What is Independent Water?

Independent Water is water provided to households that are independent of government and utility services to households. This includes rainwater tanks, recycled water, water from waterways, bottled water and bore water for homes both in urban and rural areas.

There is little recognition of Independent Water in media and government policy relating to water, housing and the rural sector.

Key Statistics

Independent Water is an important part of the conversation on water security in Australia.

Fig 1 Sources of Independent Water for Australian Households

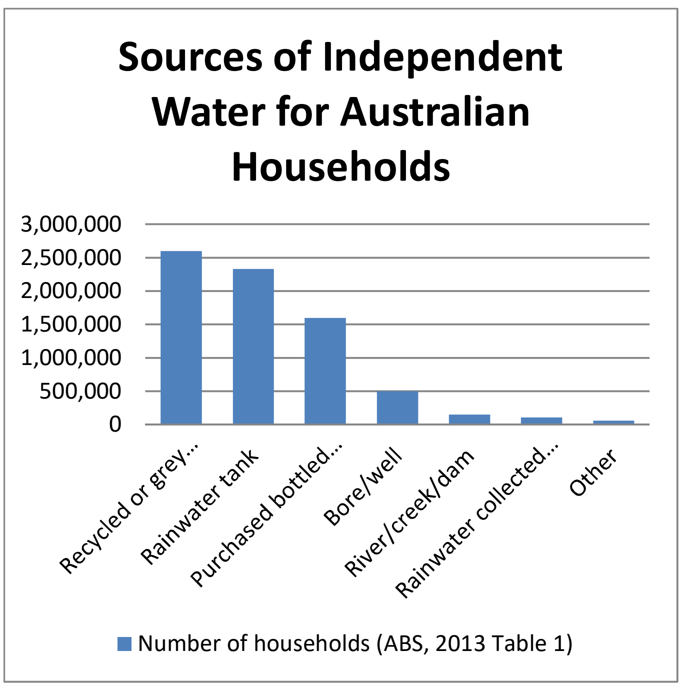


Fig 1 demonstrates that there are many sources of Independent Water and millions of households use them. If you sum up all the households that use Independent Water it is about 80% of all the households in Australia however this is not reliable because some households will use multiple sources of water.

Independent Water Use is widespread.

- 2.6 million (29%) of Australian households used greywater and 2.3 million (26%) households used rainwater in 2013 (ABS, 2013, Table 1)

- At least 28% of Australian households in urban areas accessed Independent Water (ABS, 2013, Table 1)
- Areas outside capital cities consume an estimated 109 GL of rainwater, or 69% of total household consumption (ABS 2015).

Independent Water is a major source of drinking water.

- 877,000 households in Australia rely on rainwater harvesting as their prime or only source of drinking water, this is about 10% of all Australian households and is equivalent to over two million people in Australia. Incredibly 577,000 households rely solely on bottled water. (ABS, 2013, Table 3).
- It is important to understand that for much of rural Australia relying on Independent Water is not a choice, it is a necessity because no other sources of water are available. Independent Water Council consultation indicates that most of these households are quite satisfied with their water source.

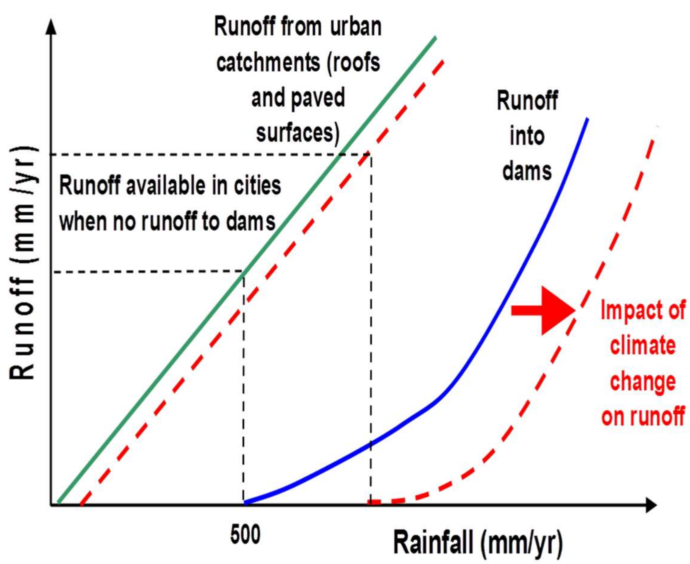
Resilience

By providing a decentralised water source Independent Water improves community resilience to natural disasters and additional options for water management in the future.

