Rainwater Harvesting in Australia

Issues Paper for National Rainwater Harvesting Policy

V 2.0

Rainwater Harvesting AUSTRALIA

A DIVISION OF IRRIGATION AUSTRALIA

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EXECUTIVE SUMMARY

Rainwater Harvesting Australia (RHA) represents the rainwater harvesting industry in Australia and is a division of Irrigation Australia. Rainwater Harvesting is defined as rainwater captured from a roof and detained or stored for later use. It does not include rainwater captured from roads, car parks, commercial hardstand areas or small-scale catchment management such as swales.

RHA is consulting stakeholders about this Issues Paper. The consultation outcome will provide input to a national Rainwater Harvesting Policy to maximise the community benefits of rainwater harvesting. A policy also provides tangible goals and practices consistent with RHA values to present to key stakeholders.

More rain falls on Australian urban cities than the water we use from our dams, but most of it is lost in our stormwater system. We could use that water for household uses, urban greening, and disaster resilience. The rainwater we don't capture becomes stormwater that increases flood risk and environmental damage to our waterways, and in future, we will need unsustainably expensive stormwater infrastructure to manage. Increasing rainwater harvesting can manage many of our urban problems at a low cost.

Decentralised policies like rainwater harvesting and water efficiency consider water and energy use in our buildings and have important benefits for the cost of living, risk management, and resilience.

Theme 1: The key to managing urban water in both flood and drought

More rain falls on our cities than the water we use from our dams. It is a valuable but overlooked source of water that can be used for household use, urban greening and cooling, and disaster resilience. The risk of not harvesting rainwater is increased stormwater flood damage and irreversible damage to our waterways.

We can implement local rainwater harvesting on buildings using building and planning controls.

Do we need a rainwater harvesting target that the community and government can use to define our goals?

Theme 2: Managing the impending urban stormwater crisis

Our cities are not designed to manage the challenge of urban stormwater in existing areas.

Rainwater harvesting is a rare, low-cost option. It is one of the very few ways to help manage stormwater in existing urban areas, and its benefits far exceed the costs.

Do we need to define stormwater performance outcomes for our buildings and cities and use rainwater harvesting to treat stormwater at the source of the problem?

Theme 3: Measuring, Monitoring and Caring for rainwater tanks: contested ground

Rainwater harvesting has good community support. However, some of Australia's stakeholders oppose it and debate its benefits. Without good analysis, there is a risk of poor policy, decision-making, and opportunity costs to the community, measured in dollars and quality of life. We need to base our analysis on community benefits to decide how we manage and support rainwater harvesting. How do we ensure our analysis reflects the community's interest and is evidence-based?

Theme 4: Drought and Resilience: Community self-sufficiency

Future communities must be self-sufficient to meet upcoming challenges, including regular drought conditions. Rainwater harvesting allows individuals to manage their water, promoting self-reliance and resilience.

To maximise efficiency and resilience, cities should combine centrally managed utility water services with decentralised small-scale water options.

Our cities have a small number of water treatment plants servicing large areas. In the event of a health risk or a power failure, services to millions of people will be at risk. While service interruptions are rare, we cannot dismiss new and emerging threats to our way of life. These threats are likely to be associated with other disruptions. Whether we are fighting a bushfire or recovering from an earthquake, storm or cyber-attack, no access to water will impact our cities and communities more acutely than other threats.

Do we need rainwater harvesting in our climate adaptation and disaster response strategies?

Theme 5: Rainwater Implementation and Regulation

Good building and plumbing design addresses most problems with rainwater harvesting, including maintenance, and ensures the community is getting the expected benefits. Evidence of risks for health and wellbeing, loss or damage, or loss of amenity from rainwater harvesting is rare.

What level of regulation is required for rainwater harvesting?

Steps from Here

Rainwater Harvesting Australia seeks a broad range of views to inform policy that will benefit the Australian community. The policy should be evidence-based and identify common interests where the rainwater harvesting industry can work with other stakeholders to achieve shared goals.

