Thank you for the opportunity to make a submission on behalf of Kingspan Water and Energy.

There are three aspects we wish to respond to you in relation to water and we request the opportunity to make a more detailed further submission after 18 September 2020.

Firstly, using the Systems Framework process developed by Professors Coombes and Barry shows that water efficient appliances and rainwater harvesting have strong whole of society benefits far exceeding the installation costs. These findings are very different to those provided by consultants and universities who work with water corporations.

Secondly, on water governance. Water Corporations have a strong commercial interest in water infrastructure supply solutions affecting their revenue differently to water efficiency and rainwater harvesting solutions. We are concerned at how that commercial outcome and the legislated requirement for the Water Corporations to act as commercial entities could influence investment decisions and advice and how that commercial interest is managed to protect the public interest.

We are concerned that the focus on supply side infrastructure solutions is inefficient and has resulted in large price rises and falling productivity in Australian cities. The exception is NSW where BASIX, through rainwater harvesting and water efficiency which was implemented by the Department, not the water corporations, has limited the need for infrastructure investment.

We consider that there needs to be a clear separation of powers with policy and investment advice made by government, and water services provided by the water businesses who, as you know, are required to operate as commercial entities. This in itself would remove many barriers to innovation and alternative water sources, under the business model we consider the water corporations are constrained to infrastructure supply solutions which determine their current and future revenue.

Thirdly, on the viability of rainwater harvesting. We are still considering how to respond to the National Productivity Commission determination that rainwater harvesting is not viable. We do not agree with the finding and process used to inform the determination. The determination was based on a small number of reports and we are aware of a significant body of published Australian research demonstrating the viability of rainwater harvesting and that further research is underway.

In the interim we consider that the most useful contribution we can make to the discussion is to submit to the NSW Productivity Commission our submission with Urban Water Cycle Solutions to the Commonwealth Productivity Commission National Water Reform Inquiry. The submission provides economic data about falling productivity in the water sector and shows how NSW, with BASIX, has performed very differently to all the other states who don't have a water efficiency program built into their land use and development process.

We have only recently become aware of this report and the opportunity to make a submission. We request the opportunity to provide a more detailed late submission and the opportunity to meet with the Commission to explain our concerns.

Kind regards

Submission to Productivity Commission National Water Reform Inquiry

24 August 2020

[redacted] **Urban Water Cycle Solutions**

[redacted] **Kingspan Water and Energy**

Recommended citation: Coombes P.J., and Smit M., (2020), Submission to the Productivity Commission National Water Reform Inquiry, Urban Water Cycle Solutions; Kingspan Water and Energy.

About the Authors

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Our Submission

Thank you for the opportunity to make a submission. Our submission is divided into three parts.

1. The principles to be satisfied for any government investment in major water infrastructure projects, including a separation of powers, potential conflicts of interest and a governance framework for a proposed national water body
2. The interaction of water policy with other policy areas such as climate, energy, agriculture, forestry, land use planning and urban development - we highlight a sustainable buildings model
3. Proposed principles for a National Water Commission

1. The principles to be satisfied for any government investment in major water infrastructure projects - including a separation of powers, potential conflicts of interest and a governance framework for a proposed national water body

A national water commission with a remit to seek non-conventional solutions from all sectors within and outside the water industry and provide an independent level playing field for assessment of water management options could deliver independent and less conflicted recommendations to improve productivity and bring forward new solutions to meet the water challenges of the 21st Century.

1.1 Problem Statement

Government owned water bureaucracies operate as regulated monopolies and corporations with narrow shareholding that are largely outside of the governance faced by other corporations. They naturally seek to protect their monopoly power through neutralising views from outside their networks to maximise revenue and market share, and influence policy. This is known as rent seeking. This interest has not been sufficiently regulated due to a lack of separation of powers and has resulted in a significant industry wide loss of productivity, reducing national household welfare and stifling innovation in the water sector.

1.2 Current Urban Water Scenario

We request the Productivity Commission, and the broader society, consider a scenario on how urban water is managed in Australia.

In this scenario the water management paradigm in Australia was established in 1842 by Edwin Chadwick in London when he proposed a system of freshwater reservoirs around London to pipe water into London, and pipe sewage outside the city. The model has been incredibly successful and adopted world-wide, including in Australia. It is a 'water in – water out' linear model designed to address important health challenges of the day but with inherent flaws, it assumed that the water supply was limitless and free and it didn't consider rural areas, drought, stormwater, local waterways, urban heat island effects, irrigation, the urban water cycle or the natural water cycle[1]. From a systems perspective the model is based on centralised infrastructure, decentralised systems are incomprehensible in this model, the paradigm does not have the concepts or analytical tools to manage decentralised service models. Current urban water management is also path dependent, decisions are limited by past decisions and factors that may no longer be relevant.

Consider that this 'water in – water out' paradigm is well established in the legislated, regulatory, financial and political framework in Australia over the last 200 years. Consider that the water industry is a $50B industry with economic and cultural influence to determine what topics are suitable for discussion. The paradigm is sacred and the whole industry, including government and the regulators, exercise normative thinking, or a desire for cohesiveness that minimises conflict, innovation and productivity (Daniell et al, 2014).[2]

In this scenario the large water corporations play a central role, they have abundant economic power afforded by their dominant firm oligopoly position to use in marketing and research budgets, highly

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[1] Troy, P. (2008). *Troubled Water: Confronting the water crisis in Australia's cities.* ANU E Press

[2] Daniell K. A., Coombes P. J., and White I., Politics of innovation in multi-level governance systems. Journal of Hydrology. 519(C): 2415-2435 2014

paid and talented senior executives to lobby and influence and they have legislated responsibilities to provide policy and infrastructure advice to government.

In this scenario the water corporations are in a conflicted position, they are required to act in their own business interests but also in the public interest. Then they are asked to develop strategies that will directly determine their future revenue.

In the neo-liberal fervour of the 1990 - 2000s water utilities were restructured into government owned water corporations with one of the consistent legislated objectives being to act as a business[3]. There are efficiency and productivity benefits from a business approach to service provision but if the corporation acts to maximise business interests they are, by definition, not acting in the public interest. The stage is set for a regulated conflict of interest.

