

Australian Government
Productivity Commission

Integrated Urban Water Management — Why a good idea seems hard to implement

Productivity Commission Research Paper

March 2020

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ISBN 978-1-74037-691-4 (PDF)
ISBN 978-1-74037-690-7 (Print)



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An appropriate reference for this publication is:

Productivity Commission 2020, *Integrated Urban Water Management — Why a good idea seems hard to implement*, Commission Research Paper, Canberra.

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The Productivity Commission

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The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

Further information on the Productivity Commission can be obtained from the Commission's website (www.pc.gov.au).

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Abbreviations

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
IPART	Independent Pricing and Regulatory Tribunal (NSW)
COAG	Council of Australian Governments
IWCM	Integrated Water Cycle Management
NSW	New South Wales
NT	Northern Territory
NWI	National Water Initiative
PC	Productivity Commission
Qld	Queensland
SA	South Australia
Tas	Tasmania
Vic	Victoria
WA	Western Australia
WSAA	Water Services Association of Australia
WSUD	Water sensitive urban design

Disclosure of interest

The *Productivity Commission Act 1998* specifies that where Commissioners have or acquire interests, pecuniary or otherwise, that could conflict with the proper performance of their functions during an inquiry, they must disclose the interests.

Dr Jane Doolan has advised the Commission that she is:

- Deputy Chair, Western Water
- Independent Chair, Yarra Consultative Committee
- Chair, Independent Expert Panel on Murray-Darling Basin Capacity and Delivery Review.

Executive summary

The urban water sector in Australia is facing major challenges over the coming decades.

Our major cities are changing rapidly. Population projections indicate that our five largest capital cities will need to accommodate around 10 million *additional* residents by 2050. Climate change is likely to mean increased temperatures, reduced rainfall, more frequent and severe droughts and more extreme storm events. In response, billions of dollars will be spent over the next decade on new water infrastructure in growth areas and replacing existing ageing assets.

With such rapid growth, there is a major focus on ensuring that cities remain 'liveable'. A key component of liveability is the provision of urban amenity, including access to high quality green open spaces, which is increasingly recognised as being important for the physical and mental health of residents and their potential to combat rising temperatures in urban areas. The availability of water — both in the landscape and to ensure the 'green' in green open space — is an important input to providing enhanced amenity.

This creates a challenge for the urban water sector, which not only needs to provide traditional water services to a rapidly growing population, but also to service potential additional demands to contribute to enhanced amenity, and to do so in the context of climate change. The level of investment required provides a key opportunity to rethink how water, wastewater and stormwater services are delivered to ensure that both current and future communities get the best value possible from this investment. As many water assets are expensive with long operating lives, it is important to get these decisions right, as decisions taken now cannot be reversed and will set up the nature of these growth areas forever.

Integrated water cycle management (IWCM) is a relatively new approach that is advocated by the water sector as a way to meet these challenges more efficiently and effectively. IWCM is a whole-of-system, multidisciplinary approach that aims to manage the entire urban water cycle by integrating the delivery of water, wastewater and stormwater services to contribute to the full suite of water security, public health, environmental and urban amenity outcomes that the community seeks. Using an integrated approach as the 'business-as-usual' approach for the planning and management of urban water services allows a greater range of options to be identified and evaluated at the outset, which can be designed to provide a broader suite of community outcomes, including enhanced urban amenity. This should lead to better decisions and lower cost solutions. However, IWCM cannot be delivered by the water sector alone. Implementing IWCM will require significant, ongoing collaboration between the land-use planning and local government sectors and the water sector, in both policy and planning at a range of different scales.

This paper examines the policy and implementation frameworks currently governing the urban water sector to identify where there may be impediments to the adoption of IWCM. The focus is on the arrangements in major cities because of their projected growth, but the issues identified are likely to be relevant to smaller towns and cities as well.

The current arrangements for water supply and wastewater management in major cities are generally effective for delivering safe and secure water supplies and disposing of wastewater in ways that meet health and environmental standards. It is when attention moves to the integration of stormwater management and the role of the urban water sector in contributing to delivering enhanced urban amenity outcomes that a number of barriers to the implementation of IWCM become apparent. The paper canvasses ten key impediments in the current operating environment. There are likely to be others, but addressing these ten, particularly those in the policy sphere, would make a significant difference to the implementation of IWCM.

Impediments in the policy environment

There is a lack of clear objectives for water-related aspects of enhanced urban amenity

While broad government statements support the need to enhance urban amenity by providing green public open space for communities, there are no clear, government-endorsed objectives for this aspect of urban amenity that would enable effective planning to meet this community need. This means that the authorising environment is ambiguous, which weakens the incentives for water and urban planners to work together at critical early stages of planning processes to identify and then evaluate a range of options. Water management options that provide enhanced amenity, or improved environments in greenfield and major infield areas, may be more expensive than traditional approaches that do not provide the same level of outcomes. However, there is no clear policy framework for making planning decisions that balance the benefits of enhanced urban amenity against any additional cost.

Roles and responsibilities for providing enhanced amenity are unclear

A consequence of the lack of clear policy objectives is that the roles and responsibilities for providing water-related urban amenity are often perceived to be unclear. In some areas, urban water utilities have been pushing the boundaries of their mandated roles and obligations. They have been showing, through pilot projects and partnerships with local governments, the feasibility and benefits of alternative IWCM approaches in providing enhanced amenity. The lack of a clear interface between urban planning and water service planning generates the potential for role creep and cost transfers (for example, from ratepayers to water utility customers). Unclear roles and responsibilities can lead to confusion about who should pay for enhanced urban amenity. This may result in some people disproportionately bearing the cost of providing this amenity or pursuing projects with low

overall benefits. Water utilities may also promulgate views on the form of urban development, which has historically been the domain of state and local urban planners.

Statutory land planning and water planning are not well linked

Identifying and evaluating options for enhancing urban amenity requires close collaboration between statutory land planners and water planners at the right scales and at the right times to influence decision-making. At the city scale, this could influence the urban form and the area, type, quality and connectivity of public open space and urban habitat to make best use of water flows within catchments. This would then be incorporated into requirements at both district/precinct and local scales. Currently, few formal processes link statutory land planning and water planning to require this collaboration at the full range of city, district/precinct and local scales.

Stormwater planning and management is not integrated into general water planning

While different models exist, stormwater management in major cities is generally undertaken by local governments, while water utilities supply water and undertake wastewater management. This gives rise to very different management arrangements across these elements of the urban water cycle. Stormwater management was not part of past COAG water reforms, and is not subject to the same level of detailed, consistent policy direction and economic and environmental regulation as other parts of the urban water sector. These factors have acted to effectively silo these functions. Despite tentative steps to break down these silos in different jurisdictions, nothing systematic is in place.

Restrictions and mandates prevent all options being put on the table

Some governments have policy bans in place that prevent evaluation of IWCM options against other possible options for achieving the required policy outcomes. Suitably treated recycled wastewater or treated stormwater cannot be used to *directly* augment the supply of potable water in all states and territories, even when that water meets exactly the same strict public health standards that apply to potable water. Suitably treated recycled water can only be used to augment potable water supplies in Western Australia and Queensland if the water is first released back into the natural environment. There are also restrictions on using rural water for urban use. Such bans may result in the adoption of higher cost or otherwise inferior solutions and may inhibit the sector from delivering the full range of potential water sector outcomes in a cost-effective way.

The flip side to this is when governments have decided to favour certain solutions over others. Many governments, for example, set recycled water targets, mandate the installation of household rainwater tanks or specify that recycled water is to be used in particular applications (such as for flushing toilets). These policy decisions are often set without clear and transparent

evidence and analysis. They have driven significant investment and have sometimes resulted in higher costs than alternatives and failed to deliver their expected benefits.

Removing these inefficient policy bans and mandates would enable urban water service providers to consider opportunities that respond to local circumstances and achieve better or lower cost outcomes.

Impediments in water service planning and delivery

There are barriers to effective collaboration

IWCM requires ongoing collaboration between a range of organisations. This is critical not only in the planning stage (impediment 3 above), but also at decision-making, through implementation and during ongoing management. Many IWCM projects are at the boundaries of water utility or local government roles and it is not always clear which entity should lead. Implementing IWCM may require better on-ground arrangements between organisations covering operational decision-making, risk sharing, land management and project governance, with agreed accountabilities for monitoring, ongoing maintenance and stakeholder engagement. There are examples of IWCM projects that have floundered because these implementation arrangements were not sufficiently considered at the outset and were not able to be agreed to later.

Project selection is not always based on rigorous and transparent assessment of the options

IWCM expands the number and range of options for delivering a broader range of outcomes, both city-wide and locally, making decision-making more complex. However, there is a lack of rigorous and transparent assessment of the options using cost–benefit analysis — a deficit that needs to be addressed. In the absence of robust processes, decisions have not always been informed by the relative net benefits of different options. Reform will require organisations involved in IWCM planning to be capable of assessing costs and benefits across the entire water cycle, recognising the interrelationships involved across different scales of water management, and across the broad range of outcomes. Such assessments are relevant at different stages of the planning process, and at different scales, with the most appropriate approach depending on the circumstances.

Local-scale and system-wide water planning are not well integrated

IWCM requires consideration of the interaction between local and system-wide projects. To achieve this, there needs to be a clear interaction and exchange of information across all water services — water, wastewater and stormwater — and between local and city-wide system planning to promote economically efficient outcomes. Few processes exist to enable

this to occur with confidence, although some jurisdictions are developing them. While this is a complex task, taking into account the interactions between centralised and local options is critical to ensuring optimal system-wide outcomes.

Impediments in the regulatory environment

Environmental regulators often focus on actions instead of outcomes

Arrangements for discharging wastewater into aquatic environments are governed by state environmental regulators, who have focused on licensing point-source wastewater discharges from water utilities to minimise their impact on the environment. By contrast, stormwater is viewed as a diffuse source of pollution and is not adequately regulated, regardless of the fact that, in growing cities, stormwater can account for a significant proportion of pollution entering waterways. In some cases, regulatory requirements to maintain or improve environmental water quality can lead to a focus on more stringent wastewater discharge conditions and inhibit an IWCM approach. Taking a more outcomes-based approach may provide more flexibility and enable a broader range of potentially cheaper solutions to achieve the same environmental outcomes.

Cumulative effects of regulation can impede integration

Additional administrative hurdles, excessive transaction costs and complex regulatory regimes can impede the uptake of IWCM options on top of any arbitrary policy bans or mandates (impediment 5). Recycled wastewater and stormwater harvesting projects, to the extent that they are allowed in individual jurisdictions, may still have to comply with the quality and other standards imposed by both the environmental and health regulators if they produce potable water, with the former regulating the recycling of water and the latter regulating drinking water. Separate national guidelines for recycled and drinking water do not help. Some jurisdictions have additional policies or impose further regulatory requirements on providers, such as the requirement to use the best quality source of water available rather than taking a fit-for-purpose approach. Such policies and regulations can arbitrarily restrict the range of options considered, consequently increasing costs to customers and impeding a fully integrated approach to urban water management.

Progressing an integrated approach

None of these impediments are new. In each area, there are examples of best practice. In these cases, governments clearly understand the need for integrated water management and are seeking to enable or facilitate the approach to be taken. Yet they have not provided the leadership required through substantive policy change for IWCM to become the new business-as-usual approach for urban water management.

Reflecting these policy impediments, IWCM projects can be difficult to fund. In the view of many urban water utilities, this could be rectified by additional government funding or by allowing water authorities to charge their customers for the additional costs involved. However, the funding issues observed by the sector are generally the symptoms of the broader policy issues described above. These policy issues need to be thought through and decisions made, particularly about the level of urban amenity sought in new growth areas. If the policy is clear, existing funding principles and mechanisms for the water sector and local governments can be employed.

Providing clearer policy on issues like enhanced urban amenity is not an easy task. There are trade-offs between the quality and type of urban amenity and environmental outcomes being sought and the costs of providing them. There are questions of equity to be considered, including the impacts on house prices, who should bear the costs of improving liveability and community wellbeing, the issue of 'intergenerational equity' as well as the long-term opportunity costs of not providing an appropriate quality of urban environment in a changing climate. However, it appears that the urban water sector, in partnership with some local governments, has gone as far as is possible under the current broad policy statements. The absence of a clear policy direction about the significance of urban amenity and the expectations of state governments are key impediments to not only the adoption of an IWCM approach, but also to the quality and liveability of future suburbs that are currently being planned. Given the rapid growth of our major cities and the importance of amenity to community wellbeing, this issue now requires stronger policy direction from governments.

The ten key impediments identified point to where action is needed to progress IWCM towards becoming the new business-as-usual way of planning and managing urban water resources. This would assist urban water providers to make better decisions and deliver lower cost solutions for providing the full suite of community water needs in our major cities. These issues and possible policy responses will be explored further in the Commission's next review of progress on national water reform to be undertaken later in 2020.