Rainwater Harvesting invites comments on the Issues Paper to our Deputy Chairperson, Michael Smit at michaels42@gmail.com or call on 0418 372 489 by 28 June please.

INTRODUCTION

Rainwater Harvesting Australia represents the rainwater harvesting industry in Australia and is a division of Irrigation Australia.

Rainwater Harvesting Australia is consulting on an Issues Paper about the benefits of rainwater harvesting and how it should be implemented and regulated. The outcome of the consultation will inform a National Rainwater Harvesting Policy.

CONTEXT

More than one in four households in Australia has a rainwater tank[1]. Outside urban areas, rainwater is the primary source of drinking water, and almost three million people use it for household use. Thorough government health studies have found that the risks of using rainwater are low, and there is no evidence of widespread health impacts[2,3].

There has been a strong focus on energy-efficient buildings and appliances in the 2020s, but water is also essential in Australia. Decentralised water management also has cost-of-living benefits by reducing the increases in the infrastructure component of water bills and insurance premiums.

During the millennium drought, when the community was asked to meet its own water needs, thousands of Australians turned to rainwater harvesting.

The high demand for rainwater tanks led to a vibrant and expanded local manufacturing industry. A study conducted in 2020 in South Australia revealed that the rainwater industry directly and indirectly employed nearly 1,000 people in the state and contributed approximately $1 billion to the South Australian economy.

The quality of the product and product offerings has significantly improved over the last decade, overcoming quality issues from some suppliers during the boom. The mature industry now offers warranties and care services for rainwater harvesting systems.

Rainwater Harvesting faces some barriers in the water industry because of perceived cost and a perceived lack of care of systems. Potentially, the lack of incentives or rewards for governments to invest in alternative water sources is also a barrier.

An indigenous understanding of water and country could help us reconsider the relationship between community, land, and water not as a mechanistic paradigm but as a valuable one. We could consider long-established sustainability principles of our shared indigenous heritage to inform and enrich our management practices.

Rainwater harvesting that respects the views of local communities may be a low-impact solution for water management that enriches our relationship with water and, through ‘at

[1] ABS Environmental Issues: water use and conservation 2013
[2] Enhealth Guidance for Rainwater Tanks 2010
[3] Heyworth Consumption of untreated tank rainwater and gastroentiritis among young children in South Australia 2006

source', stormwater management reduces our reliance on mechanistic solutions and intrusive infrastructure in our waterways.

One of Australia's most successful water efficiency and rainwater harvesting policies is the BASIX program in NSW, which has set water-related performance objectives for new buildings since 2004.

Understanding the benefits of Rainwater Harvesting

Rainwater Harvesting is only one of a range of urban water management tools. Still, this simple technology has many benefits: demand management, drought response, disaster resilience, flood management, stormwater pollutant and volume controls, urban cooling, and groundwater replenishment. Compared to other water management technologies, including desalination plants or retention ponds, rainwater harvesting also uses low-cost, easily accessible products.

Rainwater is delivered by nature to the building where it will be used, so transport costs are very low. A roof is a non-trafficable area, so the risk of contamination is low, and treatment costs are very low for many household uses. In principle, rainwater should be a very efficient source of urban water.

Thirty years ago, the benefits of rainwater harvesting were measured by the number of litres of utility water a householder could save, multiplied by the water charge per litre. Significant water savings of 20 to 40% of household uses, or 40,000 - 80,000 litres annually, equate to $100- $200 annually. Even multiplied by 500,000 homes in the NSW BASIX program, the annual savings of $100 million are modest.

Professor PJ Coombes provided groundbreaking research by modelling whole urban systems, including water and sewage distribution costs. The study showed that a more significant benefit of demand management and alternative water sources is deferring investment in major water infrastructure projects. The benefits to the whole community are measured in billions rather than millions of dollars. If households pay 70% of urban water charges[4] Then, a six-billion dollar deferred investment in Sydney represents a $2100 savings for each of Sydney's 2 million households.