However, it is the revenue model for water corporations where some of the most extraordinary aspects of this scenario come into play. The widely adopted method for determining water corporation revenue is the building block method[4] and it comes straight from the Chadwick model in 1842. In the Chadwick model the water is free but the utility invests in and operates reservoirs, treatment plants and pipes. So, the main components of the building block method are a return on the capital invested in infrastructure and the operating cost of that infrastructure. In the building block method the water itself has no value, just as Chadwick assumed.

So, the more infrastructure the water corporation owns the more revenue it receives as a return on capital invested. Water management options that don't require infrastructure investment, like water efficiency, result in perceived lost revenue to the corporations relative to infrastructure investment options. For example, if the water strategy requires a $3B recycled sewage plant that represents $180 million of annual revenue to the owner of the infrastructure based on a 6% weighted average cost of capital. Incidentally, the weighted average cost of capital discussion appears to be a common assumption, in the UK it is 2.96%.

The higher the costs of operating and maintaining the infrastructure the more revenue the Water Corporation receives. Water management options that do not require utility operation and maintenance again result in perceived relative lost revenue to the water corporations.
Finally, the water corporations are regulated to determine water management options for Australian cities. These decisions are made in the context that the corporation is expected to act in its business interest and the more infrastructure required the more revenue will be received from capital invested and operational costs.

In this scenario it could be argued that revenue is not a net benefit, and revenue is balanced by expenditure and the corporation is no better off. That is not how private industry operates, providing you are not making a loss (and as a government monopoly even if you are!) the more turnover and

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[3] IPART. (2018). *Review of the Sydney Water Corporation Operating Licence 2015-2020.* Sydney: Independent Pricing and Regulatory Tribunal

[4] IPART. (2020). Review of Prices for Sydney Water from 1 July 2020 - Draft Report. Independent Pricing and Regulatory Tribunal New South Wales. Retrieved from https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/pricing-reviews-water-services-metro-water-prices-for-sydney-water-corporation-from-1-july-2020/legislative-requirements-prices-for-sydney-water-corporation-from-1-july-2020/draft-report

cash flow the more opportunities for flow on benefits internally and to other stakeholders, increased economic influence, increased employees, marginal benefits, higher executive salaries and so on.

In this scenario an argument could be put forward that infrastructure investments have increased the water security for our cities. This may be the case, however it is not proven in two regards. Is the infrastructure investment we have made the most efficient solution or could some lower cost investment have provided a better outcome? Secondly the supply infrastructure installed after the millennium drought has not proved itself in a subsequent drought. Early indications in all states are that the infrastructure does not provide sufficient water security and that additional infrastructure investments will be required to meet the challenges of the next drought.

Translating this scenario into a hypothesis, if water corporations are acting in their business interests what would the outcomes be? Arguably we would see a bias towards infrastructure investment to maximise corporate revenue and inefficient decision making would lead to increased prices and loss of productivity. Arguably the loss of productivity would be less where a broader range of demand and supply options were implemented reflecting a more balanced and therefore more efficient decision-making process (Coombes et al., 2018).[5]

1.3 Urban Water Productivity

The economic efficiency of Australia's centralised water utilities is rapidly declining – and consumers are paying for it. At a macroeconomic level (household welfare across the economy), grid water costs for households in Melbourne, Adelaide and south-east Queensland have jumped by up to 180 per cent over the past decade, while water usage has increased by less than 10 per cent. At a microeconomic level (Utility budgets), the operating costs for water utilities have soared by up to 170 per cent and the economic efficiency of water supply has plunged by up to 2300 per cent.[6]
Australian Financial Review 18 Jan 2017

Coombes et al[7] investigated household expenditure on utility water services impact on household disposable income which influences household welfare and ultimately consumption in the economy.

Household welfare was considered a macroeconomic indicator of economic efficiency of water utilities in each region. Household expenditure on utility water services impacts on household disposable income which influences household welfare and ultimately consumption in the economy.

Utility water operating costs were found by Coombes et al. (2015)[8] to be a dominant proportion of the costs of providing urban water services and a measure of the efficiency of utility services. Water operating costs are considered a micro-economic indicator of utility performance in this investigation.

National results for total consumer (Total Bill) and household expenditure (Total Household Bill) on utility water and sewerage services, and total urban water use (Water Use) was derived from BOM and NWC data as presented in Figure 1.

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[5] Coombes P. J., Barry, M. E., Smit, M., Systems analysis and big data reveals economic efficiency of solutions at multiple scales, OzWater 2018, Australian Water Association, Brisbane, Australia, 2018

[6] Coombes, P. (2017, January 18). Why the water supply needs a splash of competition. *Australian Financial Review*

[7] Coombes, P J; Barry, Michael; Smit, Michael. (2018). Systems Analysis and Big Data reveals Economic Efficiency of Solutions at Multiples Scales. OzWater 2018. Australian Water Association.

[8] Coombes P.J. and Barry M.E. (2015). A Systems Framework of Big Data for Analysis of Policy and Strategy. *WSUD2015 Conference.* Sydney: Engineers Australia