1 Why this study?

1.1 The Commission has an ongoing role in assessing water policy

The Commission has two recurring functions under the *Water Act 200*7 (Cwlth):

- to assess progress against the *National Water Initiative* (NWI) every three years
- to assess progress in implementing the *Murray-Darling Basin Plan* every five years.

Given its ongoing role and presence in Australia's water sector, the Commission has decided that, between scheduled inquiries, it will conduct targeted research to help inform strategic policy thinking on matters that are important to progressing national water reform.

1.2 Further development of urban water policy is required

In its 2017 inquiry into *National Water Reform*, the Commission identified that providing urban water services in our fast growing cities, against a backdrop of climate change, is a significant water policy challenge for Australia. The Commission recommended that urban water management should be a new major theme in a renewed NWI.

Since the Millennium Drought (1997–2009), the water sector has pursued the idea that urban water services could be delivered more effectively if 'integrated water cycle management' (IWCM) was adopted. IWCM is a whole-of-system, multidisciplinary approach that aims to manage the entire urban water cycle by integrating the delivery of water, wastewater and stormwater services to provide a range of economic, social and environmental outcomes for the community. There are many different interpretations of IWCM. A definition of how IWCM has been interpreted and applied in this paper is provided in chapter 3.

A broad range of IWCM solutions have been trialled at different scales, and many have shown that integrated solutions can not only deliver safe and secure water supply, wastewater and stormwater services, but can also contribute to achieving a wider range of environmental and urban amenity objectives than traditional water management approaches (WSAA 2017a, 2019a). This has given rise to a strongly held view in the sector that IWCM should be endorsed as the new 'business-as-usual' approach. Governments have generally endorsed IWCM at a broad, conceptual level (DELWP 2017a; DPIPWE 2010; DWE 2007; EPD 2014; SA Government 2010; Seqwater 2017; WAPC 2008).

Despite these developments, the prevailing view from water service providers is one of concern — that their current operating environment does not allow these alternatives to be properly considered, even though they may be feasible and efficient options for achieving this broader suite of objectives. Recently, the Water Services Association of Australia (WSAA), the peak urban water industry body, has called on governments to:

- put all water supply options 'on the table'
- better integrate planning
- initiate a new NWI that recognises the future challenges of the urban water sector (WSAA 2019a, 2019b).

The current confluence of rapid urban expansion and the development of new approaches to delivering urban water services, combined with impacts of climate change, means that now is a crucial time to consider the role that water will play in the future of our urban centres, particularly our major cities.

Substantial infrastructure investment will need to occur to replace ageing assets and provide water services in our rapidly growing cities over the coming decades. The lumpy, expensive and long-lived nature of urban water assets means that their form and timing will have implications for meeting future needs of water users and the prices that water customers will pay for them. Once decisions about water infrastructure for a new area are made, they are locked in for the life of that area. Infrastructure Australia recently described the substantial investment required in the urban water sector as 'an opportunity to rethink how water and wastewater services are delivered', but also noted the considerable risks of getting it wrong, including rising water bills and declining water quality and service reliability (IA 2019, p. 609). It subsequently placed town and city water security and the need to develop a national water strategy on its latest high priority infrastructure list (IA 2020, p. 13).

This paper identifies key areas in the policy and implementation frameworks governing the urban water sector that are barriers or impediments to the adoption of an IWCM approach. It points to areas where further policy development is required if governments wish to realise the benefits of IWCM and enable all options to be identified and assessed on their merits as part of a new 'business-as-usual' approach to urban water management. It also identifies shortcomings in past attempts that have led to inefficient outcomes and need to be avoided in the future to ensure that IWCM decisions are economically efficient and in the best interests of the community.

1.3 The Commission's approach

This paper uses a mix of desktop review of publicly available literature and consultation with key stakeholders in the urban water sector (appendix A). While there are more general changes that can improve the delivery of urban water services, this paper specifically:

- explores the challenges ahead to ensure that we have 'liveable' cities that meet community expectations in terms of amenity and environmental quality, particularly against the pressure of population growth and climate change. It looks at the implications of these challenges for urban water management and the role that it plays in meeting these expectations
- defines IWCM and provides a framework for evaluating the current arrangements for urban water management in order to identify key barriers to implementing IWCM
- describes key policy, service delivery, regulatory and funding barriers that impede the adoption of a fully integrated approach to urban water management, and provides examples of best practice and/or problems to be avoided to assist in further policy development.

While the discussion in this paper and the examples used focus on our major cities, the issues and impediments identified may also be relevant for smaller regional cities and towns, particularly those undergoing rapid population growth.

2 The urban water sector faces substantial challenges

The urban water sector faces substantial challenges to providing efficient and affordable services in rapidly growing cities in the face of climate change. These challenges are not just restricted to supplying secure, reliable and affordable water, but will also impact on the level of demand and the mix of services that the sector will need to supply in order to meet the full suite of community needs into the future, potentially including a contribution to urban amenity and environmental outcomes.

2.1 Our cities are changing rapidly

Population growth

Australia is a highly urbanised country with over 17 million people currently living in the five largest cities — Sydney, Melbourne, Brisbane, Perth and Adelaide (65 per cent of the total population) (figure 2.1).

Population projections by the Australian Bureau of Statistics (ABS) point to Australia becoming even more urbanised over the next 30 years, with these five cities projected to grow at an average annual rate of 1.5 per cent per year, well ahead of the 0.7 per cent for the rest of Australia.

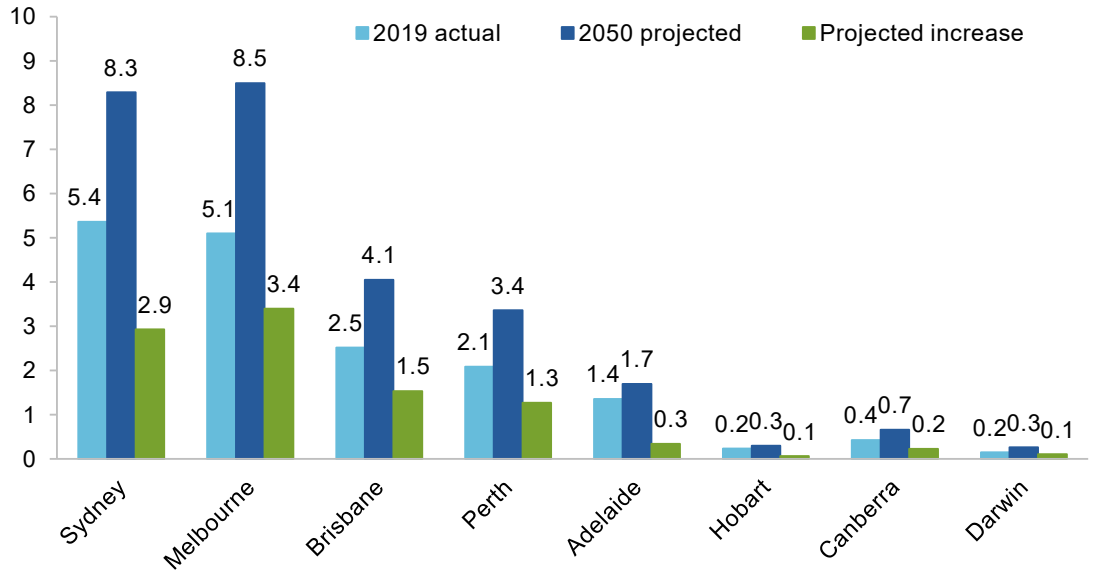
These five cities will need to accommodate around 10 million *additional* residents by 2050 (figure 2.1).[1] This would take their combined population to 26 million (or 70 per cent of the overall population), with 45 per cent of Australia's population living in just two cities — Sydney and Melbourne (with 8.3 million and 8.5 million people, respectively).

The projections point to Melbourne and Sydney both having to accommodate more additional residents by 2050 than currently live in Brisbane, Australia's third largest city.

[1] The ABS population projections detail three growth scenarios to 2066. These scenarios reflect different demographic assumptions and the ABS refer to them as series A, B and C (high, medium and low, respectively). These series show population increases of between 7.2 million (Series C) and 12.1 million (Series A) people for the five largest cities by 2050, with Series B indicating an increase of 9.5 million (estimates based on ABS 2018).

Figure 2.1 **Our capital cities are expected to grow strongly**[a]

Million people



[a] Greater Capital City Statistical Areas.

Sources: ABS (2018, 2019).

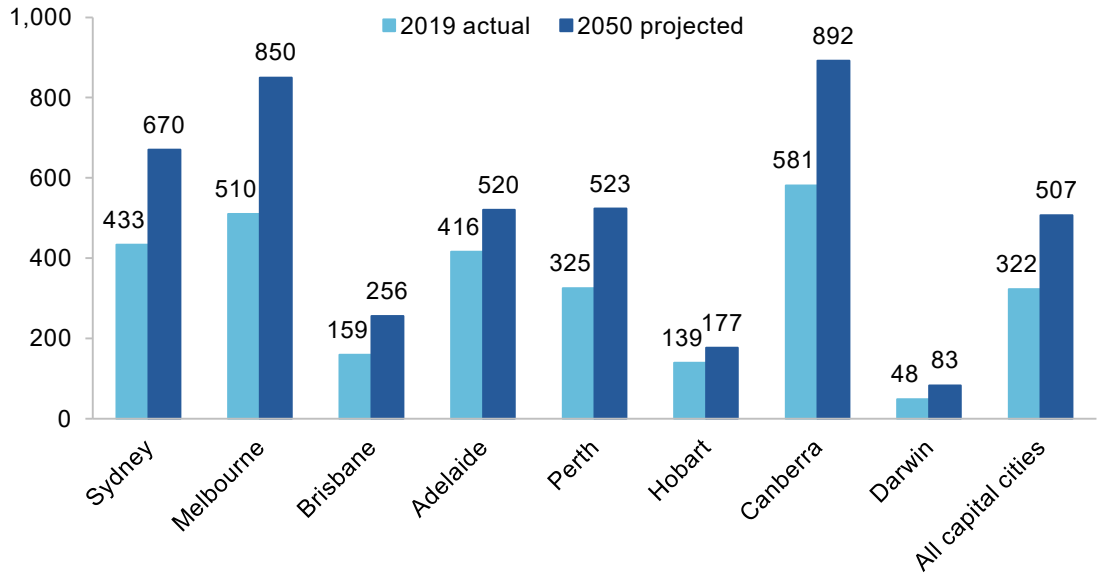
Increasing densification

Growth will increase the density of these capital cities (figure 2.2), fundamentally affecting how they look, feel and function. Proportionately more Australians will live in units than is currently the case, with fewer residents living in standalone dwellings. Where they do occur, standalone dwellings will generally also be on smaller blocks with smaller gardens than in the past.

The increasing density will have implications for the urban water sector. Higher density will involve proportionately more hard surfaces, such as concrete, brick, glass, metal and asphalt, than is currently the case. These hard surfaces are generally impermeable to rainfall and result in relatively more runoff of rainwater that needs to be managed to avoid pooling and flooding. Hard surfaces also absorb more heat than natural vegetation. This, coupled with the reduction in vegetation, will result in cities being warmer than surrounding rural areas (this is referred to as the 'urban heat island effect').

Figure 2.2 **Our capital cities will also increase significantly in density[a]**

Residents per square kilometre



[a] Greater Capital City Statistical Areas. Population density based on 2016 area in square kilometres. Greater Sydney includes the Central Coast. The area of Canberra is that of the Australian Capital Territory less the area of Urriarra — Namadgi, which is essentially a national park.

Sources: Estimates based on ABS (2017, 2018, 2019).