Systems analysis also identified the costs if our buildings did not harvest the BASIX rainwater. Rainwater from roofs becomes stormwater, and the benefits associated with flood management and stormwater pollutant management represented an additional $6 billion benefit or an additional $3000/household in reduced charges or reduced risks[5].

For example, nitrogen from falling rain is a critical pollutant of our waterways, and it is expensive to remove at about $4000/kg. Harvesting and storing rainwater in a tank reduces nitrogen and other stormwater pollutants. Harvesting about 32GL of rainwater across Sydney represents a $256 million community benefit from nitrogen reduction or about $128 annually

[4] Coombes et al Systems Analysis and Big Data reveals Economic Efficiency of Solutions at Multiples Scales 2018

[5] Coombes, P., & Smit, M. (2020). Alternative Water Strategy for Sydney v1. Newcastle: Urban Water Cycle Solutions p41

per household. Traditionally, these benefits have not been associated with the cost-benefit analysis of rainwater harvesting.

The yield from rainwater harvesting mostly depends on how it is used—the more connected appliances, the higher the yield. The tank size and the roof area harvested are relevant but less important. Yearly yields of 60,000 - 90,000 litres are achievable from well-designed rainwater harvesting systems on average-sized detached dwellings[6].

Most houses use about 88,000 to 390,0000 litres of water each year.[7] Combined with water efficiency measures, rainwater can meet about 40% of household uses in Greater Sydney.[8]This is important because it reduces the demand for water and infrastructure across the urban system, providing long-term savings by deferring and reducing new infrastructure costs.

Quantifying the costs of Rainwater Harvesting

A 5000-litre rainwater tank costs about $2000 to $5000 fully installed. A 2000-litre tank could cost $800 - $4000, and a 10,000-litre tank could cost $2000 to $6000[9]. Additional plumbing, landscaping, and stormwater plumbing will cost much less if the tank is installed during the house's construction, but they will cost more if the rainwater tank is fitted after the house's construction.

Maintenance and service costs about $100 each year over the 20-year life of the rainwater tank.[6]

The energy cost of pumping rainwater is relatively high, at about 1kwh/1000 litres. Still, the costs are relatively low, at about $0.30/1000 litres, so most householders use more powerful pumps than they need. These pumps can be used for garden irrigation or cleaning if required. This area is where rainwater harvesting could be more efficient, subject to customer preferences.

For new development, these costs are borne by the builders and passed onto homeowners. According to economists, this creates a market failure because the builders who bear the costs do not receive the benefits of the investment and, therefore, will only invest if required by legislation. This was the rationale for NSW's BASIX water efficiency and rainwater market intervention and regulation.[8]

Rural Rainwater Harvesting Outside of Cities

Rainwater is the main source of drinking water outside urban areas, and almost three million people use rainwater for household uses, including drinking. Without rainwater

[6] Coombes and Smit, Alternative Water Strategy for Greater Sydney 2020

[7] Bureau of Meteorology. (2024). *National Performance Report 2022-2023: urban water utilities 3.1.1.* Bureau of Meteorology

[8] NERA Economic Consulting BASIX Post-Implementation Cost-Benefit Analysis An Economic Evaluation of the State Environmental Planning Policy- Building Sustainability Index (BASIX) A Report for the Department of Planning 2010

[9] Websearch April 2024 rainwater tank price catalogues

harvesting, our communities could not survive in most of rural Australia. Rural practitioners are experienced in managing rainwater harvesting and meeting their own needs.

Rainwater Harvesting Australia does not have evidence of risks to the community from rural rainwater harvesting, and our consultation with rural rainwater users does not support increased regulation for rainwater harvesting.

Thorough government health studies have found that the risks of using rainwater for drinking are low with sensible conditions and that there is no evidence of widespread health impacts.[10,11].