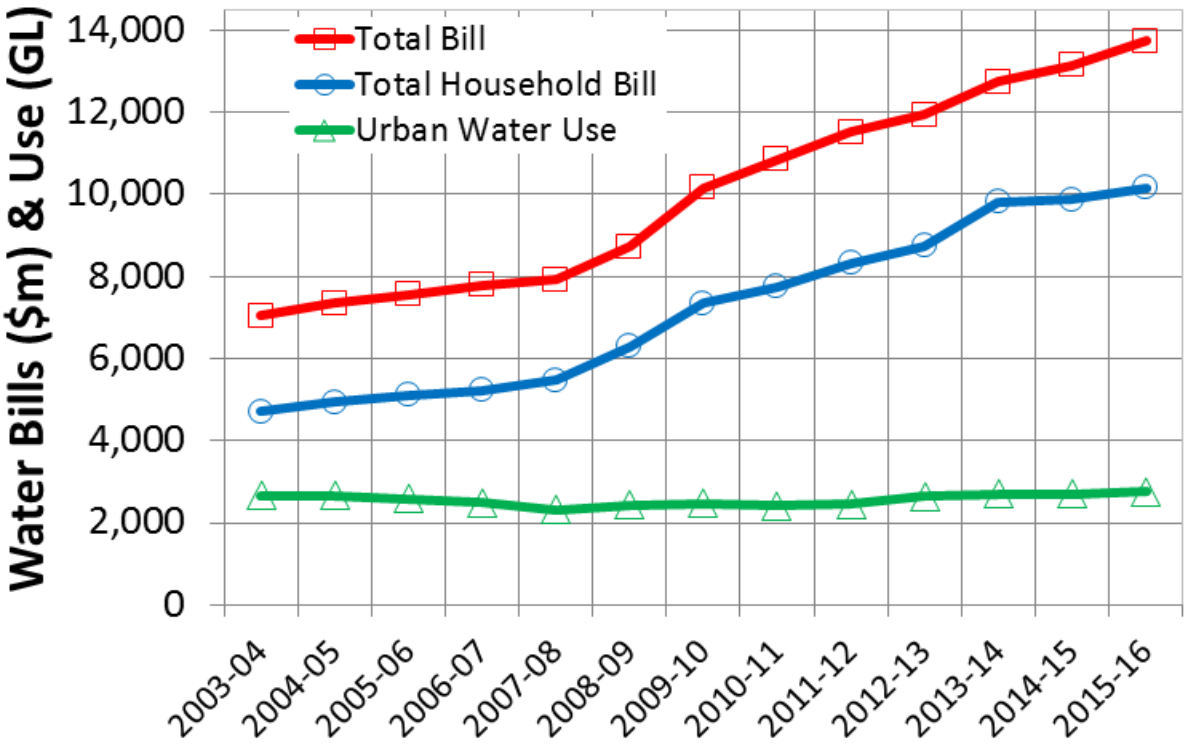

Figure 1: National expenditure for all connections (Total Bill) and households (Total Household Bill) on utility water services and urban water use.

Figure 1 shows that total expenditure on urban water services increased by 95% ($6,695 million) and household expenditure increased by 116% ($5450 million) for a 3% (88 GL) increase in utility supply. The change in Consumer Price Index (CPI), a measure of the changing value of money over time or inflation, during the same period was 38% (Reserve Bank of Australia, 2017). Determination of the present values of national expenses (adjusted for inflation effects) for all urban water and sewerage services reveals a 41% real decline in economic efficiency. These results provide a historical national average real marginal cost of urban water services of $46/kL. Figure 1 reveals that households are paying a greater proportion of urban water revenue. The proportion of household expenses has increased from 67% to 74% whilst the proportion of household water use has declined from 61% to 60% of total urban water use. National results for household expenditure on utility water and sewerage services (Total Household Bill), household expenditure on utility water services (Household Water Bill) and household water use were also derived from BOM and NWC data and shown in Figure 2.

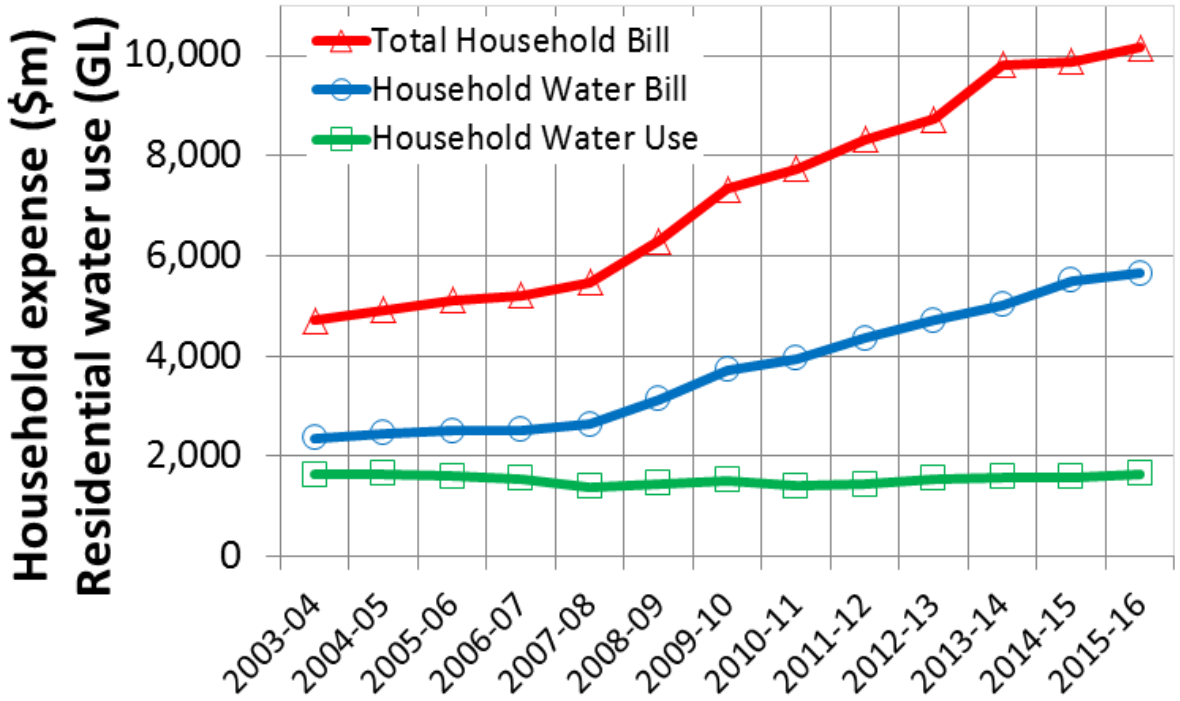

Figure 2: National expenditure by households on utility service (2013 – 2016)

Figure 2 highlights that household water bills increased by 140% ($3290 million) for a 2% (28 GL) increase in household use of utility water services. These results represent a real increase in household expense for utility water services of 74% and a real historical marginal cost of $85/kL for utility water supply to households. The historical real marginal cost for utility water and sewerage services to households was $140/kL. These real increases for total consumer and household expenses, and historical marginal costs of utility services represent a substantial loss in economic efficiency from a national perspective.

Regional household expenses for utility water services

The magnitude and patterns of household expenditure for utility water services were expected to vary across Australia. Household expenses for utility water services is presented for Sydney, SEQ, Melbourne, Adelaide and Perth regions in Figure 3.