2.2 Climate change will magnify the challenges of population growth for urban water management

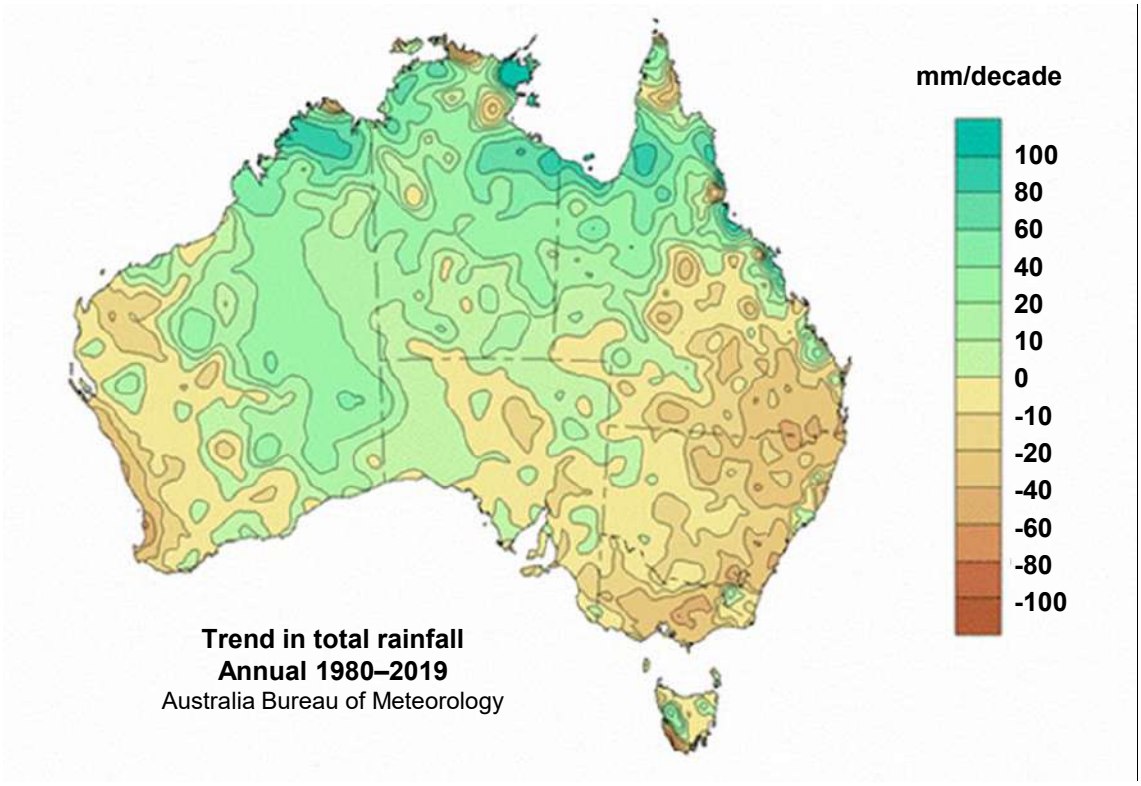
Climate change will magnify the challenges of population growth and increasing urban densification. While there is a localised dimension to climate impacts, many of the anticipated effects are predicted to be broadly similar across southern Australia, where most people live (BoM and CSIRO 2018).

The climatic projections indicate that most of Australia will be warmer. This is particularly the case for south-eastern and south-western Australia. Sydney, for example, is projected to experience a 0.7°C increase in average maximum temperatures over the period from 2020 to 2040, and by up to 1.9°C over the period from 2060 to 2080. Similar increases are also projected for minimum temperatures.

Climate change will increase the frequency, duration and intensity of heat waves. The frequency of 'hot days' — those exceeding 35°C — and the number of hot days in a row are expected to rise, in some cases markedly.

Much of Australia has experienced reduced rainfall over the last 40 years (figure 2.3) and is expected to become drier. Rainfall in southern Australia is projected to be significantly lower. Melbourne, for example, is projected to receive 6 per cent less rainfall per year under a 'medium emissions' scenario by 2059 compared to the average from 1986 to 2005, and 8 per cent less under a 'high emissions' scenario (Clarke et al. 2019, p. 6).[2] When this rainfall occurs, relatively more of it will be in the warmer summer months, when evaporation rates are higher. Extreme rainfall events will also become more intense. Droughts are expected to increase in severity, frequency and duration.

Figure 2.3 **Rainfall in southern Australia has been declining**
1980 to 2019



Source: BoM (2020).

Some implications for people living in cities

Warmer temperatures and increasing density create liveability challenges for our cities. Much of the projected population growth in Sydney and Melbourne is slated for their western suburbs, which are further inland and further from potentially cooling sea breezes. The

2 These reductions are the median value reported for each scenario. The 90th percentile projection under the 'high emissions' scenario is for a 19 per cent reduction in annual rainfall by 2059.

western suburbs in both cities are already warmer and drier than the rest of the city. The proposed Western Parkland City in Sydney has roughly half the annual rainfall of the existing city centre and seven times the number of hot days (figure 2.4). For example, the annual average number of hot days per year in western Sydney is expected to increase from the 10 to 20 days currently experienced to 15 to 30 days by 2030, and to 20 to 40 days by 2070 (OEH 2014, p. 10). Increasing the density of settlement in these hotter areas has the potential to further amplify the existing urban heat island effect.

Figure 2.4 **Development in Greater Sydney is focused on areas that are warmer and drier than existing areas of settlement**



Source: Adapted from GSC (2018a, p. 143).

Higher temperatures and more frequent heat waves have a wide range of impacts, such as higher energy costs, higher morbidity and mortality and disruptions to essential services (AECOM 2012; DHHS 2018).

Many of these impacts are health related, with heat stress a particularly serious impact, especially among young children, the elderly and those with certain existing medical conditions. Extreme heatwaves in Victoria in 2009 and in 2014, for example, resulted in appreciably higher levels of mortality than normal:

> In 2014, 167 excess deaths were recorded during a four-day heatwave across the state. This heatwave followed the 374 excess deaths recorded during the 2009 heatwave compared to the same period in the previous five years. (DHHS 2018, p. 1)

A body of research indicates ways to reduce heat in cities. The use of different materials in construction can play an important role. Reflective materials, such as white roofs, reduce heat absorption. Green open spaces can help cool cities and absorb rainfall, which also helps in stormwater management. The use of more permeable surfaces also assists in cooling by absorbing water. Planting trees provides shade and facilitates evapotranspiration to cool the air. The provision of water in the urban environment, whether it be through rivers, wetlands, streams or fountains, can also help.

As well as reducing urban heat, many of these measures also enhance the liveability of our cities in other ways.

2.3 Governments have signalled the importance of ensuring cities function well and are liveable

As cities grow and population density increases, governments are becoming focused on ensuring that cities remain 'liveable'. Cities that are liveable and function well are important for a range of reasons — such as the health and wellbeing of people and for national productivity — given that 80 per cent of national production is generated in cities (PC 2017b, p. 123).

Common measures of liveability include community safety, the form and affordability of housing, access to goods and services (such as health and education), the mix and proximity of employment opportunities, access to public transport, and the level of urban amenity, including access to high quality green spaces.

The links between the provision of open spaces and health outcomes are well established in the health literature. Because of this, urban planners consider access to green open space important to encourage more active lifestyles, reduce heat-related illnesses, improve air quality and improve mental wellbeing (City of Melbourne 2012). In recent years, some are also recognising the importance of tree coverage in combating the consequences of increasing temperatures and urban heat island effects.

Governments have recognised this and articulated, at a broad level, the importance of providing green open spaces in our cities. The Australian Government's *Smart Cities Plan* (DPMC 2016) sets out a vision for productive and liveable cities. Specifically, it identifies the importance of high quality urban design to provide tree coverage and green spaces to provide lifestyle options, improve air and water quality and to protect the environment. State Governments have articulated similar high-level visions and priorities as part of their long-term strategic plans for our major cities, such as *The 30-Year Plan for Greater Adelaide* (DPTI 2017), *Plan Melbourne 2017–2050* (DELWP 2017b) and *The Greater Sydney Region Plan: A Metropolis of Three Cities* (GSC 2018a).

Responsive to these strategic directions, and to achieve the benefits associated with open spaces, urban planners are exploring the opportunities for multifunctional green spaces, particularly in growth areas or in areas of significant urban renewal.

2.4 These challenges have implications for the provision of urban water services

The combination of significant population growth and climate change poses major challenges for urban water service providers to affordably meet many of the traditional objectives that governments have set for them — the supply of water, wastewater and stormwater services (PC 2017a).

Providing green open space to improve liveability also has implications for the sector. Water service provision can contribute to liveability by:

- meeting the demand for fit-for-purpose water to irrigate green open spaces and trees and to supply water for fountains
- managing stormwater flows in the landscape in ways that provide greater urban amenity, more natural habitat and contribute to public open space (for example, using stormwater retention wetlands and retaining natural creeks)
- managing stormwater and wastewater in ways that enhance the quality of urban waterways by reducing pollution and harmful flows, or contribute to desirable environmental flows
- more effectively integrating natural waterways into the design of cities to provide amenity.

Demand for water services will increase

Population growth rates and per-capita demand are key assumptions that inform water supply planning. Unless there are significant improvements in the efficiency with which water is used or changes in the mix of demand away from water-intensive forms of consumption, the more people we have, the greater the demand that has to be met by water supplies. For example:

- in south-east Queensland, the demand for water services is expected to increase by 74 per cent over the next 30 years as a result of population growth and increased per capita water usage (Seqwater 2017, pp. 44 & 60)
- in Melbourne, with the population set to double and urban density to increase significantly by 2065, annual water use is expected to increase by 50 per cent from 400 GL to around 600 GL (City West Water et al. 2017, pp. 10–11)
- in Sydney, with population set to increase by over 2 million people over the next 20 years, planners and service providers are expecting ‘significant pressure on [the] water supply system’ (NSW Government 2017, p. 19).

The form of our cities and the desire to make them liveable with green open spaces will also drive future demand for water. For example:

- the number and size of private open spaces influence residential water demand for use on gardens
- the parks, gardens, sporting fields and other green open space that make our cities more liveable will require secure water supplies for irrigation to supplement rainfall, particularly during droughts
- the type and extent of urban tree cover (to improve air quality and reduce the urban heat island effect) may require supplementary irrigation to achieve these outcomes.

The pursuit of liveability and urban amenity objectives will generally increase the overall demand for water. For example, Infrastructure NSW estimates that an additional average 47 GL of water per year will be required to achieve the 'Parkland City' vision for Western Sydney, which is 35 per cent more than if business-as-usual urban development forms were pursued (Infrastructure NSW, pers. comm., 2019). The Parkland City involves the provision of more local open space, street trees, trees on blocks of land, integrated open space and less impervious surfaces compared to a more traditional approach that seeks to maximise the number of dwellings in a development. This is expected to increase the mature tree canopy by three times and double local open space.

Population growth not only increases the demand for water but also generates more wastewater requiring treatment and disposal, putting further pressure on the quality of receiving waterways. As community expectations for enhanced environmental quality of urban waterways, bays and the ocean increase, the cost of wastewater treatment to meet these community expectations also increases.

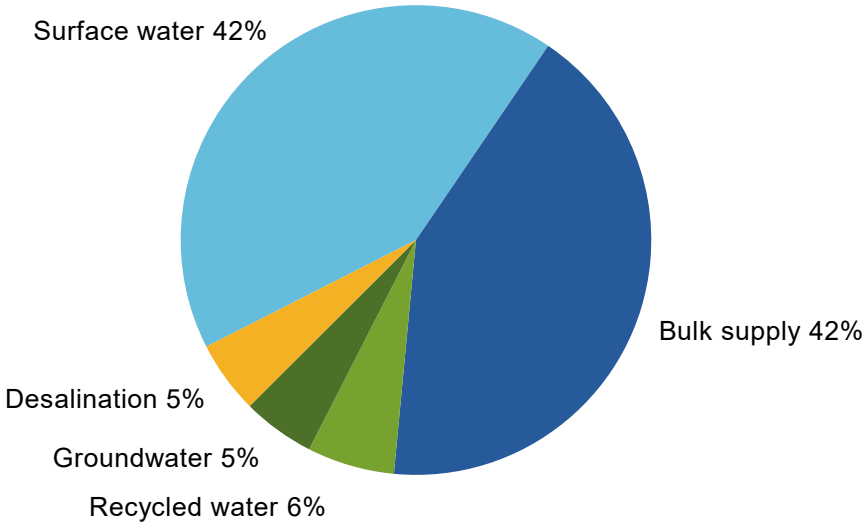
- In south-east Queensland, demand for wastewater services is set to exceed the capacity of the system by approximately 2023 (Seqwater 2017, pp. 44 & 60).
- In Melbourne, population growth and changing environmental preferences will see an increase in annual sewage production from 350 GL to up to 500 GL (City West Water et al. 2017, pp. 10–11).

Many existing sources of water will be less reliable

The water sector will need to accommodate growing demand in the face of an expected reduction in the reliability of rainfall. Rainfall — directly (as surface or bulk water) or indirectly (as groundwater) — accounted for 89 per cent of all urban water in 2017-18 (figure 2.5). Rainfall independent sources accounted for the remainder (recycled water 6 per cent and the desalination of sea water 5 per cent). Declining rainfall in southern Australia has been reducing inflows into the dams, rivers and aquifers that currently supply water to our cities, and this is projected to continue.

Figure 2.5 **Our cities are highly reliant on rainfall for their water**[a]

2017-18 (per cent)



[a] All major urban water providers in Australia with 100,000+ connected properties, their bulk water providers, Barwon Water and Western Water.

Source: Estimates based on BoM (2019).

- Annual inflows to Perth's water storages have dropped from a mean of 338 GL (1911–1974) to 134 GL (1975–2017), with average inflows during the last six years dropping to 47 GL (BoM and CSIRO 2018, p. 9).
- While projections are uncertain, climate modelling for Sydney indicates the potential for both wetter times and much longer periods of drought (NSW Government 2017). Given its reliance on dams for supply, longer periods of drought will put pressure on the resilience of Sydney's supplies.
- South-east Queensland's water supply faces the dual risks of flooding and drought. Climate modelling forecasts that, while rainfall will remain highly variable over the next decade, it is likely more time will be spent in drought. However, the intensity of heavy rainfall events is likely to increase, and it is likely that trade-offs will need to made between flood mitigation and water security in the operation of major dams (DEHP 2016; Seqwater 2017).
- Long-term warming and drying trends are expected to continue in Victoria, with reductions in rainfall in autumn and winter and, in many catchments, less streamflow will be generated for the same amount of rain (Melbourne Water 2018). This is likely to have implications for the long-term yield of Melbourne's major water storages.
- Projections for the supply of water to Canberra and the surrounding region suggest the likelihood of lower rainfall and changed rainfall patterns, combined with longer, more frequent and more pernicious periods of drought, may lead to a 40 per cent fall in runoff

flowing into dams in the longer term (EPD 2014, p. 23). Such conditions may significantly limit the reliability of the ACT's mainly dam and river-centric sources of water.