RHA supports off-grid homes and communities that are self-reliant for their water, power and waste. Capturing and using resources like rainwater at the source, as rural communities have done for over two centuries, allows regional areas to thrive and supports our agricultural and farming communities.

[10] Enhealth Guidance for Rainwater Tanks 2010

[11] Heyworth Consumption of untreated tank rainwater and gastroentiritis among young children in South Australia 2006

RAINWATER HARVESTING THEMES

Theme 1: How can we manage urban water for both flood and drought?

Issue:

Small-scale building designs can manage water demands and mitigate the impact of stormwater on a city-wide scale.

Problem Statements

More rain falls on Australian urban cities than the water we use from our dams, but most of it is wasted into our stormwater system.

We harvest less than 10% of the rainwater that falls on our cities, but we could use that water for household uses, urban greening and cooling, and disaster resilience.[6]

The rainwater we do not harvest or detain becomes stormwater, which increases flood risk and environmental damage to our waterways. In the future, we will need expensive stormwater infrastructure to manage it, and our communities will face higher insurance costs.

Rainwater is seasonal and cyclical. During dry times, there may not be enough to meet the needs of the whole city.

Pathways

The National Water Agreement, States and Territories establish water efficiency, demand management and stormwater management targets in urban planning policy and building regulations and allow rainwater harvesting to contribute to these outcomes.

Building design is one of the most practical and effective ways to manage water because many of the problems our buildings create, such as additional water demand and increased stormwater volumes, can be addressed at construction and the source of the problem. Additional water sources balance the increased demand for water. The potential stormwater generated from the site can be mostly captured so management doesn't have to go further down the catchment.

Supply and demand solutions are implemented simultaneously with the buildings that create the problems. Importantly, at-source stormwater management is more efficient and requires smaller capacity to manage stormwater challenges than solutions further down the catchment.[12]

[12] Ruijie Liang, Michael Di Matteo, Mark A. Thyer, Holger R. Maier, Graeme C. Dandy, Russell King, Aaron Wood. (2020). EVALUATING SMART STORMWATER STORAGE SYSTEM FLOODING, REUSE AND WATER QUALITY BENEFITS. *OzWater Conference.* Australian Water Association

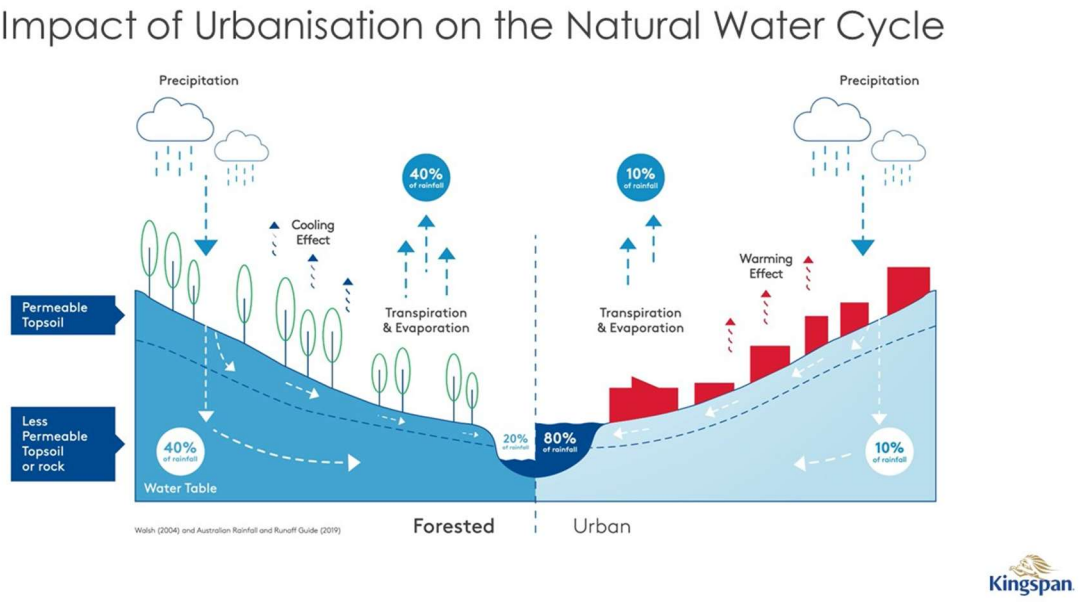
Theme 2: Managing the impending urban stormwater crisis

Issues:

Should our buildings help to reduce the stormwater damage they cause?