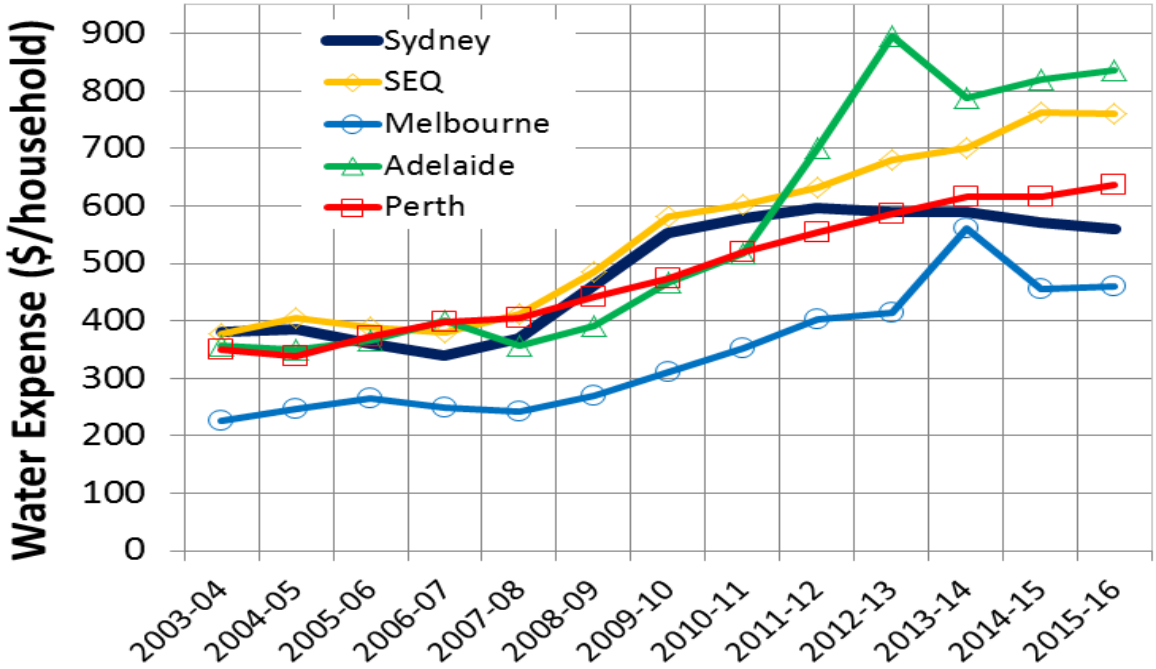

Figure 3: Regional average annual expenditure by households on utility water services in Sydney, SEQ, Melbourne, Adelaide and Perth regions

Figure 3 shows all regions are subject to increases in annual household expenses for utility water services. The trend for average annual household expenses for Sydney is different to other regions with household expenses stabilising and declining after the 2009-10 financial year. This result is consistent with the greater and more substantial increases in household water savings of 46440 ML (93%) in Sydney.

Nominal (actual) and real (adjusted for inflation) changes in household expenses for utility water services is summarised in Table 1 for each capital city region.

Table 1: Nominal and real changes in household expenses for utility water services for Sydney, Melbourne, SEQ, Adelaide and Perth

Region	Change in household water expense			
	Nominal		Real	
Sydney	$180	47%	$35	7%
Melbourne	$236	104%	$150	48%
SEQ	$381	101%	$237	45%
Adelaide	$479	134%	$343	70%
Perth	$285	81%	$151	31%

Table 1 shows Sydney households experience the smallest real increase in household expenses for utility water services of $35 (7%). The remaining regions were subject to higher increases in real

household expenses for utility water services ranging from $151 (31%) for Perth to $343 (70%) for Adelaide. Median available household income (AMI) in each region was defined using data from Australian Bureau of Statistics (2016) Population and Housing data as median income less taxation (disposable income) less mortgage or rent expenses. The proportion of household water expense (HWE) of available income was defined as (HWE/AMI). Increased real impact on household welfare was defined as the change in real household water expense (HWE) divided by available household income (AMI) as summarised in Table 2.

Table 2: Available median income (AMI), utility water expense (HWE) and real effect on households

Region	AMI ($/yr)	HWE ($/yr)	HWE/AMI (%)	Change HWE/AMI (%)
Sydney	41530	560	1.4	0.08
Melbourne	39180	461	1.2	0.38
SEQ	39090	461	2.0	0.61
Adelaide	33130	836	2.5	1.04
Perth	40120	636	1.6	0.38

The economic efficiency of utility water supply, as defined by household expenditure, has declined in all regions which impacts on household welfare and gross domestic product. These impacts are substantially reduced in Sydney that has the highest growth in water savings due to water efficient appliances and rainwater harvesting. These results indicate that higher growth in water savings has driven down utility water tariffs (Sydney has the second lowest usage and lowest fixed utility water changes) which has diminished growth in household expenses for utility water services across the entire Sydney region relative to other regions. This provides additional benefit of reduced utility water expenses to low income households.

The change of utility water operating costs per connection, during the period 2003 to 2016, from BOM and NWC reports was examined to understand the efficiency of the urban water systems in each region as shown in Figure 4.