Water supply planning — that takes into account a range of future climate scenarios based on the best available information — will help the sector to manage the uncertainty of future inflows, but will not eliminate it. Access to a broader portfolio of water sources (including wastewater, stormwater, desalination, geographic diversification, reducing water losses and demand management) is likely to become increasingly attractive to spread risks, helping to maintain water security under different possible circumstances. The industry's capacity to select and implement the best options from the many available — including unconventional ones — will be a key determinant of its capacity to manage less reliable supplies from rainfall.

Our ability to effectively manage storm events will be tested

More intense extreme rainfall events will impose challenges for stormwater management. When it occurs, more rainfall will need to be managed over shorter periods than is currently the case, stretching the capacity of current stormwater systems to cope with higher periods of flow. The increasing density of our cities will compound this challenge, as less rainfall will be absorbed by nature, resulting in proportionately more runoff that needs to be managed to avoid localised flooding.

For example:

- in south-east Queensland, CSIRO modelling indicates more intense rainfall and flood events and a deterioration in raw water quality by 2030, despite a 7 per cent decrease in average annual rainfall (relative to the 1971–2000 average) (Seqwater 2017, p. 32)
- more intense storms in Melbourne, combined with more impermeable surfaces as density increases, will lead to greater stormwater runoff and increases in wet weather overflows from wastewater treatment plants. As a result of increases in nutrients and pollutants entering downstream environments, poorer water quality is expected unless action is taken to manage impacts (Melbourne Water 2017, p. 28)
- a hail storm on 20 January 2020 caused unprecedented damage in central Canberra. Parts of Melbourne and Sydney also experienced severe hailstorms on the same day.

In addition to meeting conventional flood management objectives in cities that are inherently more flood-prone and which are exposed to more frequent extreme weather events, stormwater management in the future will also be called on to make a growing contribution to urban amenity and environmental objectives. These objectives are not always mutually consistent and can be difficult to define precisely. Moreover, stormwater management often involves complex interfaces between local governments, water utilities, catchment management authorities and regulators. Effective management of these interfaces will be a prerequisite for success.

Significant investment will be required

The current drought in eastern Australia is refocusing attention on the importance of our cities having safe, reliable and affordable supplies of water.

Most major urban water systems have capacity to accommodate some population growth (box 2.1). This is largely the consequence of significant investment during the Millennium Drought (1997–2009).

However, population growth and climate change will, at some stage, necessitate additional investment, and sooner if the drought continues.

The nature, timing and extent of the investment required varies by city (box 2.1). Uncertainty over the level and composition of future demand and supply gives rise to a range over which investment is expected to occur, typically reflecting the difference between the capacity of the current system to meet high demand/low supply and low demand/high supply scenarios. In Melbourne, for example, additional investment may be required as early as 2028 under a worst-case scenario, or as late as 2065 under a best-case scenario. In planning for this, water utilities consider the benefits of a diverse range of sources that reduce their reliance on rainfall-dependent sources.

In addition to augmenting the system, investment is required to connect new developments in growth areas to water supply and wastewater services. For example, Sydney Water planned to spend $2.4 billion on infrastructure projects in Greater Sydney and the Illawarra over the four years from 2016-17 to 2019-20. Around 38 per cent of this is to accommodate future growth, including $598 million in network assets, $276 million in treatment assets and $43 million for stormwater projects (Sydney Water 2017, p. 13).

Furthermore, additional investment will also be required in established parts of the city to replace water, wastewater and stormwater assets that are reaching the end of their economic lives:

> Compounding the challenges of climate change and population growth, the water and wastewater infrastructure networks in our cities were largely designed and built many decades ago for very different cities of a much smaller scale. This infrastructure has served Australia well, but with so much of Australia's water and sewerage network built over the first three-quarters of the twentieth century, utilities are expected to require an increasing level of investment to replace ageing assets. (IA 2019, p. 609)

The ageing of stormwater and drainage assets has been identified as a particular concern:

> The majority of stormwater assets in Australian cities are made of concrete and generally require replacement every 100 to 150 years. The asset base is believed to be in the order of tens of billions of dollars across major urban centres.
>
> Given the expected lifetime of stormwater infrastructure, examples of ageing urban infrastructure are apparent. (Senate Environment and Communications References Committee 2015, p. 10)

Box 2.1 Anticipated urban water supply augmentation

The nature, timing and extent of investment in urban water infrastructure will vary across cities depending on their current circumstances and future events. For example:

- in Sydney, the 2017 *Metropolitan Water Plan* assessed that the water supply portfolio for the city was sufficient to meet projected demand until 2036 under an average climate scenario, although augmentation would be required by around 2022 under higher demand scenarios (NSW Government 2017, p. 29). Since this plan was published, the NSW Government has triggered planning for the construction of Stage 2 of the Sydney Desalination Plant in response to the current drought (NSW Government 2019)
- in Melbourne, supply augmentation will be required by 2028 under a worst-case scenario to meet a forecast doubling of demand by 2065 (high per capita demand, high climate change impacts), although this could be delayed until after 2065 under a best-case scenario (City West Water et al. 2017, p. 15; Melbourne Water 2018, p. 4)
- in south-east Queensland, $2 billion in investment is needed over 20 years under a centralised suite of options, and $4.5 billion over 20 years under a decentralised suite of options, to meet significant demand increases from population growth and higher per capita usage (Seqwater 2017, p. 111)
- in Adelaide, an additional 68 GL of supply would be required in 2050 under a significant dry scenario, equivalent to one-third of Greater Adelaide's total water consumption. Without further investment, Greater Adelaide may experience water shortages in dry years from 2029 onwards, even taking into account output from the Adelaide Desalination Plant (Office of Water Security 2010, pp. 50–51, SA Government, 2013, p. 24)
- in Perth, the anticipated gap between the future demand for water services and existing supplies is projected to be 120 GL by 2030, and growing to 365 GL by 2060. To meet this supply gap, the Water Corporation anticipates that it will need to invest in 235 GL of new water sources, and employ demand management strategies, such as water efficiency savings and per capita reductions, to reduce demand by 135 GL. Water Corporation believes to meet this target, almost half a billion dollars of additional investment will be needed by 2022 alone (Water Corporation 2009, p. 22, 2011, p. 4).

The extent of investment required to replace ageing assets is unclear owing to a lack of data on the age of some water assets, particularly those associated with stormwater management. However, it is clear that there will need to be substantial investment in water-related infrastructure over coming decades.

3 Can IWCM be delivered to help meet the challenges?

The previous chapter showed that our major cities face challenges that will have important implications for the urban water sector. Meeting these challenges will require substantial investment in new water-related infrastructure, whether to service new growth areas or to replace existing assets in established parts of cities. This provides a significant opportunity to rethink how water, wastewater and stormwater services in high-density metropolitan areas can be delivered. As many water assets are lumpy and expensive with long operating lives, it is important to get these decisions right, as decisions taken now cannot be reversed and will set up the nature of these growth areas forever. It is also crucial that this investment is economically efficient, to reduce the impacts on water bills and to ensure reliable and quality services.

This chapter considers two key questions:

- can an integrated approach can help to meet the challenges ahead (section 3.1)?
- can the current water management arrangements deliver an integrated approach (section 3.2)?

3.1 An integrated approach can help meet the challenges ahead

Taking an integrated approach to the provision of water, wastewater and stormwater services can help to optimise water use across cities and increase efficiency by:

- meeting the demand for water by providing water of a quality that is fit-for-purpose — not just providing potable water for all uses
- managing wastewater to meet environmental objectives in ways that provide an alternative, climate-independent source of fit-for-purpose water that can meet a range of consumption, amenity and/or environmental demands
- managing stormwater for community safety objectives in ways that keep water in the landscape and contribute to urban amenity, create urban habitat, improve the health of rivers and wetlands, reduce localised flooding and/or provide alternative sources of water supply
- delivering lower cost solutions to multiple water management objectives
- enhancing the resilience of water systems by increasing the diversity of water supplies and potentially delaying the need to augment the water supply and transfer system.

Trials over the last decade have demonstrated the value of taking an integrated approach

The water sector has been exploring integrated water management approaches for well over a decade, triggered by the experience of the Millennium Drought. The drought showed the necessity of thinking beyond traditional supplies (such as surface and groundwater sources) to those less dependent on rainfall. It also tested community tolerance for water restrictions that banned the irrigation of parks and playing fields and highlighted the value of green space to the community.

In addition to major system augmentations, policy-makers sought to encourage and promote local responses, particularly for non-potable water, and service providers responded. During that period of severe water scarcity, there was an over-riding perception that using potable water to irrigate parks and gardens was wasteful and that using rainwater, wastewater or stormwater was a better alternative. As a consequence, governments issued mandates and provided subsidies that drove investment in solutions such as household rainwater tanks, recharging aquifers with treated wastewater or stormwater, and the recycling of wastewater — in effect starting to link in an *ad hoc* way services in different parts of the urban water cycle.

These policy decisions, which often reflected non-economic motivations, tended to incentivise a few aspects of integration, and encouraged projects that demonstrated reduced potable water use. They did not adopt a consistent and robust approach to integrated water service planning that would identify appropriate projects and subject them to a considered, rigorous and transparent evaluation to ensure that they represented value for money. As a result, a range of integrated water management projects have been implemented in different locations to meet different objectives and at different scales. These included:

- re-using stormwater to irrigate public open space (such as parks, gardens and sporting fields) and reduce pollution entering waterways
- using recycled wastewater for flushing toilets or for use in the laundry or for irrigating household gardens
- using recycled wastewater and harvested stormwater to irrigate parklands and golf courses and replacing or supplementing potable supplies used for irrigated agriculture
- using stormwater to supplement drinking water supplies
- installing bio-swales and flood retarding basins to remove gross pollutants, such as litter and coarse sediment, from stormwater, to reduce flood peaks and to create wetland habitat and green parklands.

A number of these projects have been successful and clearly show the potential for integrated water management solutions to deliver a broader suite of community objectives than traditional approaches.

However, this period of trial has also been a period of learning. There have been significant shortcomings where a number of projects ended up being more costly than first thought or did not deliver the predicted benefits, with additional costs borne by taxpayers or water

customers. Some projects exposed unforeseen risk, accountability and scale issues (West et al. 2016). Through these projects, water service providers have developed a better appreciation of the risks, costs and benefits of alternative ways to deliver services.

The period of trial has demonstrated that, while integrated solutions may not always be efficient choices, they should always be evaluated on an equal footing to traditional alternatives. Taking an integrated approach to planning water, wastewater and stormwater services will allow a greater range of options to be identified and evaluated. This may ultimately lead to better decisions or lower cost solutions to achieve the water, public health, environmental and urban amenity outcomes that the community seeks.

3.2 Current arrangements can impede the delivery of an integrated approach

While the concept of IWCM is generally supported by all governments at a broad policy level (chapter 2), water service providers and industry experts are united in the view that the current operating arrangements do not enable an integrated approach to the management of water supply, wastewater and stormwater to be properly taken (WSAA 2017a, pp. 22–24). Their concern is that, as investment continues to occur, opportunities to provide enhanced community benefits are being lost. The question for them is: 'how can we mainstream integrated water management as the new business-as-usual approach to the provision of urban water services'?

This section briefly describes the current arrangements for the delivery of urban water services. It then sets out the key aspects of IWCM and what this entails. Finally, it outlines the framework against which the current arrangements have been examined to identify key impediments to the implementation of an integrated approach to urban water management, which are discussed in more detail in later chapters.

Current arrangements for the delivery of urban water services

Water supply and wastewater services

The current policy and regulatory approach for the delivery of urban water supply and wastewater services has been shaped by more than two decades of reform, including the *Water Reform Framework* (COAG 1994), the *National Competition Policy Reforms* (COAG 1995) and the *National Water Initiative* (COAG 2004). In the urban context, this period of reform focused on services that had historically been supplied by state and territory governments — water supply and wastewater services in large cities. Key aspects of these reforms focused on:

- separating policy, standard setting and regulation from service delivery
- implementing consumption-based pricing with full cost recovery

- delivering water services as efficiently as possible by organisations with a commercial focus.