A long established ecological principle is that systems with multiple inputs are more resilient to change, as a situation changes the system has more options to respond and can change the proportions of different inputs. For example a plant that is fertilised by several different insects will respond better to the loss of an insect species than a plant which is entirely dependent on one species.

Therefore a community that can rely on a range of options, mains water, borewater, rainwater harvesting and greywater will respond better to challenging changes – drought, flooding, contamination of one water source, than a community that is entirely reliant on water from one or two water sources.

In particular, Rainwater Harvesting increases community resilience as it is less sensitive to drought than traditional catchments (Coombes and Barry 2008). Traditional catchments are also vulnerable to reduced runoff due to increased bushfire risk.



.
Figure 2. Rainwater Harvesting vs Traditional catchments *(Coombes and Barry, 2008)*

Figure 2 is a graph with extraordinary implications for understanding water security in Australia. There are two parts to this graph. In the first part of the graph on the left is a green and blue line comparing runoff into a rainwater tank with runoff into a dam from local streams. One of the weaknesses of traditional catchments is that when the soil is dry quite a lot of rain is needed to 'wet' the soil before runoff occurs into local waterways, filling up dams. Just how much rain was calculated by Coombes and Barry as about 500mm annually for Warragamba Dam. In comparison hard roof surfaces absorb less than 5% of rainfall landing on them. Figure 1 shows that almost all the 500mm of rainfall is available to rainwater harvesting when it is most needed, when none is flowing into Warragamba Dam. However it is also important to capture rainwater harvesting in normal rainfall times as this reduces the drawdown on the dams allowing a greater reserve for future droughts.

The second part of the graph are the two red lines, showing the impact of climate change. The climate change impact is considered as less rainfall and the subsequent impact on roof and catchment runoff. Coombes and Barry predicted that in Sydney
a 50% decrease in median rainfall would lead to a 70% reduction in catchment runoff and only a 20% reduction in yield from a 3 kL tank. In Brisbane, Sydney and Melbourne a 3KL was significantly more resilient to decreases in median rainfall than a traditional catchment.

In key supporting research Potter et al (2011) also identified a temperature elasticity linked to temperature changes associated with climate change. Potter et al calculated a 5% loss of catchment yield with every 1 degree increase in the maximum daily temperature. Most parts of Australia have already experienced a 1 degree increase in temperature since the 1970s suggesting that all traditional catchments are experiencing a 5% loss of traditional yield.

Independent Water Health Outcomes

We have not researched all the health impacts of other Independent Water sources however there is good evidence for rainwater harvesting. The important principle is that while government takes responsibility for water utility health outcomes the householder is responsible for the water quality and health outcomes of independent water options. We are indebted to the long term research of Professor PJ Coombes in compiling these references.

There is a 20 year history of well documented research of rainwater drinking quality. The key issue for policy makers is the 877,000 Australian Households (ABS, 2013, Table 1) who drink rainwater every day and there is no associated epidemic of illness.

We have referenced key research including an article from the American Journal of Public Health by Shelly Rodrigo et al and one from the International Journal of Epidemiology by Heyworth et al.

· *Consumption of untreated tank rainwater and gastroenteritis among young children in South Australia* JS Heyworth ,*G Glonek, EJ Maynard, PA Baghurst and J Finlay-Jones
Young children, who were regular consumers of tank rainwater, were at no greater odds of gastroenteritis than those who drank treated public mains water. Two international standard public health investigations by Prof Heyworth confirmed this result.

· *Drinking Rainwater: A Double-Blinded, Randomized Controlled Study of Water Treatment Filters and Gastroenteritis Incidence* Shelly Rodrigo, PhD, Martha Sinclair, PhD, Andrew Forbes, PhD, David Cunliffe, PhD, and Karin Leder, PhD

There were no appreciable differences in health outcomes from drinking untreated or treated rainwater.

In addition we highlight the results of the independent comprehensive and long term national investigations by Morrow et al and Evans et al.