Problem Statements

The existing stormwater infrastructure in our cities will be overwhelmed by a factor of around 2.5 due to the combined impact of more hard surfaces and more intense rain events.[13]. The figure below shows the radical change to natural water flows when urbanising land.



Flooding is the most expensive natural disaster. We tend to focus on massive floods, which are relatively rare, and rainwater harvesting has little impact in an overwhelming rain event. Minor floods that occur regularly have a significant financial impact, and rainwater harvesting is one of the simplest and most cost-effective ways to help address small flood events in existing urban areas.

It is financially unsustainable to retrofit stormwater pipes and ponds in existing urban areas to meet these challenges.[14]

Walsh and Fletcher in Victoria have identified stormwater runoff as a new class of environmental flow problem due to the impact of directly connected impervious areas with very low percentages of the catchment area, causing irreversible damage to local waterways.[15] The damage from fast-moving stormwater to our waterways is irreversible and

[13] South Australia State Planning Commission People and Neighbourhoods Discussion Paper 2019
[14] South Australia Legislative Council Hansard Statutory Authorities Review Committee Inquiry into the Stormwater Management Authority *2021*
[15] Walsh, Fletcher, Burns Urban Stormwater Runoff: A New Class of Environmental Flow Problem 2012

unnecessary; we can make simple improvements to building design to help create a city that celebrates and enjoys healthy and high-functioning waterways, not concrete drains.

Urban stormwater is a new class of environmental flow problem: one that requires the reduction of a large excess volume of water to maintain riverine ecological integrity. It is the best type of problem, because solving it provides an opportunity to solve other problems such as the provision of water for human use.[12]

This is also an equity issue. New development avoids additional building costs to manage their stormwater, which increases the flooding risk and environmental damage to communities downstream.

Rainwater Harvesting through the BASIX policy in NSW is expected to deliver $6.6 billion in stormwater management benefits in Sydney by 2050[16] This government-commissioned research is not acknowledged in NSW State government policy.

Pathways

Harvesting rainwater has significant and measurable stormwater benefits, which Engineers Australia clearly documented in the Australian Rainfall and Runoff Guidelines 2019. Rainwater Harvesting acts as a shock absorber for urban stormwater, reducing stormwater volumes and velocity by storing rainwater for later use and slowing down urban runoff.

Require 'at source' stormwater management to reduce stormwater volumes and reference rainwater harvesting as a performance outcome for urban planning policy

Require 'at source' stormwater management to reduce pollutant impact on waterways and reference rainwater harvesting as a performance outcome for urban planning policy

Require 'at source' stormwater management to reduce flooding risk and reference rainwater harvesting as a performance outcome for urban planning policy

Require the disconnection of impervious area runoff from stormwater channels to reduce volume and flow and prevent irreversible damage to local waterways.

Reference rainwater harvesting as a performance outcome for urban planning policy.

Rainwater Harvesting is recommended as a preferred but not mandatory policy response. It is accessible and low-cost, but the policy uses performance outcomes that can be met with various performance solutions.

[16] Coombes and Smit, Alternative Water Strategy for Sydney, 2020

Theme 3: Measuring, Monitoring and Caring for rainwater tanks: contested ground

Issue:

Rainwater harvesting has good community support. However, some of Australia's stakeholders oppose it and debate its benefits. Without good analysis, there is a risk of poor policy, decision-making, and opportunity costs to the community, measured in dollars and quality of life. We need to base our analysis on community benefits to decide how we manage and support rainwater harvesting.