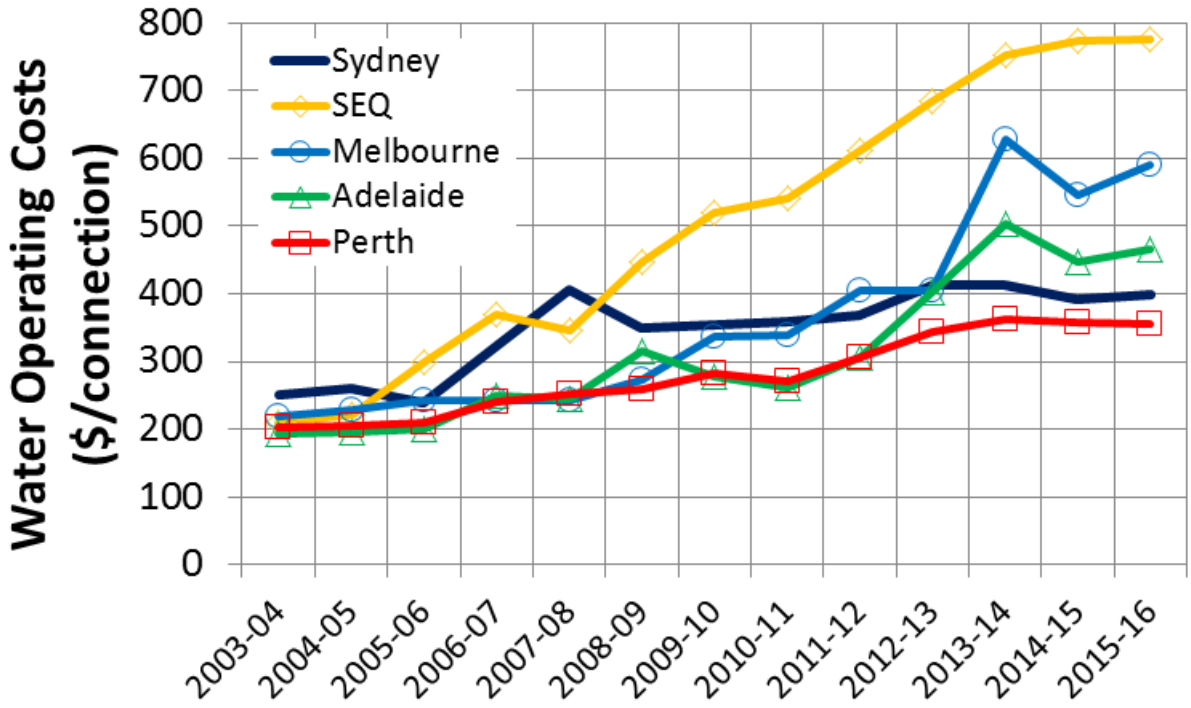

Figure 4: Regional utility operating costs in Sydney, SEQ, Melbourne, Adelaide and Perth regions

Figure 4 shows that utility water operating costs of has increased across all regions since 2003. The lowest and highest increases in utility water operating costs were in Sydney (59%) and SEQ (269%). The nominal and real changes utility water operating costs per connection for each region is presented in Table 3.

Table 3: Nominal and real changes in utility water operating costs per connection for Sydney, Melbourne, SEQ, Adelaide and Perth

Region	Change in operating costs			
	Nominal		Real	
Sydney	$148	59%	$53	15%
Melbourne	$361	158%	$273	85%
SEQ	$565	269%	$485	167%
Adelaide	$271	140%	$197	73%
Perth	$162	76%	$81	28%

Table 3 demonstrates that SEQ (167%), Melbourne (85%) and Adelaide (73%) have experienced substantial real increases in operating costs since 2003. Sydney (15%) and Perth (28%) had the significantly lower real increases in reported water operating costs. Sydney experiences a different pattern of growth in water in utility water operating expenses that stabilises after the 2007-08 financial year that consistent with the growth in household water savings (Figure 3). In contrast, the SEQ region is subject to a high growth in water utility operating costs that may be driven by implementation of a regional water grid after 2008.

1.4 Water Conservation in Greater Sydney and more broadly

In June 2020 the NSW auditor general reported on water conservation in Greater Sydney. The report concluded that

the Department and Sydney Water have not effectively investigated, implemented or supported water conservation initiatives in Greater Sydney. The agencies have not met key requirements of the Metropolitan Water Plan and Sydney Water has not met all its operating licence requirements for water conservation. There has been little policy or regulatory reform, little focus on identifying new options and investments, and limited planning and implementation of water conservation initiatives. As a result, Greater Sydney's water supply may be less resilient to population growth and climate variability, including drought.[9]

This would be consistent with the Current Urban Water Scenario presented for Sydney Water where water efficiency would be inconsistent with their business interests and a common narrative would prevent the Department of Planning, Industry and Environment from speaking out.

One of the problems with water efficiency/demand management/conservation is the lack of transparency in the industry. It would be extremely useful if both the budget and volume of water saved by each utility was included as an additional performance measure in the Bureau of Meteorology National Performance Reports. There are 166 performance measures but water efficiency is not one of them. The absence of these reporting items despite the importance of these programs in the millennium drought does seem to support the Current Urban Water Scenario.

1.5 Infrastructure Australia Infrastructure Audit 2019

An external audit of the water industry was carried out by Infrastructure Australia in 2019 and made the following findings.

"*Governance and decision making in the water sector are not meeting best practice and are not adequately preparing Australia for the future*"

COAG urban water planning principles[10] requires urban water planners 'consider the full portfolio of water supply and demand options' and that selection of options should be made through a robust and transparent comparison of all demand and supply options…with the aim to optimize economic, social and environmental outcomes… recognizing that in most cases there is no one option that will provide a total solution. The Current Urban Water Scenario would suggest it is illogical to expect this outcome from the current governance structure of corporate water utilities who are constrained in their business model and their scope.

In response to the 1994 COAG agreement water utilities in metropolitan areas were corporatized but wholly owned by government, as they remain today. The result is a notional separation which, in practice, is characterized by inherent conflicts…[11]

One of the potential conflicts is between the public interest and the business interest of the corporate utility. Enabling legislation for corporate water utilities indicates they are expected to

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[9] New South Wales Auditor General. (2020). Water Conservation in Greater Sydney. Audit Office of New South Wales

[10] Australian Government . (2020, March 12). National Urban Water Planning Principles - COAG. Retrieved from Department of Agriculture, Water and the Environment: https://www.agriculture.gov.au/water/urban/policy-reform-urban-water/planning-principles

[11] Infrastructure Australia. (2019). Australian Infrastructure Audit 2019. Infrastructure Australia.

operate on business principles[12]. A logical strategy for building long-term revenue streams seems to be making large infrastructure investments and enjoying the return on capital built into water pricing. This commercial interest may be a barrier to recommending other water security options, such as water conservation and rainwater harvesting that do not increase the asset base.

"*Desalination is typically regarded as one of the most expensive forms of water supply, meaning it should be one of the last options considered. By contrast many solutions that have little or no cost… have not been fully explored*"[11]

Many of the 'new' water management solutions are outside the scope of traditional water managers, including water pricing, land use planning, stormwater management, green infrastructure, decentralized and distributed solutions.

1.6 Separation of Powers

It is proposed that the structural separation of powers principles demonstrated in the Australian constitution be applied to water law frameworks to separate the operation of government water monopolies from their bureaucratic partners, regulators and government owners. Planning and approval powers must also be separated from operational functions to better protect the long-term interests of consumers and environment (Coombes, 2017).[13]

This should form a guiding principle for government investment in water infrastructure and the operation of a national water commission.