- *Elements in Tank Water – Comparisons with Mains Water & Effects of Locality & Roofing Materials* A. Morrow, P. Coombes, H. Dunstan, C. Evans, A. Martin

A majority of the rainwater harvesting systems in these national investigations were compliant with the chemical and metal values in Australian Drinking Water Guidelines. The use of repeated independent sampling is important for the reliable determination of the concentrations of elements in rainwater harvesting systems and determination of real health risks.

- *Extensive bacterial diversity indicates the potential operation of a dynamic micro-ecology within domestic rainwater storage systems.* Craig A. Evans, Peter J. Coombes, R. Hugh Dunstan, Tracey Harrison

This important publication is the result of comprehensive and pioneering use of medical science techniques including polymerase chain reaction (PCR) methods (not experimental real time analysis) to extract DNA of microbes in over 40 rainwater harvesting systems over a three year period. However, each sample was also subjected to a comprehensive range of leading microbial, medical and biochemical tests to confirm the results of the PCR analysis. The research found that bacteria of faecal origin was rare, and not abundant or persistent in rainwater harvesting systems. This research discovered that rainwater storages act as balanced ecosystems in a similar fashion to environmental systems that improve water quality.

EnHealth (2010) acknowledges the low prevalence of disease associated with consumption of rainwater and details the probable reasons for this as the low probability of microorganisms in rainwater being zoonotic pathogens and the possibility that regular consumers of water may acquire immunity to rainwater borne pathogens. Enhealth recommends people drink potable water from a water utility where it is available.

Dean et al (2012) pooled epidemiological studies which quantified the risk of gastrointestinal disease from rainwater consumption (13 studies) and concluded there was no significant difference in risk comparing rainwater to improved water supplies (relative risk 0.82 95% CI 0.38, 1.73).

With respect to chemical contaminants the only chemical that a range of research studies have shown to be likely to be present at harmful thresholds in rainwater is lead, where point sources of lead leachate are present in the rainwater collection system (Chapman et al 2006, Morrow et al 2007, Huston et al 2009, Rodrigo et al 2009). The primary point source of lead in new homes is lead flashing and it is noted that NCC Vol Two 3.5.1.2 (e) precludes use of lead flashing where it is intended that the roof is to form part of the potable water catchment area.

Stormwater

In urban areas increasing levels of impervious areas generate increasing runoff and reduced infiltration. More intense rain events exacerbate this trend. Significant levels of urban rainwater harvesting have an important benefit for stormwater volumes, peak flow and water quality in our creeks, rivers and bays. Capture/use/controlled use of stormwater is a better alternative than piping to disposal.

The Systems Framework by Coombes and Barry (2015) was utilized to evaluate impacts of reduced runoff of existing household rainwater harvesting systems on contaminant loads discharging to waterways (Table

4). This analysis also examined (shown in brackets) reductions in contaminant loads created if all houses with rainwater harvesting capture rainwater overflows and stormwater runoff in 5 m2 vegetable gardens. (Coombes et al, 2016)

Table 4: Estimated reductions in stormwater runoff and pollutant loads for 2014 (Coombes et al, 2016)

Capital City	Reduced runoff (ML/yr)	Reduced pollutant loads (reductions in contaminant loads combined with 5 sqm vegetable garden)		
		Total Soluble solids (Tonnes/yr)	Total Phosphorus (Tonnes/yr)	Total Nitrogen (Tonnes/yr)
Sydney	17,493	4,523 (7,790)	8.5 (11.1)	54.5 (96.6)
Melbourne	19,976	3,807 (26,681)	7.5 (34.3)	52.4 (258.9)
Brisbane	15,682	2,756 (9,098)	5.5 (11.5)	36.1 (113.1)
Adelaide	7,129	829 (6,460)	1.7 (9.0)	11.8 (65.5)
Perth	2,786	630 (773)	1.2 (1.1)	7.84 (9)
Hobart	496	122 (361)	0.24 (0.5)	1.56 (4.7)
Darwin	389	144 (178)	0.26 (0.7)	1.47 (2)
Canberra	1,296	233 (2,162)	0.47 (1.0)	5.96 (22.5)
Total	**65,248**	**13,044 (53,501)**	**25 (69)**	**172 (572)**

Table 4 shows that existing household rainwater harvesting systems produced substantial reductions in stormwater runoff volumes and contaminant loads discharging to waterways in capital cities. These results indicate a significant contribution to the health of waterways. However, the synergistic benefits of these household systems are substantially greater when rainwater harvesting systems are combined with vegetable gardens that accept stormwater runoff and rainwater overflows.