These reforms have resulted in the current model, in which:

- state governments corporatised their large water supply and wastewater service providers that are now run as business utilities by independent boards according to commercial principles, with surplus profits often returned to governments as a dividend
  - in Sydney, Melbourne and south-east Queensland, structural reform led to the separation of the bulk supply of water (such as the management of large dams and desalination plants) from the treatment, distribution and retail functions of providing water supply and wastewater services to customers
- government policy sets objectives for these business that are issued through formal legal instruments such as operating licences or statements of obligations
- there is a robust regulatory environment governing all aspects of water businesses with:
  - economic regulators in most jurisdictions seeking to ensure that regulated water businesses deliver efficient and cost-effective services and protect the interests of consumers, although the nature and extent of regulation varies between jurisdictions
  - health regulators in each jurisdiction set water quality standards for drinking water and other uses
  - environmental regulators setting standards for the quality and quantity of wastewater disposed into receiving environments to limit the impact of pollution on urban waterways, bays and the ocean emanating from point discharge sources, such as wastewater treatment and desalination plants.

While health and environmental regulation is the responsibility of the states and territories, there is a nationally agreed strategy for managing key aspects of water quality, and national guidelines to ensure that water quality is fit-for-purpose — in particular, the *Australian Drinking Water Guidelines* (NHMRC 2016), the *Australian Guidelines for Water Recycling* (EPHC, NRMMC and AHMC 2008), and the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG 2018). This ensures that the approach adopted across jurisdictions is broadly consistent.

The past urban water reforms have delivered significant benefits, improving efficiency and service delivery, increasing transparency and promoting more efficient pricing (PC 2017c, p. 179).

Stormwater services

In contrast, the provision of stormwater and drainage services was not included in past water reform policies and the principles of those reforms have not been applied to stormwater management. As such, the policy and regulatory arrangements for the delivery of stormwater

services differ markedly to those for water supply and wastewater. The institutional framework is far less clear and the variation between jurisdictions is more marked.

Local governments have been the primary providers of stormwater services in urban areas. In some jurisdictions, regulated water utilities provide some stormwater services in parts of some metropolitan areas.

Historically, stormwater management focused solely on safely draining the urban landscape to minimise the nuisance and damage that arises from flooding. However, as understanding of the environmental damage stormwater can inflict on an ecosystem has improved, there has been a greater focus on water quality issues.

Policies governing stormwater are implemented almost exclusively through land-use planning policy and the application of building codes. This is largely because decisions about the form of stormwater infrastructure are made at the time of development. While building codes were traditionally designed to drain water from the urban landscape as quickly as possible, modern codes have adopted a form of stormwater abatement and quality control known as 'water sensitive urban design' (WSUD). Most states now have stormwater pollution and quantity minimisation targets that are expected to be achieved by developers through WSUD. It should be noted that WSUD is the only set of controls on the way that stormwater is managed — stormwater discharges into waterways are generally not subject to treatment or environmental regulation.

The approaches to recovering the costs of stormwater service provision vary between, and even within, jurisdictions, and full cost recovery is not explicitly required. The general approach is for costs to be funded from local council rates.[3] Developer levies are also used. In some jurisdictions, councils have dedicated stormwater levies, but there is limited information on the extent to which these recover the full cost of service provision.

Local governments are typically not subject to economic regulation, although rate capping applies in some jurisdictions. By contrast, in the cases where a regulated utility provides stormwater services, it is subject to the same economic regulation as water and wastewater services. As such, costs are recovered through regulated pricing processes and tend to be more cost reflective.

As a result of these arrangements, the provision of water supply and wastewater management is largely siloed from the provision of stormwater services and the policy and regulatory frameworks governing them are completely different.

[3] Some urban water utilities also provide and fund some stormwater services. For example, Melbourne Water charges approximately 1.9 million residential property owners a waterways and drainage charge of $102.08 per year (Melbourne Water 2019b) and Sydney Water charges a stormwater service charge of $79.32 per year for houses and $24.76 per year for units or low impact residential in stormwater catchments that it manages (Sydney Water nd).

Defining IWCM

While governments generally support the idea of taking an IWCM approach to urban water management, their definitions of what this means are generally broad and conceptual — mostly acknowledging the need to manage all aspects of the hydrological cycle in cities together to achieve environmental, social and economic benefits. While this is fundamentally the essence of the concept, the difficulty lies in understanding what this actually means in practice.

A consequence is that there are many interpretations of IWCM (or similar terminology) in practice, and of what it entails. These differences in interpretation frequently vary depending on which part of the water sector is using it, the scale at which it is being applied, the water service involved and the stakeholder group that is interested in it. In some cases, it has been interpreted in a narrow sense, seen as 'decentralised' water supply options that provide an alternative to centralised sources. For example, household rainwater tanks, small-scale wastewater recycling plants, or the harvesting of stormwater for reuse are considered IWCM alternatives to large centralised supply options, such as dams and desalination plants. It is interpreted by others as WSUD, which has a focus on reducing the negative impacts of stormwater flows at a local scale, and reducing the nutrients and sediments entering downstream environments.

The Commission considers that, to deliver on the potential to improve urban water management, there needs to be a widely understood and consistently applied definition of IWCM and what it is aimed at achieving.

The Commission has adopted the following definition of IWCM for the purposes of this paper.

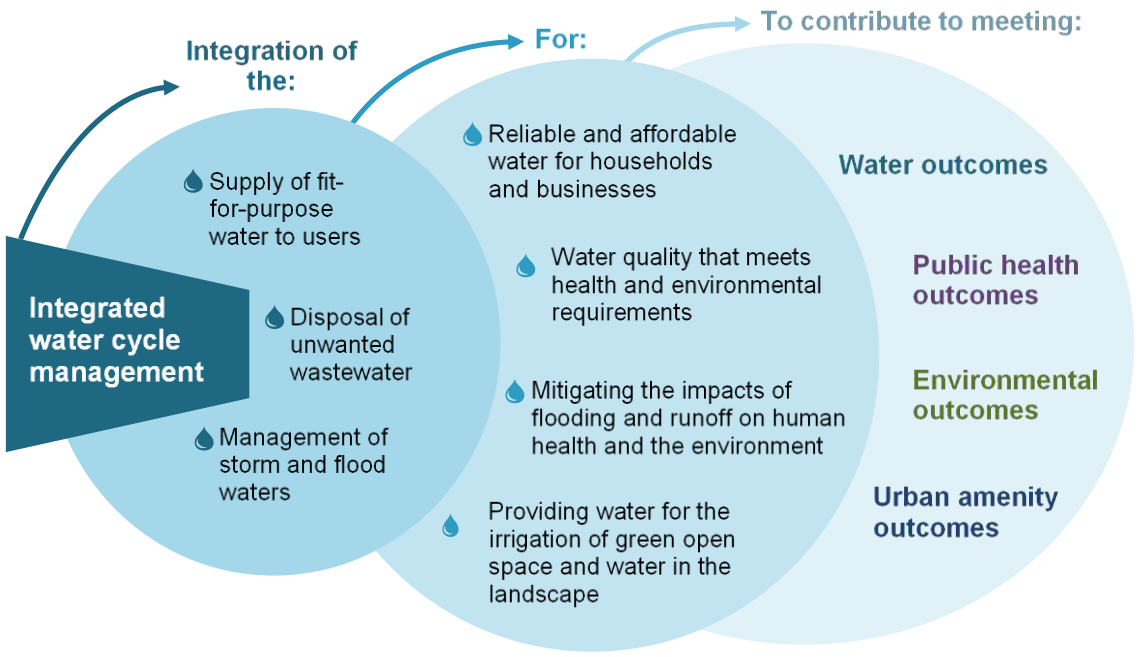
> **Integrated water cycle management is the integrated management of water resources in the urban environment in a way that achieves the full suite of water security, public health, environmental and amenity outcomes that the community seeks. It encompasses all urban water, regardless of its source, and the provision of the full range of water services and water infrastructure, regardless of scale or ownership**.

The Commission considers that the implementation of IWCM should be subject to the same economic principles that have applied to traditional water management and were established under the *National Water Reform Framework* (COAG 1994). Therefore:

> **IWCM should be undertaken in ways that provide an economically efficient mix of water supply, wastewater and stormwater services that achieves the full suite of desired community water-related outcomes at lowest cost.**

This approach is simply illustrated in figure 3.1.

Figure 3.1 **A fully integrated approach to urban water management**



Adopting this definition and approach more generally would have the following implications for the way urban water is managed:

1. Expanded suite of outcomes

Under this definition, the outcomes sought from urban water management are explicitly expanded to include not only the traditional outcomes of:

- provision of safe, reliable and affordable water
- disposal of wastewater in ways that meet regulatory standards
- management of stormwater to reduce the likelihood and consequences of flooding in ways that reduce environmental impact

but also:

- contributing to the provision and/or enhancement of urban amenity, including improvements to natural urban environments.

The water sector's contribution to this outcome could encompass, for example, supplying water to irrigate public green open spaces, providing access to wetlands and waterways, improving waterway health in urban areas and assisting with urban cooling.

Accepting this definition of IWCM would provide a holistic, integrated set of objectives to achieve the appropriate mix of the four key outcomes from urban water management valued by the community and would be a key change from the previous conceptualisation of water management.

2. All water sources would be considered

Under this definition, planning to meet the full suite of water-related outcomes for the community would need to consider all possible water sources (that is, natural water, wastewater, stormwater, manufactured water and demand management) and, where efficient, integrate the provision of water supply, wastewater and stormwater services.

3. Water planning at system-wide and local scales would be integrated

Adopting this definition would mean that integrated water planning would occur at both system-wide and local scales, with capacity for interchange between the two to enable the most economically efficient suite of options to be identified.

4. IWCM cannot be delivered by the traditional water sector alone and collaboration will be key

Currently, the water sector is generally recognised as including water utilities, private providers, water policy departments and relevant regulators. However, the adoption of water-related urban amenity as an additional outcome for urban water management and the inclusion of stormwater management as a key element means that IWCM cannot be delivered by the agencies in the traditional water sector alone. They are not the lead agencies for these functions, although they can play a supporting role (table 3.1). The major players in these areas are planning departments and local governments. Implementing IWCM will require significant collaboration between the planning and local government sectors and the traditional water sector in both policy and planning at a range of different scales.

Table 3.1 **Roles in delivering the outcomes of IWCM**

Outcome area	*Responsibility for policy-making and standard setting*	*Role of the water sector in policy-making and standard setting*	*Role of water service providers*
Water outcomes	Water policy department[a]	Lead provider of advice for policy-making Responsible for policy implementation & standard setting	Provide economically efficient, fit-for-purpose water services
Public health outcomes	Department of Health[a]	Provide advice on early identification of potential issues & options Provide information on the costs & benefits of policy & regulatory options	Meet water standards to protect public health
Environmental outcomes	Department of the Environment[a]	Provide advice on early identification of potential issues & options Provide information on the costs & benefits of policy & regulatory options	Meet wastewater standards to protect environmental health Manage discharges to mitigate other negative effects or to enhance urban waterways
Urban amenity outcomes	Department of Planning / local government	Provide advice on early identification of potential issues & options Provide information on the costs & benefits of potential options Undertake water infrastructure planning & setting minimum infrastructure standards	Meet the demand for fit-for-purpose water Manage stormwater flows in the landscape that also contributes to available open space Manage stormwater & wastewater to enhance the quality of urban waterways

[a] Supported by a regulatory agency.

5. Project selection would be based on rigorous investment analysis and not all IWCM projects would be adopted

The application of this approach would mean that infrastructure planning would seek to meet the four key community water-related outcomes outlined above and would enable the evaluation of the full scope of possible water supply options, including the use of harvested stormwater and recycled wastewater. However, it does not mean that these four outcomes would be provided to the community at any cost. The broadened scope of water planning to include water-related urban amenity outcomes means that water supply options to meet these outcomes would be identified and their costs and benefits evaluated, enabling trade-offs between these outcomes and pricing impacts to be transparently understood before decisions are made. Consideration of a broader suite of options has the potential to deliver a more cost-effective option or an option that better meets the agreed suite of community outcomes. A fully integrated approach to planning may still deliver traditional supply options, such as providing potable water for irrigating green space or building a dam or desalination plant, if they are the most cost–effective options available.

Overall, the adoption of the Commission's definition and approach would mean that IWCM becomes a system of more effective planning to identify and implement least-cost infrastructure options to meet a broadened suite of community needs (with accepted community needs being authorised by governments). The Commission considers that the focus should be on integrating planning across those outcome areas for which governments have formally assigned roles and responsibilities to the water sector, thereby enabling alternative ways of delivering services to be considered alongside traditional approaches.