1.7 Stifling Innovation – crowding out

"It appears that the more decentralised, integrated and participatory water management innovations developed in the name of greater sustainability for water security are struggling to successfully negotiate their implementation in multi-level governance systems; especially when they present competition and challenges for existing entrenched systems of water management that exhibit significant inertia and pathway dependence."[14]

The paper identifies that at least two levels of administration are needed to implement innovation with one level focussed on practical implementation. This suggests a role for a national water commission in supporting and promoting not just innovation but specific models of innovation.

Discussions with government regulators have shown that it is critical that regulators, departments and higher governance levels have unrestricted access to water corporation data sets to prevent the problem of asymmetrical access to data.

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[12] Coombes, P., & Smit, M. (2019, March 21). No separation of water powers - what are we losing? The Fifth Estate. Retrieved from https://www.thefifthestate.com.au/urbanism/environment/no-separation-of-water-powers-what-are-we-losing/

[13] Coombes, P.J. (2017). Impact of water law on urban monopoly power and consumer expenses. unpub

[14] Daniell, Coombes and White, (2014) Politics of innovation in multi-level water governance systems

2. The interaction of water policy with other policy areas such as climate, energy, agriculture, forestry, land use planning and urban development (sustainable buildings argument)

The Current Urban Water Scenario shows that the water management solutions we need will not come from the water industry without active engagement with other sectors and an externally imposed direction to change path dependent and uncritical preference for narrow options.

The scenario highlights the inherent and effective barriers to innovation and increased productivity and the path dependency that without external intervention will ensure we get more of the same, more centralised infrastructure, more pipes, more treatment plants limited to better ways to get water into our cities and sewage out.

Based on the systems framework analysis developed by Coombes and Barry, we identified that building design plays a key role in integrated water management. Specific, measurable and accountable performance standards on buildings relating to water efficiency, stormwater management, green infrastructure and alternative water sources have a synergistic benefit at every scale, lot scale, neighbourhood scale, regional and city-wide scales.

Integrating land use development with water related performance standards allows an incremental change to the urban landscape as new sites are developed and older sites are redeveloped. This model has already been tested and proved to deliver measurable benefits through the BASIX program in NSW.

We do need to highlight the important body of work carried out by Coombes and other authors on the systems framework and integrated water management. Consistent with the Current Urban Water Scenario this body of work is mostly excluded from the consideration of the water industry. It is not that it has been assessed and disputed, it is simply not acknowledged and not referenced. This body of work does not fit the urban water paradigm, it is does not comply with the required path and it creates controversy and disagreement. In the Current Urban Water Scenario, it is better for the industry not to mention it.

Key publications include the following:

- Parliamentary reports in NSW leading to the development of BASIX in 2004
- Bonacci Water and Office of Living Victoria reports in Victoria in 2011, 2012 and 2014[15]
- Resolving Boundary Conditions in economic analysis of distributed solutions for water cycle management for South East Queensland in 2015[16]
- The Greater Melbourne Alternative Plan 2018[17]

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[15] Coombes, P.J. (2011). Initial response Study 1 - Transitioning to a resilient, liveable and sustainable greater Melbourne (system wide study) for the Living Victoria Ministerial Advisory Committee. Bonacci Water;

Coombes, P.J., and Barry, M.E., (2014), Systems Analysis of Water Cycle Systems: economic analysis of Options and Scenarios for the Living Ballarat project, Report to the Victorian Government by the Chief Water Scientist;

Coombes, P.J., and Bonacci Water, (2012), Living Melbourne, Living Victoria: Greater Melbourne Systems Model – Modelling in support of Living Victoria Ministerial Advisory Council

[16] Coombes, P., Smit, M., & Macdonald, G. (2016). Resolving boundary conditions in economic analysis of distributed solutions for water cycle management. Australian Journal of Water Resources, Vol 20, 11-29

[17] Urban Water Cycle Solutions, & Thirsty Country. (2017). The Greater Melbourne Alternative Water Plan. Newcastle: Urban Water Cycle Solutions

- Planning Resilient water resources and communities: the need for a bottom up systems approach 2018[18]
- An Alternative Water Strategy for Sydney 2020[19]

Given the 2018 publication received the GN Alexander medal from Engineers Australia as the best engineering paper for hydrology and water resources in Australia it is increasingly difficult for the water industry to continue to pretend this body of research does not exist.

This behaviour serves as an example of the behaviour outlined in the Current Urban Water Scenario to limit the scope of discussion and stifle innovation. This behaviour also serves to demonstrate the need for external forces to manage the development of the water industry in Australia. The systems framework analysis which leads the world in this field, the findings about decentralised and integrated water management and the key concepts of performance standards for building design at the lot level and water utility operations need to be put on the table and considered in an impartial way not constrained by 150 years of water history.

This can only be done through the creation of a national body with the authority and independence to step outside our current paradigm and open the door to new stakeholders and new solutions.

[18] Barry, M. E., & Coombes, P. J. (2018). Planning resilient water resources and communities: the need for a bottom up systems approach. Australasian Journal of Water Resources 22(2), 113-136

[19] Coombes, P., & Smit, M. (2020). *Greater Sydney Alternative Water Plan.* Newcastle: Urban Water Cycle Solutions

3. Proposed Principles for a National Water Commission

- Commissioners bring experience from other industries to provide independence and innovation and have no commercial interest in water utilities or water industry associations.
- The remit of the Commission it to seek and assess non-conventional solutions from all sectors within and outside the water industry and provide an independent level playing field for assessment of water management options to deliver independent and less conflicted recommendations to improve productivity and bring forward new solutions to meet the water challenges of the 21st Century.
- The Water Commission has full access to government owned water corporation data to ensure symmetry of data access in assessment and decision making. This data should be publicly available whilst compliant with privacy legislation.
- The Water Commission consider the full portfolio of water supply and demand options and that selection of options should be made through a robust and transparent comparison of all demand and supply options…with the aim to optimize economic, social and environmental outcomes… recognizing that in most cases there is no one option that will provide a total solution. The principles of Pareto Optimum based on maximising whole of society welfare must be applied.
- The Water Commission consider all the urban water planning principles documented by the Council of Australian Government[10]
- The Water Commission has a special function to review new research in the water industry every two years, to independently evaluate the research and report the findings to Parliament
- Innovation research[2] identifies that at least two levels of administration are needed to implement innovation with one level focussed on practical implementation. This suggests a role for a national water commission in supporting and promoting not just innovation but specific models of innovation.
- The Water Commission be guided by the structural separation of powers principles demonstrated in the Australian Constitution applied to water law frameworks to separate the operation of government water monopolies from their bureaucratic partners, regulators and government owners.
- Strategic and infrastructure planning and approval powers must also be separated from the utilities or organisations that provide operational function to better protect the long-term interests of consumers and environment

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Mr Peter Achterstraat
NSW Commissioner for Productivity
By email: ProductivityFeedback@treasury.nsw.gov.au
2 October 2020

Dear Commissioner Achterstraat,

Submission to Productivity Commission Green Paper

Thank you for the opportunity to make a further submission on this matter from a NSW business that is deeply impacted by your report.