How do we ensure our analysis reflects the community's interest and is evidence-based?

Problem Statements

The best available independent modelling indicates community benefits in Greater Sydney alone of more than $10 billion NPV from rainwater harvesting and more efficient service delivery to 2050; however, this is not reflected in government policy and decision-making.[6]

The economic and environmental benefits of rainwater harvesting and sustainable building design are contested and not articulated in government policy considerations. Without this analysis, there is a risk of poor decision-making, with an opportunity cost to the community measured in dollars and quality of life.

Significant differences exist between the data on the yield, effectiveness, and viability of rainwater harvesting in the rainwater harvesting industry and the traditional water industry. This creates an uncertain environment for policy development in the community's interest.

Existing independent data from the Australian Bureau of Statistics and Melbourne Water show that the community maintains rainwater harvesting systems and is highly satisfied with them. This does not suggest a widespread reluctance to support them.

Despite widespread community benefits, there is little or no government investment in education and support for rainwater harvesting systems. There are also no government rainwater harvesting maintenance strategies, support, or incentives for maintaining rainwater harvesting systems.

Pathways

There is a low-cost, high-quality data solution to these issues through IoT telemetry, which can demonstrate rainwater tanks are operational or require maintenance, show yield patterns over time and, most importantly, demonstrate stormwater volumes diverted from local urban areas. The cost per rainwater tank is several hundred dollars, and the recommendation is that all urban rainwater tanks include telemetry until there is a common understanding of the quantified benefits and costs of rainwater harvesting.

A rainwater harvesting system should be treated like any other integral infrastructure system and administered based on evidence-based implementation, outcomes, life cycle, and maintenance schedules.

If there is evidence of significant problems with caring for rainwater tanks, then a state and local government maintenance strategy based on a mix of education, regulation, and incentives is recommended. Such a program is likely low-cost and practical, given the high levels of community support for rainwater harvesting and the community benefits from reduced household costs in water charges and stormwater management.

Given that the best available modelling indicates community benefits of more than $10 billion in Greater Sydney alone from an alternative water strategy to 2050, a program to investigate and quantify actual benefits appears to be firmly in the community's interest.

Theme 4: Drought and Resilience: Community self-sufficiency

Issue:

Should we include rainwater harvesting as a significant climate adaptation and disaster response strategy for water management?

Problem Statements

Australia has a long history of enduring severe, consistent droughts. Government policies shift quickly from emphasising strong water efficiency during droughts to focusing on other objectives in the following decades.

The COAG principles for water management developed after the Millennium drought were quite clear. Policymakers should always consider a balance of water supply (more desalination/recycled water plants) and demand management (water efficiency and alternative water sources like rainwater harvesting) in planning for water security.

Although parts of Australia are arid, our capital cities have a history of small rainfall events during droughts. Because a roof is an impervious surface, rainwater harvesting can still collect water from small rain events long after dry catchments cease to have any runoff. In a significant drought, it may take 150mm of rain before runoff resumes.

Resilience requires a range of available responses to unexpected events. Relying on a single solution or set of solutions is not resilient, and we should look for solutions that meet multiple objectives. While government support is essential and welcome, we also need our communities to be self-sufficient.

Urban flooding is likely to be a significant issue. The Australian projections from the Insurance Australia Group indicate tropical cyclones are likely to extend south into northern NSW. Warmer air holds more water and generates more intense storms, indicating more intense rain and storm events across most of Australia. These impacts will coincide with rising sea levels.[17] Other reports suggest up to 5% of Australian houses may become uninsurable due to rising premiums in higher-risk locations.[18]

Water infrastructure may be a risk for the community. A small number of water treatment plants service large areas. In the event of a health risk or potential health risk to a treatment plant, water services to millions of people will be at risk. Centralised water systems are also vulnerable to cybercrime, terrorism, and more mundane incidents such as operational failures.