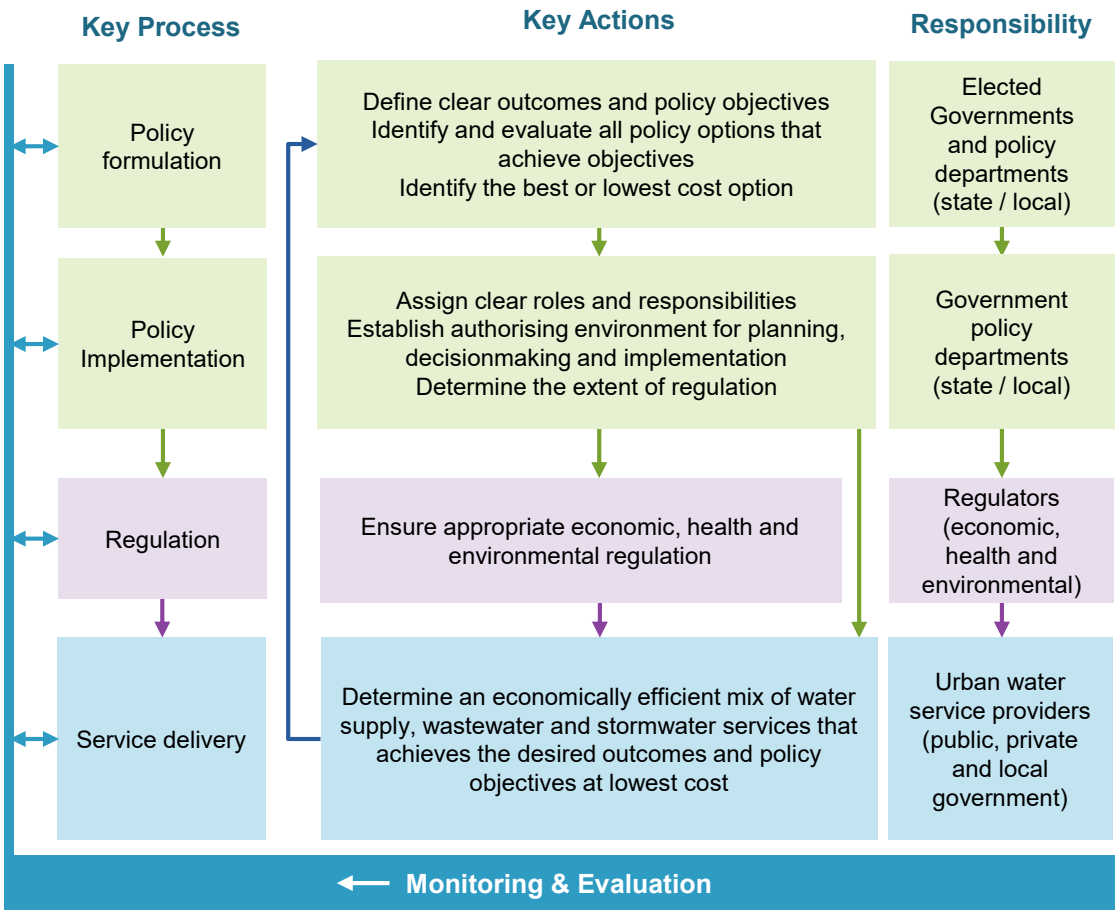
A framework for identifying impediments to IWCM in the current arrangements

The Commission's definition and approach to IWCM outlined above clarify the outcomes expected from an integrated approach to urban water management, the water service delivery functions encompassed by it and its key attributes.

The approach used in this paper to consider the adequacy of the current arrangements for IWCM, and for identifying major impediments that may restrict or prevent the implementation of IWCM, involves the application of a standard policy formulation and implementation framework (figure 3.2). This involves considering:

- **the policy context** — to determine whether the existing policy environment clearly identifies the outcomes to be delivered, the principles governing how they will be delivered and who should pay for them, and the institutional framework for implementation. This includes ensuring clear roles and responsibilities for all aspects of IWCM and establishing the role for, and extent of, regulation. Effectively, this approach considers whether the existing policy environment provides an effective authorising environment to facilitate an IWCM approach
- **service delivery** — to identify whether the current arrangements facilitate integrated planning and delivery of water supply, wastewater and stormwater services and achieving the community outcomes at least cost
- **regulation** — to identify whether the current approaches taken by economic, public health and environmental regulators facilitates an integrated approach to achieving the community outcomes.

Figure 3.2 **A policy development framework to support IWCM**



This type of framework is consistent with the principles underlying past major reforms in the delivery of water supply and wastewater management.

Looking at the current arrangements through this lens is useful for identifying how they hinder a truly integrated approach to urban water management and who might be best placed to remedy them. In short, it is useful for guiding thinking through the current arrangements so that they are able to deliver the right mix of urban water services in an efficient and cost-effective way. This structured approach also enables the identification of where additional work may be required and by whom to ensure that taking an integrated approach to all aspects of urban water management can become the new 'business–as–usual'.

In applying this framework, it is important to recognise that different players are responsible for each of the key elements of the framework — urban water policy is the responsibility of governments undertaken through their policy departments; service delivery is the job of water utilities and local governments; and regulation is the responsibility of government-assigned regulatory agencies.

The current arrangements for water supply and wastewater management are generally effective in delivering safe and secure water supplies and disposing of wastewater in ways that meet health and environmental standards. It is when the outcomes are extended to include the provision of urban amenity outcomes and stormwater management and the integration of these functions that a number of clear barriers to the implementation of IWCM become apparent. The Commission has focused on ten key impediments across policy, service delivery and regulation. There are likely to be others, but addressing these ten, particularly those in the policy sphere, would make a significant difference in the implementation of IWCM. Each of these is discussed in more detail in the following chapters, but broadly they include:

- **Policy environment**
  - while there are broad government statements supportive of the need to provide amenity for urban communities, there are no clear, government-endorsed objectives for urban amenity that would enable effective planning to meet this community need
  - roles and responsibilities for the provision of amenity are either unclear or not well-understood
  - in general, there are few formal processes that link statutory land planning and water planning at the right scales with the right timing to enable good decision-making on the provision of urban amenity at city, district/precinct and local scales
  - stormwater planning and management is not integrated with water supply and wastewater management
  - government policy bans mean that some alternative, less expensive options for water supply cannot be considered. On the flip side, mandating reuse and recycling targets has led to inefficient outcomes
- **Service delivery**
  - achieving effective collaboration can be difficult
  - planning processes for consideration of water supply options to meet community outcomes do not enable consideration of all options on their merits and the choice of the least–cost option. This is often the result of either policy bans on options or the mandating of preferred solutions at the local level, and arises because decisions are not always based on rigorous and transparent assessment
  - local water planning is not well integrated with system-wide water planning
- **Regulation**
  - environmental regulators are often focused on prescribing actions rather than a more outcome-based approach that would enable more innovative solutions
  - additional administrative hurdles, excessive transaction costs and complex regulatory regimes can impede the equal consideration of all water sources.

In general, most of these impediments stem from a lack of clear and cohesive government policy, including clear arrangements for implementation. However, there are several

impediments in the areas of service delivery and regulation where water managers and regulators can take action that would improve the potential to take an effective IWCM approach.

The identification of these issues may seem surprising to those in the water sector who consider that the key impediment to implementing IWCM is the current funding arrangements, which could be easily rectified by additional government funding or allowing water authorities to charge their customers for the additional costs involved. However, the funding issues observed by the sector are generally symptoms of broader issues, particularly in urban water management policy. These policy issues need to be thought through and decisions made, particularly on the level of urban amenity sought in new growth areas. If the policy is clear, the funding principles and mechanisms that exist for the water sector can be employed. These issues are discussed further in the following chapters covering policy, planning and service delivery, regulation and funding.

4 Impediments in the policy environment

This chapter identifies policy impediments to adopting an integrated approach to urban water management. These impediments are discussed thematically and include:

- those that relate to the provision of urban amenity and the contribution that integrated water management can make to this (section 4.1)
- those that impede the integration of stormwater into general water planning (section 4.2)
- those that restrict options from being put on the table for potential consideration (section 4.3).

Each section provides examples of where best practice is occurring, but they are yet to be consistently adopted to enable IWCM to become the new 'business-as-usual' approach to urban water management.

These impediments occur within the sphere of policy departments of state, territory and local governments and the political processes that shape the operating environments in which water providers deliver urban water services.

4.1 Uncertainties about the provision of urban amenity

All state and territory governments have large-scale, long-term plans governing the growth of their capital cities (table 4.1). These plans contain general policy statements about the importance of urban amenity and green open space in recognition of their contribution to the health and wellbeing of their communities and, more recently, their significance in combating the urban heat island effect and improving air quality. These plans are the responsibility of urban planners and/or the planning arm of state governments. Their pathway to implementation is largely through the state statutory planning frameworks, which, at different scales, determine the shape of the urban form and how land is used within cities. The legislation that supports these statutory planning frameworks also determines the extent to which local governments are free to make autonomous decisions within their areas.

Table 4.1 **Examples of city-wide plans that cover urban amenity**

City	*Plan (Date of plan)*	*Period covered*
Adelaide	The 30 Year Plan for Greater Adelaide (2017 update)	2010–2040
Brisbane	ShapingSEQ, South East Queensland Regional Plan 2017 (2017) Brisbane. Clean, Green, Sustainable (2017)	50 years 2017–2031
Canberra	ACT Planning Strategy (2018)	2018–2045
Darwin	Darwin Regional Land Use Plan (2015)	40 to 50 years
Hobart	Southern Tasmania Regional Land Use Strategy (amended 2018) Capital City Strategic Plan (2019)	2010–2035 2019–2029
Melbourne	Plan Melbourne 2017–2050 Strategy (2017)	2017–2050
Perth	Perth and Peel @ 3.5 million (2018) Liveable Neighbourhoods (2015)	2018–2050 2015–2050
Sydney	Greater Sydney Region Plan, A Metropolis of Three Cities (2018) A Liveability Framework for Sydney (2017) Directions for a Greater Sydney (2016)	2018–2056 2016–2036 2017–2056

This system of urban planning at the city scale, as it operates in most jurisdictions, generally does not recognise the dependence of the provision of green open space and new areas of urban tree coverage on a secure water source (particularly in times of drought). Nor does it recognise that collaborating with water planners, as they plan the next extension of the networks for water supply, wastewater and stormwater in growth areas, can offer opportunities for enhancing urban environments and providing greater urban amenity. For example:

- stormwater management assets can provide recreational lakes or wetland habitat
- water easements and natural waterways can become corridors for recreation and habitat
- water systems can provide fit-for-purpose water to support these areas (such as providing recycled wastewater or harvested stormwater to irrigate public open space).

Western Australia is a notable exception to this. Because of their dry climate, they have always had to plan new suburbs with identified water supplies for their public open space.

In other jurisdictions, there has effectively been a boundary between water and land planning processes. Unless this barrier is overcome, communities living in the new growth areas that face increasingly hotter and drier conditions run the risk of missing the opportunity for greater urban amenity, recreational space and environmental features (figure 4.1).

Figure 4.1 **Water in the landscape can enhance urban amenity**

Existing development



Low to medium density, maximise lot yield; 50 per cent less local open space; Limited trees, connectivity; More impervious surfaces

IWCM approach providing enhanced urban amenity



Higher density; Trees; Integrated open space; Less impervious surface; Uses 30 per cent more water

Source: Infrastructure NSW (pers. comm., 2019).

The urban water industry has recognised the potential for urban water management to contribute to enhanced urban amenity outcomes. The peak industry body representing Australia's urban and rural water providers sees the water sector as playing a key role in providing urban amenity and in improving the liveability of our cities:

> Contributing to liveability is how the water industry will meet customers' expectations and provide better responses as the world changes and our customers' needs and preferences evolve. To achieve this, we need to extend the breadth of our contribution from just being the city's plumbers. We need to participate in our cities' and regions' future as master planners. This includes working across and linking a range of issues and opportunities to provide value to our customers. (WSAA 2014, p. 9)

The concept of water utilities being master city planners would be a very significant change with major implications. However, there is a real opportunity, without changing institutional arrangements, to provide enhanced urban amenity through the way water is managed in our major cities.

Some state governments have recently recognised both the issue and the opportunity and have created collaborative forums between water planners, urban planners and local governments in key growth areas to identify IWCM options to support enhanced urban amenity, environments and other community benefits. Victoria, for example, established Integrated Water Management Forums across the state in 2017 to bring together organisations with an interest in the water cycle to identify, prioritise and oversee the implementation of collaborative water opportunities. As lead agency, Infrastructure NSW, in collaboration with the Greater Sydney Commission, is leading a whole-of-government

initiative to develop the South Creek corridor within the western Parkland City, with Sydney Water being involved in the project from the outset. The NSW Government has also established the Western Sydney Planning Partnership to coordinate state and local government involvement to:

> … achieve more efficient and higher quality outcomes for Western Sydney through innovative and collaborative planning. The will enable coordinated delivery of the rezoning of land that also integrates with the planning and delivery of infrastructure. (Australian Government and NSW Government 2018)

While these are reasonable first steps, there are still some significant policy impediments to the implementation of an IWCM approach for delivering urban amenity outcomes.

- There are no clear objectives for those key aspects of urban amenity to which the water sector can contribute to provide direction to both urban planners and water planners about what they should be seeking to achieve.
- There is little clarity on the roles and responsibilities of the water sector in planning and providing urban amenity.
- There is generally no formal process for providing an interface between the urban planning sector and the water sector.

There is a lack of clear objectives for water-related aspects of urban amenity

Poor articulation of urban amenity objectives is particularly problematic for greenfield and major infill developments that do not have the green open space of established suburbs.