Kingspan Water & Energy is the largest manufacturer of rainwater tanks in Australia, and is part of the Kingspan Group, a global manufacturer of sustainable building products. Nearly a decade ago Kingspan and Rainwater Harvesting Australia, the industry peak body, became involved in a systems approach to urban water research. The research findings of Professor PJ Coombes will change urban water management to meet the challenges of the 21st century.

More efficient solutions for water management exist but we are not implementing them. There are a series of institutional and regulatory barriers to efficient decision making that are based on outdated and unchallenged assumptions. As a result, the way we analyse and understand urban water management and the decisions regularly fail the public interest test.

THE RESEARCH

Professor Coombes is a Fellow of Engineers Australia and Chair of Engineering at Southern Cross University, a former Chief Water Scientist for Victoria, a former member of the advisory panel on urban water resources to the National Water Commission and an adviser to the United Nations.

The body of research work is based on an important idea. Because of the scale of urban areas and the complexity of the interactions the analysis and understanding of urban issues has traditionally been based on a top down analysis using averages and general assumptions. Coombes and Barry utilised the power of modern computing to reverse this analysis, using behaviour at the individual building level to model all water related performance based on local data and building suburb, city and regional models from 'the bottom up". The impact of this research is still being understood but the insight that using system wide averages hides some of the most important relationships in managing urban water was recently awarded the GN Alexander Prize for Hydrology and Water Resources by Engineers Australia[1].

[1] Barry, M. E., & Coombes, P. J. (2018). Planning resilient water resources and communities: the need for a bottom up systems approach. *Australasian Journal of Water Resources 22(2)*, 113-136

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Coombes and Barry called this mode of analysis the Systems Framework[2] and used it to analyse different urban water scenarios. This analysis consistently showed that the benefits of decentralised 'at source' solutions such as water efficiency and rainwater harvesting outweighed the costs.

There are some key documents to consider, which explain the development of the Systems Framework and analyse the costs and benefits of decentralised sustainable building design incorporating water efficiency and rainwater harvesting for capital city systems:

- Barry, M. E., & Coombes, P. J. (2018). Planning resilient water resources and communities: the need for a bottom up systems approach. *Australasian Journal of Water Resources 22(2)*, 113-136.
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- Coombes, P., & Smit, M. (2020). *Alternative Water Strategy for Sydney.* Newcastle: Urban Water Cycle Solutions.

KEY CONCEPTS

Big data modelling

A key understanding of the Systems Framework is that multiple services and assumptions including water, sewage, stormwater, water efficient behaviour, rainwater harvesting and their prices can all be modelled simultaneously at the lot level through stochastic simulations at six minute intervals for 100 year runs to assess how changing one factor changes the behaviour of all the others. The outcomes at every local level can be scaled up to regional analysis. This modelling uses billions of calculations and requires supercomputers running continuously for hundreds of hours.

[2] Coombes P.J. and Barry M.E. (2015). A Systems Framework of Big Data for Analysis of Policy and Strategy. *WSUD2015 Conference.* Sydney: Engineers Australia

Long transfer distances for water and sewage

A second key understanding is that the long transfer costs of water and sewage services create diseconomies of scale which give 'at source' decentralised solutions an economic advantage. This is a good example of 'top down' vs 'bottom up' analysis. Top down analysis uses a 'postage stamp' approach to water costs, the cost of water services are assumed to be the same for each property throughout Sydney.

In contrast Coombes and later IPART found that water service costs per property vary with geography, by up to a factor of 10 based on distance and elevation. This is simple economics, more energy and infrastructure is required to move water 50km up to the Blue Mountains than 1km on a flat plain. Based on a bottom up analysis in parts of Sydney where transfer costs are high alternative water sources and water efficiency are far more cost effective than increasing the supply of utility water. Changing the mode of analysis has reversed the cost benefit analysis and revealed previously hidden opportunities.

Sustainable Buildings

A third key finding is to see 'sustainable buildings' as a solution for urban water problems, rather than their cause. Addressing demand management, stormwater management, water security and economic efficiencies at the lot scale has surprising and non-linear benefits at every scale including a regional level using a Systems Framework analysis. We are fortunate that NSW has implemented this approach through the BASIX land use planning policy and we can report on the outcomes using the systems framework.

Stormwater and Severe Weather in a Changing Climate

This is the fourth key finding of the Coombes research, sustainable buildings are important and effective at managing stormwater challenges 'at source'. Emerging stormwater and flooding issues in urban areas have the potential to have the most significant financial implications for urban water managers.

In 2015 a Senate enquiry into Stormwater Management[3] found
Wheater (2006) and UN (2015) highlight that urban flooding is a recurring and increasing global challenge. The inquiry into stormwater management by the Australian Senate (2015) reveals that flooding and ecological degradation is an escalating problem in Australia. Urbanisation drives substantial increases in flood risks and ecological damage at the small catchment scale (Wheater 2006; Walsh 2004; Coombes, Babister, and McAlister 2015). Substantial proportions of insurance claims for flood damage are associated with urban stormwater run-off (Wheater 2006; Australian Senate 2015).