Economic Efficiency

Independent Water is economically efficient as the cost of providing utility water services to both rural properties and urban properties can be high due to local geographic constraints. In urban areas an integrated approach to water management can be more efficient than relying entirely on centralised infrastructure. Infrastructure solutions are capital intensive and can lock people out of choices. Independent Water gives people options.

Bibliography

Australian Bureau of Statistics, 2013, *Environmental Issues: Water use and Conservation*, Table 1 'Sources of water for households, All households–2013', data cube: Excel spreadsheet, cat. no. 6261.0.55.00, viewed 28 March 2017, http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4602.0.55.003Mar%202013?OpenDocument

Australian Bureau of Statistics, 2015, *4610.0 -Water Account, Australia, 2013-14*, 'Main Findings', viewed 28 March 2017, http://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/4610.0Main%20Features22013-14?opendocument&tabname=Summary&prodno=4610.0&issue=2013-14&num=&view=

Chapman H, Cartwright T, Huston R, O'Toole J. 2008, *Water Quality and Health Risks From Urban Rainwater Tanks*. Adelaide, Australia: Cooperative Research Centre for Water Quality and Treatment; 2008. Report 42.

Coombes, PJ and Barry, M, 2008, *The relative efficiency of water supply catchments and rainwater tanks in cities subject to variable climate and the potential for climate change,* Australian Journal of Water Resources, Vol 12 No 2

Coombes, PJ and Barry, M, 2015, *A Systems Framework of Big Data for Analysis of Policy and Strategy ,* WSUD2015 Conference, Engineers Australia, Sydney

Coombes, PJ, Smit M, Byrne J, Walsh C 2016 *Water resources, stormwater and waterway benefits of water conservation measures for Australian capital cities* Stormwater2016, Stormwater Australia, At Gold Coast, Queensland, Australia

Peter J Coombes, Michael Smit & Garth MacDonald (2016): *Resolving boundary conditions in economic analysis of distributed solutions for water cycle management*, Australian Journal of Water Resources, DOI: 10.1080/13241583.2016.1162762

Dean, J. and Hunter, P.R., 2012, *Risk of gastrointestinal illness associated with the consumption of rainwater: A systematic review*. Environmental Science & Technology. 46; 2501- 2507

enHealth 2010 Guidance on use of Rainwater Tanks Commonwealth of Australia

Evans Craig Andrew, Coombes Peter J., Dunstan Richard Hugh, Harrison Tracey Lee, *'Extensive bacterial diversity indicates the potential operation of a dynamic micro-ecology within domestic rainwater storage systems'*, Science of the Total Environment, 407: 5206-5215. (2009).

JS Heyworth, G Glonek, EJ Maynard, PA Baghurst and J Finlay-Jones 2006 *Consumption of untreated tank rainwater and gastroenteritis among young children in South Australia,* Int. J. Epidemiol. Advance Access published May 24, 2006

Morrow Abigail Cecilia, Coombes Peter John, Dunstan Richard Hugh, Evans Craig Andrew, Martin Anthony, *2007 'Elements in tank water - Comparisons with mains water & effects of locality & roofing materials*', Rainwater and Urban Design Conference 2007, Sydney (2007)

Potter N, Petheram C, and Zhang L, 2011 *Sensitivity of streamflow to rainfall and temperature in south-eastern Australia during the Millennium drought*, 19th International Congress on Modelling and Simulation, Perth, Australia, 12–16 December 2011 http://mssanz.org.au/modsim2011

Rodrigo S, Sinclair M, Cunliffe D, Leder K. *Effectiveness and cost of recruitment strategies for a community- based randomised controlled trial among rainwater drinkers*. BMC Med Res Methodol. 2009;9:51–58.

Shelly Rodrigo, PhD, Martha Sinclair, PhD, Andrew Forbes, PhD, David Cunliffe, PhD, and Karin Leder, PhD *Drinking Rainwater: A Double-Blinded, Randomized Controlled Study of Water Treatment Filters and Gastroenteritis Incidence*, American Journal of Public Health | May 2011, Vol 101, No. 5