While the city plans referred to above recognise the importance of green open spaces for community health, wellbeing and urban cooling, these broad statements are often high-level 'motherhood statements'. Urban planners must provide certain set areas of public open space, but they are not required to prioritise the quality of that space and the level of amenity it will provide to its community, particularly given the future prospect of a drying climate. Figure 4.2 illustrates two extremes for meeting the same requirement for public open space, but providing different levels of amenity. A key input to providing enhanced amenity is the availability of water, both in the landscape and as a water supply, to ensure the 'green' in green open space.

The lack of such objectives for water-related aspects of urban amenity makes it difficult for both water and urban planners, even when they are collaborating, to identify and then evaluate a range of options.

Water management options that provide enhanced amenity or improved environments in greenfield and major infield areas may also be more expensive than traditional approaches that do not provide the equivalent level of amenity or environmental outcomes.

Figure 4.2 **The provision of green open space can provide vastly different levels of amenity**

Drought-affected urban lake



Water in the landscape



Sources: Botanic Gardens and Centennial Parklands (2020); Productivity Commission (2020).

However, there is no clear policy framework to enable a decision to be made that balances the benefits of enhanced urban amenity against any additional cost.

Moreover, in these greenfield and major infill sites, there is no one to ask whether they are willing to pay for this.

Given this, the urban water sector has attempted to estimate the benefits of enhanced amenity.

The Cooperative Research Centre for Water Sensitive Cities has developed a number of tools to assist in assessing integrated water management projects, including:

- a benefit–cost analysis tool to assess investments for water-sensitive cities
- an investment framework value tool that contains 336 non-market benefit values from 76 Australian studies that specifically relate to investment in water sensitive systems to allow 'users to identify and use existing estimates of non-market values of water sensitive systems and practices in Australia' (Gunawardena et al. 2017; Iftekhar et al. 2019).

Similarly, the Victorian Department of Environment, Land, Water and Planning (DELWP), for example, commissioned the development of an *Integrated Water Management Tool Scan* to provide an up-to-date portfolio of tools available to assist practitioners with IWCM project planning and delivery. This tool is available to water utilities through WSAA's online *Water Research Access Portal*, to provide a one-stop website for planning and implementing IWCM projects.

While they have been developed with the aim of assisting land-use planners, water planners and others to quantify the potential benefits, the accuracy of the resulting estimates will depend on the assumptions and mechanisms incorporated into each tool and how they are used.

Moreover, the assumptions, methodology and findings from one study are not automatically transferable to other situations, particularly where the circumstances differ markedly.

However, as discussed further below, water utilities are not responsible for urban amenity — they are simply important enablers. The existing collaborative forums are either still in the investigative phase or appear to be working at the margins of the existing policy frameworks (that is, largely within existing funding envelopes).

The lack of clear policy direction on the significance of water-related aspects of urban amenity and a clear indication of the expectations of state and territory governments in relation to this issue are key impediments to not only the adoption of an IWCM approach, but, more importantly, to the quality and liveability of future suburbs. It would seem that governments have a somewhat inconsistent approach to urban amenity, where often a minimum requirement for public open space is specified or guidelines provided, but where the actual level of urban amenity provided in new developments can be highly variable and dependent on who is leading the development. With the current level of planned growth and the recognised importance of amenity to community wellbeing, this issue now requires stronger policy direction or guidelines from governments.

The provision of clear policy objectives for water's contribution to urban amenity and specific guidelines or processes to follow will assist the development of a decision-making framework under which the costs and benefits of IWCM options that contribute to meeting the objectives can be evaluated. However, developing these objectives may not be an easy task for governments. There are trade-offs between the quality and type of urban amenity and environmental outcomes being sought, and the costs of providing them. There are also questions of equity to be considered, including the impacts on house prices, who should bear the costs of improving liveability and community wellbeing, the issue of inter-generational equity as well as the long-term opportunity costs of not providing an appropriate quality in a changing climate. Nevertheless, without some clear policy direction, the issue cannot be given proper consideration within the existing decision-making frameworks.

While this lack of policy direction on water's contribution to urban amenity seems to be a common problem across jurisdictions, there are several instances where governments are experimenting with different approaches, such as the Victorian collaborative forums mentioned above. As mentioned previously, one of the best examples is the initial planning currently being undertaken for the Western Parkland City in Sydney (figure 4.1). However, this development is still in its formative stages and has yet to deliver improved amenity outcomes.

In addition, local governments themselves are developing their own plans, including targets for urban forests and canopy cover. In Melbourne, 32 metropolitan councils, state government agencies and other organisations endorsed the *Living Melbourne, Our Metropolitan Urban Forest* strategy in 2019 to counter the adverse effects of a growing population and climate change — including increasing urban heat — to sustain Melbourne's liveability for people and nature (The Nature Conservancy and Resilient Melbourne 2019). The urban forest:

> … cleans our air and water, reduces damaging heat in our neighbourhoods, and provides valuable habitat for native flora and fauna. Exposure to nature reduces stress and the incidence of mental illness, and provides opportunities to strengthen community bonds by providing spaces where people can congregate, connect and recreate. (p. 1)

Three key strengths of the strategy include: the involvement of local governments, the state government and other stakeholders; its city-wide perspective; and its long-term focus out to 2050.

However, this is not a government strategy, so appears to be more aspirational in nature, without a clear pathway to implementation and with no clear accountabilities for getting it done — effectively a communal wish list.

Some local governments have developed their own plans concerning the provision of public open space, street trees and urban amenity. One such council with a long track record in water sensitive urban design and water in the landscape is the City of Salisbury (box 4.1). However, in many cases, councils acting on their own can often miss larger scale options, particularly those offered at the catchment scale.

Box 4.1 Water in the environment: City of Salisbury, South Australia

The City of Salisbury in Adelaide's northern suburbs has grown rapidly since the 1970s. Water sensitive urban design principles were adopted to maximise the use of the increased run-off generated by urbanisation and to ameliorate the risk of flooding. Stormwater from the initial development was collected in a retention basin to form a wetland and scenic lake, surrounded by extensive tree planting, trails and a dog park. Water was pumped into aquifers to store remediated low-salinity stormwater for subsequent reuse to irrigate adjacent sports fields, thereby reducing the Council's demand for purchased potable water. This was followed by over 40 similar, though often smaller, wetlands being built into land developments to provide aesthetic amenity.

The City of Salisbury Council has developed a Landscape Plan to provide a cohesive direction for existing and future development of the landscape in the city (Hassell 2007). The Plan aims to provide guidelines to strengthen the physical characteristics of the landscape by promoting biodiversity, water sensitive urban design and landscape design. The plan covers, among other things, guidelines and strategies covering: new private developments; the provision of street trees and streetscapes; the provision, connectivity and linkages of public open space; irrigation; and maintenance.

Sources: Hassell (2007); Radcliffe et al. (2017).

A possible solution could be the development of a State Government open space strategy or equivalent for key growth areas at a large scale that provides a broad plan for the area, type, quality and connectivity of open space. This would establish the minimum requirements for delivery of amenity by local governments, water authorities and others.

Roles and responsibilities for the provision of enhanced amenity are unclear

An effect of the lack of clear policy objectives for water-related aspects of urban amenity is that the roles and responsibilities for providing or enhancing urban amenity are often perceived to be ambiguous and opaque.

As mentioned earlier, the water sector recognises that it can contribute to urban amenity outcomes:

> The way water services are provided and water is used has strong links to many of these key attributes [factors that make cities liveable], our customers' experience of the cities and regions in which they live, and the way governments' respond to their priorities and challenges. …
>
> These attributes can be addressed if infrastructure, particularly stormwater infrastructure is developed, managed and maintained in a broader land use planning context. That is, as an environmental, and public health, safety and wellbeing asset, assisting in moving water and people through a community. (WSAA 2014, p. 10)

In their enthusiasm to demonstrate their ability to play this role, some urban water providers are pushing the boundaries of their mandated roles and obligations. They have been showing, through pilot projects and partnerships with local governments, the feasibility and benefits of innovative, alternative approaches to the delivery of water, wastewater and stormwater services. The Aquarevo development in Melbourne is one such example (box 4.2).

Such innovations have been undertaken in an ad hoc manner with the water provider incurring many of the costs but with little clear benefit to their existing customer base. Such projects, if properly evaluated, may benefit other water providers, including those interstate.

Some water businesses have taken tentative steps in developing land they own, usually in response to broader government directives to dispose of surplus land. Barwon Water, for example, is the developer of Salt at Torquay, a 7½ star housing development on the site of a former water basin.[4] South East Water in Melbourne is also a partner in Aquarevo (box 4.2). This can raise a number of issues.

4 www.salt-torquay.com.au.

Box 4.2 Aquarevo Estate in south-east Melbourne

The Aquarevo Estate is a residential development joint venture between Villawood Properties and the water utility South East Water in the south-east of Melbourne suburb of Lyndhurst.

The homes feature a range of innovative water saving features, including:

- a high-technology 'rain to hot water system' for bathing and showering that includes screening, filtering, treatment and temperature sensing devices
- connecting to a pressure sewer system that pumps wastewater to a water recycling plant within the estate, treats the water to Class A standard, and sends it back to each home for use in the garden, toilet or washing machine
- rainwater tanks with technology that receives weather forecasts and then releases water before heavy rainfall to minimise overflows or flooding in local waterways
- technology to remotely monitor the sewer pressure and read water and energy use.

In order to reduce consumption of potable water by up to 70 per cent, each house is supplied with three types of water:

- potable mains water — for use in the hot and cold water taps in the kitchen, the cold water tap in the bathroom sink, and the hot and cold water taps in the laundry trough
- rainwater — for use in bathing and for hot water use in the washing machine
- recycled water — for use in flushing toilets, cold water use in the washing machine, and for garden use.

Rainwater is screened four times before entering the rainwater tank. It passes through a filter and is subjected to ultraviolet treatment before being heated to 60 degrees in the hot water tank. Despite these treatments, rainwater cannot be used for drinking water purposes.

Sources: SEW (2020); Villawood Properties (2018).

For example, there are attendant risks that water customers could incur additional costs if water providers exceed their mandated roles and obligations, especially where customers receive significantly different levels of service, and that other parties benefit at the expense of water customers. Instances of this could include water customers funding some or all of the costs incurred in:

- providing enhanced urban amenity that *directly* benefits others (such as cyclists, runners and walkers)
- providing enhanced urban amenity that *indirectly* benefits others (such as local property owners, whose properties subsequently increase in value).

In the past, some economic regulators (most notably South Australia and New South Wales) have taken a strong stance on proposals by water utilities to spend customers' funds to enhance 'liveability or amenity'. Unless the investment was the least-cost way to meet the utilities' mandated responsibilities, they would not allow costs to be passed through to their customers. However, this stance seems to be softening. The NSW economic regulator, IPART, has recently signalled an openness to take into account evidence of customers' willingness to pay for higher levels or different types of service when considering pricing

proposals (box 4.3). It will be interesting to see whether IPART accepts the current pricing proposals before them, which are based on customers' willingness to pay, given that water utilities in New South Wales have not traditionally been responsible for providing urban amenity.

Box 4.3 Hunter Water is seeking to provide amenity services

Since at least 2017, IPART has been able to allow 'discretionary expenditure' where there is evidence of customer willingness to pay:

> When setting prices, we can provide regulated utilities with allowances for expenditure to achieve standards above minimum regulatory requirements (e.g. service or performance standards mandated in their operating or environmental protection licences), provided they provide sufficient evidence of customers' capacity and willingness to pay. (IPART 2017, p. 9)

In its most recent pricing proposal, the Hunter Water Corporation has incorporated a proposal to invest:

> $11 million for naturalisation of concrete stormwater channels to improve amenity and liveability. We are proposing that the cost of this investment be recovered from the broader customer base, in line with customers' willingness to pay. (Hunter Water 2019, p. 48)

Under its operating licence, Hunter Water is not responsible for providing urban amenity or public open space outcomes to the community.

Sources: Hunter Water (2019); IPART (2017).

This push by some water utilities into delivering enhanced urban amenity suggests that they perceive that they can fill an unmet void by responding to the wishes of the community. The use of willingness-to-pay studies is their way of assessing the value of this unmet need.

However, there are some challenges with the applications of willingness-to-pay valuation methods. First, they can be open to manipulation in terms of the questions asked, the breadth of the community tested, their understanding of what they are currently paying for and the fact that, in new areas, there is no existing community to ask. Second, the extent of any unmet void in the provision of urban amenity that the community is willing to pay for indicates that the land-use planning arms of state and local governments, which have policy responsibility for urban amenity in our cities, may not adequately reflect the current preferences of the wider community that they are supposed to represent. If this is indeed the case, this may be the consequence of an underlying problem, such as inadequate community consultation by land-use planners or a possible funding constraint.