A recent report from the Insurance Australia Group found that intense bursts of rainfall are expected to increase across the country, increasing rainfall intensities by between 7% and 21% for every

[3] Australian Senate. (2015). *Stormwater Management in Australia.* Environment and Communications References Committee of the Australian Senate, Commonwealth Government of Australia

degree of warming resulting in more frequent and severe flash floods, even though the overall rainfall trend may decline. The east coast of Australia will be particularly vulnerable to flash flooding and fast response river flooding due to this expected increase in intense rainfall coupled with increased impacts from east coast lows and the southward expansion of the areas at risk of tropical cyclones. The report implies that major changes in urban planning and urban water management will be required. [4]

A recent ABC report projected that up to 10% of Australian homes could become 'uninsurable' by 2100[5] due to a whole combination of insurance factors including flooding. The IAG report used the term 'uninhabitable' for localised urban areas experiencing the potential impact of multiple severe weather events. Even though the statistical likelihood of such events remains rare the insurance premiums could be unsustainable.

Using a systems perspective demonstrates efficiencies where particular infrastructure can achieve multiple benefits. An important finding of the Australian Rainfall and Runoff Guidelines are that rainwater harvesting is an effective means of managing stormwater. This means that rainwater tanks as a stormwater management solution are also available to improve water security and cost effectively reduce the demand for potable water. This is a particularly important consideration for sustainable building design and the principle that each asset should fill multiple roles in effective design.

Currently Stormwater Queensland, Water by Design in Queensland, Water Sensitive SA, the Improving Stormwater Ministerial Advisory Committee in Victoria, CASBE in Victoria and the Engineers Australia Australian Rainfall and Runoff Guide all call for rainwater harvesting to help address urban stormwater management challenges.

Most recently, although we have reservations about some of their assumptions, we note the report released by SA Planning on 1 October documenting a positive cost benefit analysis for rainwater harvesting in urban infill areas in South Australia[6] based on community savings in stormwater infrastructure.

[4] Bruyère, C., Buckley, B., Prein, A., Holland, G., Leplastrier, M.,. (2020). Severe weather in a changing climate, 2nd Ed. Insurance Australia Group. doi:10.5065/b64x-e729

[5] Ting, I., Liu, R., Scott, N., & Palmer, A. (2019, March 19). The runaway insurance effect. Retrieved from www.abc.net.au: https://www.abc.net.au/news/2019-03-13/climate-data-reveals-australias-worst-affected regions/10892710?pfmredir=sm&fbclid=IwAR3vjhdDcMcW5GfWiDKyCehwfWuWJVAr6xACs-DNd1eMRw0VD68lymYtsy4

[6] BDO EconSearch. (2020). *Options Analysis: Costs and Benefits of Stormwater Management Options for Minor Infill Development in the Planning and Design Code.* BDO EconSearch

[redacted]

BASIX

Urban Water Cycle Solutions and Kingspan have prepared an Alternative water Strategy for Sydney[7] assessing the costs and benefits of the BASIX provisions as an integrated strategy for the water management of Greater Sydney.

"This report finds that Greater Sydney, despite significant challenges, currently has the most efficient and sustainable water services in Australia. This has been achieved through the strategic alignment of water demand management, rainwater harvesting and urban development. The BASIX state environmental planning policy has built-in demand management and stormwater management in most new buildings in the Greater Sydney region since 2004 and this 'bottom up' approach has a major legacy impact on the efficiency of water services. BASIX policies have already saved the Greater Sydney region about 79 billion litres of water annually by 2019, comparable to the 90 billion litre annual capacity of the Sydney desalination plant.

The Systems Framework is used to model and then compare four future scenarios based around the current BASIX policy. Business as Usual projects continuing the current Planning Policy compared to

- not having BASIX,
- an improved BASIX to include water sensitive urban design and
- a combined improved BASIX and variable price structure for water and sewage.

BASIX has already, up to 2019, delivered a combined economic value of benefits from savings in water and sewage services, stormwater management, avoided flood damages and reduced nutrient loads of $3414 million

Up to 2050 an improved BASIX and variable price structure would deliver benefits of $7B in community benefits compared to Business as Usual and $11B compared to not having BASIX at all.

The key insight is that a combination of supply and demand management is more efficient than relying entirely on supply solutions when considering whole of society benefits. These demand management solutions include behaviour change, water efficient appliances and rainwater harvesting. An example of these benefits is the 5 year deferral of the multi-billion dollar desalination augmentation provided by the BASIX policy. The inclusion of rainwater harvesting as a stormwater management solution has both infrastructure and demand management benefits and is an efficient decentralised infrastructure asset that improves the performance of the whole system.

This investigation has identified water and sewage transfer distances of over 50 km across Greater Sydney. Transporting a heavy liquid over these distances and significant changes in ground elevations represents high capital and operational costs and potential economic inefficiencies. In some parts of Greater Sydney, the shadow cost (medium run marginal cost) of delivering water and sewage services is greater than $16/KL, which is nearly 800% more than the household usage tariff.[7]

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

[redacted]

The design of new and renovated buildings is the main driver of water and energy demand for urban utilities. One of the reasons that Sydney Water has been able to maintain some of the lowest operating costs is that over 460,000 houses in Sydney have now been built with BASIX measures in place. It is working.

CONCLUSION

We believe we have provided both documentation of the benefits of rainwater harvesting and an important understanding about the changing state of urban water analysis and the expanding range of challenges that our urban water managers need to consider.

The latest systems framework assessment of water management options shows that NSW can delay the cost of these big infrastructure spends just by changing the way the water utilities get paid. And save the state billions. And still have enough water supply.

A crucial component of efficient service delivery is competition. The proposition that water corporations are monopolies that do not compete with other water sources is based on the assumption that all water comes from a treatment plant and is quite wrong.

The productivity implications are enormous. As per our first submission there is considerable economic data to suggest that current water management practices have rapidly declining productivity over the last two decades in areas outside NSW and that a significant factor in the efficiency of the Sydney system is due to BASIX and decentralised water management solutions.

There is also data to suggest that water challenges pose a significant threat to the viability of many of our urban areas. Severe weather events, flooding risks are heatwaves are difficult to comprehend, however the expert advice is that the costs of mitigating these risks is much less than the costs of natural disasters. This means we need to shift from relying on the water utilities for advice to include a much broader spectrum of local government, stormwater associations, environmental associations and private industry who can contribute to smarter ways to make sure NSW continues to be a liveable and productive place to live.

We would welcome an opportunity to discuss this further. Please contact [redacted]

Yours sincerely,

[redacted]

Kingspan Water and Energy

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