A disturbing feature of the NSW 2019 bushfires was that some households no longer had access to town water before and after the fire unless they had a rainwater tank or other water storage. In the longer term, as experienced in Christchurch, NZ, rainwater tanks provided an ongoing water source for six months after significant water pipes were damaged in their earthquake.

[17] Bruyere et al, Severe weather in a changing climate, 2nd Ed *2021*
[18] Ting et al The Rise of Red Zones at Risk 2021

While water service interruptions are rare, they are likely associated with other disruptions. If we are fighting a significant bushfire or recovering from a major earthquake, storm, or cyber-attack, no access to water will make a bad situation worse for the community.

Pathways

Communities with some control over the critical resources they need will likely be more resilient, particularly when emergency services and utilities are overwhelmed. If most buildings have a rainwater tank this becomes an emergency local water storage for household and emergency needs.

Decentralised infrastructure is more complex to administrate, requires different management understanding and skills, has more variability and doesn't have well-established funding models. However, decentralised infrastructure is resilient because destruction or interruption of any part of the network doesn't affect the rest of the network. A decentralised network of rainwater tanks in urban and rural areas provides high levels of community self-sufficiency in a crisis and natural and man-made disasters.

Based on risk management principles, intervention is justified to increase resilience because while the incidence of water service interruptions may be low, the consequences are very severe.

Theme 5: Rainwater Implementation and Regulation

Issue:

Good building and plumbing design addresses most problems with rainwater harvesting, including the need to care for your rainwater harvesting system. Evidence of risks for health and wellbeing, loss or damage, or loss of amenity from rainwater harvesting is surprisingly rare.

Regulation must be based on a clear public rationale. In consultation with the rainwater harvesting industry, costs, competitive impact, and regulatory alternatives must be documented. Rainwater harvesting should not be regulated without documented evidence of a problem.

What level of regulation is needed for rainwater harvesting?

Possible Actions

1.1 Work with the Australian Building Codes Board to amend the National Construction Code to include water efficiency, water resilience and stormwater management performance outcomes for our buildings

1.2 Work with the Australian Building Codes Board to develop voluntary guidelines that can be used to help the community manage rainwater harvesting

1.3 Oppose regulation of rainwater harvesting not supported by a robust public benefit rationale as required by COAG principles of best practice regulation, the Commonwealth Intergovernmental Agreement with the ABCB and the Commonwealth Memorandum of Understanding with Standards Australia

Problem Statements

Evidence of risks for health and wellbeing, loss or damage, or loss of amenity from rainwater harvesting is rare. The benefit to the community of regulating rainwater harvesting has not been demonstrated.

The costs of regulating rainwater harvesting, the cost of limiting restrictions on technologies and practices, the cost to the community of determining who can do the work, and the competitive impact on different industries do not appear to have been sufficiently considered by regulators[19].

As a result, it has not been possible to show that the benefits of rainwater harvesting regulations are more significant than the costs and that there is a clear rationale for regulation.

[19] Urban Water Cycle Solutions. (2021). Review of the potential for cross connection and backflow from properties with rainwater harvesting. Carrington: Urban Water Cycle Solutions.

Pathways

Building design is one of the most practical and effective ways to manage water because it addresses many of our water problems at the source to create more self-sufficient cities.

Rainwater harvesting should be supported in building and plumbing codes through relevant performance objectives that encourage its benefits and ensure the National Construction Code does not inadvertently prevent it (as has recently occurred for charged lines in Victoria).

Voluntary measures to satisfy performance objectives are available through industry associations and government advice (including the RHA Design Guide, HB230, and BASIX Guidelines). These documents are generally free of charge and easily accessible. Because plumbing practitioners are required to meet performance objectives, there is a strong incentive to use the voluntary guidelines.

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(All these reports are available from the Rainwater Harvesting Australia website)

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