groundwater and Global Change: trends, opportunities and challenges*, UN World Water Assessment Programme, Paris, UNESCO, 2012, <<http://unesdoc.unesco.org/images/0021/002154/215496e.pdf>>.
- Åsa Wahlquist, *Thirsty Country: options for Australia*, Crows Nest, Allen and Unwin, 2008.
- Water Authority of Western Australia, *Perth Urban Water Balance Study*, Perth, Water Authority, 1987.
- Water and Rivers Commission, *Perth Groundwater Atlas*, East Perth, Water and Rivers Commission, 1997.

© APH Network and contributors 2013. All rights reserved.

Citation: Ruth Morgan, *Out of Sight, Out of Mind? The Use and Misuse of Groundwater in Perth, Western Australia*. Australian Policy and History. March 2013.

URL: <http://www.aph.org.au/files/articles/outSight.htm>