The lack of a clear interface between urban planning and water service planning generates the potential for role creep and the transfer of costs (for example, from ratepayers to water utility customers).[5] In some cases, this lack of clarity could work to the advantage of both sides, particularly if the community views the outcome of enhanced urban amenity positively

5 This role creep is not just confined to water utilities. Some metropolitan local governments engage in water planning, setting water use targets, specifying how water is to be used and engage in demand-side management, which have traditionally been the role of the water sector.

and neither governments, nor communities, are fussy about how the work is funded. However, from a public policy perspective, having unclear roles and responsibilities leads to a lack of clarity about who should pay for enhanced urban amenity, with the implication that some within society may disproportionately bear the cost of providing this amenity or that inferior projects from the point of view of society may be pursued. The absence of clear roles for urban planning and water service planning also has implications for the financial viability and funding of integrated water projects (chapter 7).

Statutory land planners and local governments have overall responsibility for urban amenity. The role of water utilities in contributing to water-related urban amenity has not been specified, but appears to be an enabling one — providing water to support or enhance amenity and providing information on possible options to support land-use planners. Before governments consider whether they want water utilities to take a more prominent role in the delivery of urban amenity, with water customers paying for this service, they would need to consider whether it is feasible to define this responsibility effectively. This would be particularly important if changing their role required changes to legislation — which, once made, are difficult to unwind — and/or to the operating licences and statements of obligations of water utilities. The current use of customer willingness to pay by regulators is, in effect, a workaround in the absence of clear objectives and formally assigned responsibilities.

Formal processes linking statutory land planning and water planning are often lacking

If governments make amenity objectives more specific, processes should ideally link water planning into urban planning at all scales — city-wide, district/precinct, local and sub-division level — to ensure that:

- the best IWCM options are identified to deliver the full suite of outcomes desired by the community, including urban amenity (chapter 3). This includes making the best use of water flows in a catchment context
- they are identified early on in the process to avoid making costly mistakes.

This is particularly important in major new developments and designated growth areas. However, there is a dearth of formal processes linking statutory land planning and water planning at all the relevant scales across the Australian urban water sector.

The following example highlights the potential benefits from having a clear interface between land-use planning and the urban water sector. Infrastructure NSW and the Greater Sydney Commission have involved Sydney Water in the integrated land-use and water-management planning for the South Creek development from the outset (box 4.4). This enabled early identification of land-use and water requirements and infrastructure options, as well as enabling stormwater management to be considered alongside wastewater. It also allowed for wider consideration of the way water flows in a catchment context and the role of water in the urban landscape.

Box 4.4 The benefits of a clear interface with urban planning

The development of the South Creek Corridor in Sydney highlights the benefits of early consultation between land-use planners and the urban water sector.

The largely greenfield development comprises 80 per cent of the Western Parkland City centred around the new airport at Badgerys Creek. The Western Parkland City is one of the three metropolises identified under the *Greater Sydney Region Plan*. The development is anticipated to consist of 184 000 additional dwellings by 2036 and accommodate around 460 000 people.

An early review of water infrastructure requirements led by Infrastructure NSW identified the importance of integrated land-use and water-cycle management planning. Sydney Water has played a key (and early) role to inform the identification and assessment of strategic options for the region, including how open spaces will be provided and designed. Infrastructure NSW has indicated that, while the capital and operating costs for the provision of local water servicing infrastructure were similar, an IWCM approach had the potential to deliver incremental benefits from the reduced cost of providing public open spaces, different (more dense) urban form and enabling alternatives ways of managing stormwater and floodwater compared to the traditional water servicing approach. An integrated approach would also delay the need for major augmentations to the centralised water supply system, due to the use of alternative water supplies for some purposes.

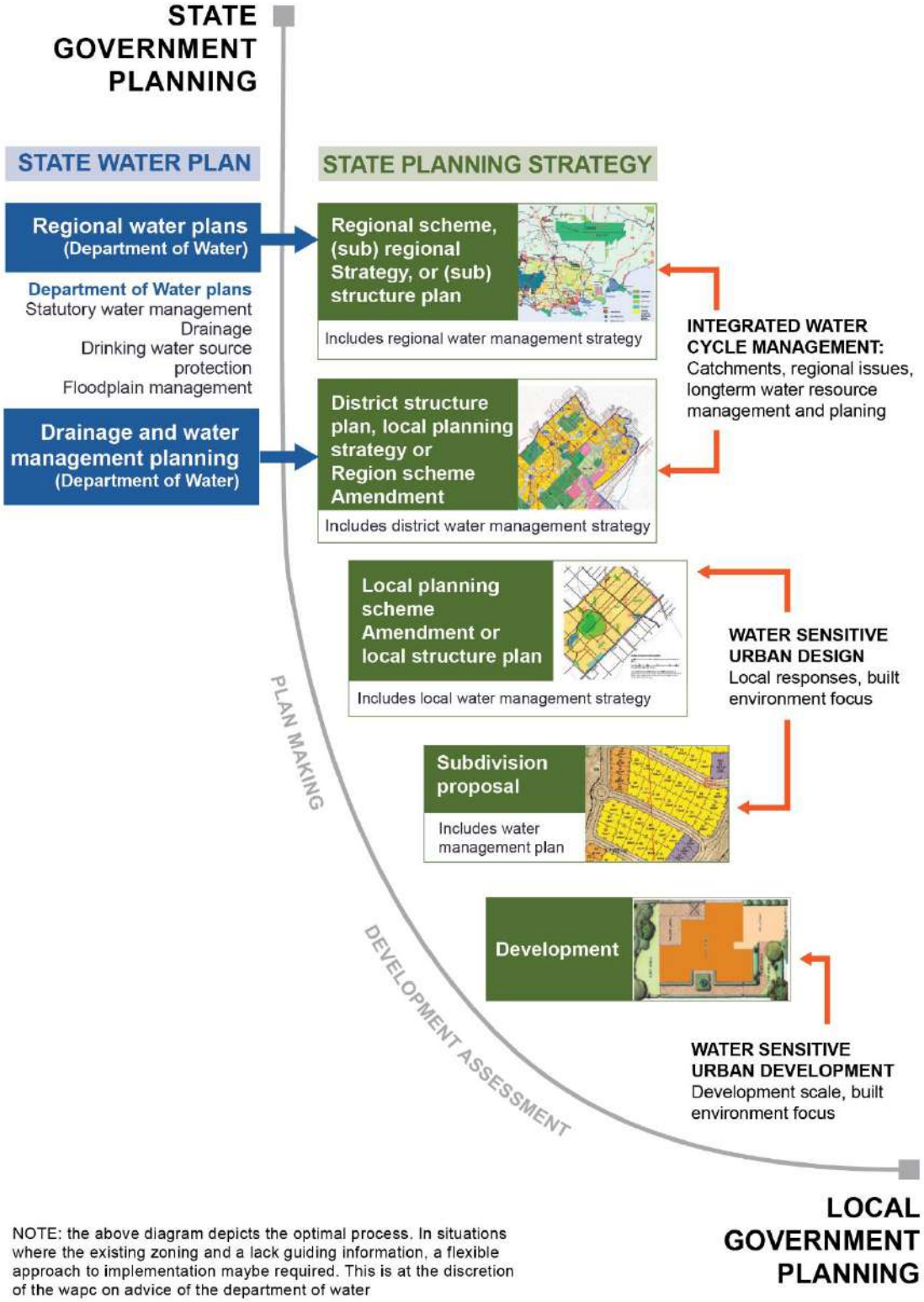
Management of waterways and riparian lands are central to the stated vision for the district, as is the provision of sufficient water supplies to meet the goals for open space and green infrastructure in an area that is appreciably hotter and drier than established parts of Sydney (chapter 2). The aim is to incorporate aspects of the natural landscape into the urban environment; protect and manage natural systems; cool the urban environment; and undertake the innovative and efficient use and reuse of energy, water and waste resources.

Sources: Greater Sydney Commission (2018a, 2018b, 2018c).

Western Australia is one of the few states that has a formal framework for integrating water planning with the land-use planning process (WAPC 2008). This was designed specifically to ensure these interactions occurred, and it could serve as a guide for other jurisdictions. This framework seeks to identify the implications for the water sector arising from the key land-use considerations addressed at each level of the land-use planning process — city-wide, district, local and sub-division level (figure 4.3).[6] The framework sets out the key land-use planning tools that are relevant, the key urban water management questions at each scale, the relevant water management report that needs to be completed, and the parties responsible for the preparation, approval and implementation of that report.

6 This framework extends beyond the sub-division level to also include four stages of the development assessment process: subdivision approval with conditions; clearance of conditions and construction of subdivision; development; and post-development.

Figure 4.3 **Integrating water planning with land planning processes**[a]



[a] Processes applicable in Western Australia.

Source: WAPC (2008, p. 14).

Improving the interface between the land-use planning and urban water sectors in this way promotes information flows between parties. This enables the parties to make more informed decisions and to better identify IWCM options and their costs and benefits. Land-use planners can inform water providers about their future development plans, the type and location of these developments, their water requirements and the timeframes involved to guide water infrastructure planning and investment to support the delivery of these services. Water planners can inform land-use planners of likely water availability, catchment hydrology and potential use of natural waterways.[7] While land-use planners are responsible for land-use planning, the water sector has technical expertise in delivering water-related services and the provision of infrastructure that can assist land-use planners to identify and cost different options relevant for the development of land-use plans and land-use planning. Even when a framework is in place it still needs the commitment of all players to cooperate at all scales for it to be effective in implementation.

4.2 Stormwater is not integrated into general water planning

A key element of IWCM is the integration of the three urban water services — water supply, wastewater management and stormwater management. However, as mentioned in chapter 3, the policy frameworks and institutional arrangements for the provision of water supply and wastewater management in our large cities are generally very different to the arrangements governing stormwater management. The fact that stormwater management is largely undertaken by local government, while water supply and wastewater management is the responsibility of water utilities (except in some regional areas of New South Wales and Queensland), coupled with the circumstance that key decisions about stormwater management are made at the time of development, has effectively siloed the traditional management of these services. This was further entrenched in the development of the national water reform agenda, which focused on improving the delivery of water supply and wastewater services across the country and virtually ignored stormwater management.

Establishing objectives for urban amenity and creating formal processes that link land-use planning and water planning (section 4.1.3) should assist considerably in integrating planning for stormwater management with planning for water supply and wastewater services, thereby creating the framework for planning IWCM.

However, if stormwater management is to be a key element in integrated water management in our cities and towns, it will need to be subject to a management framework that is sufficiently robust to ensure that communities get the quality of service and the outcomes that they expect in an economically efficient way. A serious review is required of how stormwater management is undertaken. Such a review could examine:

[7] It is important to also take into account catchment boundaries, which determine natural flows of water and may span the boundaries of councils and water utilities, in land-use and water planning.

- the need to set clear environmental objectives for stormwater management and ensure there is a framework for demonstrating they are being met
- the processes for asset planning and management. Currently, these lack visibility, transparency and quality reporting. Publicly available information on the capacity, condition and age of stormwater assets is limited, and often is not presented to support aggregation or comparison between service providers. This makes it difficult to assess the extent to which significant investment in stormwater infrastructure will be required
- the need to set clear service standards for stormwater management and have transparent processes for determining any trade-offs (such as between flood mitigation and protecting the environment)
- the development of a clear framework for charging for stormwater management
- the role of regulation in stormwater management
- how stormwater management and stormwater harvesting fit into the wider system of water entitlements, especially in the Murray-Darling Basin, that may restrict their operation.

WSAA recognises the importance of incorporating stormwater and flood management into the urban water cycle and into water governance (WSAA 2017, p. 6). With regard to stormwater, WSAA called for:

> New national arrangements … [to] reflect the role stormwater management can play in the overall urban water cycle. This can be through harvesting, reuse, creating green spaces in Australian cities, and improving waterway health. Underpinning this should be a robust and transparent framework of rights to the water resource that provides investors with the certainty and security they need for these long-life infrastructure investments. If stormwater is treated separately and not linked to other arrangements … this could lead to inefficient investment and urban planning, and poor outcomes for water security. Collaboration between all agencies responsible for stormwater management is encouraged. Without a nationally consistent funding and pricing framework, stormwater will remain the 'poor relation' in the broader urban water environment. (p. 6)

The 2015 Senate inquiry into Stormwater Management in Australia similarly recommended that:

> … the Australian Government work with the state and territory governments to develop and implement a national policy framework for stormwater management (a National Stormwater Initiative). (Senate Environment and Communications References Committee 2015, Recommendation 1, p. vii)

4.3 Restrictions and mandates prevent all options being put on the table

Policy bans unnecessarily restrict options

Implementation of a fully integrated approach to urban water management is constrained by explicit or implicit bans that restrict some types of water from being used for some purposes,

even when they are fit–for–purpose. Such measures prevent lower cost or otherwise superior options from being considered to meet the desired water use objective, and affect the economic viability of IWCM projects (chapter 3).

The Commission has previously highlighted examples where governments have imposed implicit or explicit policy bans on particular options that have prevented integration of water and wastewater management and of urban and rural water uses (PC 2011, 2017). These include restrictions on using rural water for urban use. For example, the Victorian Government restricts water use between predominantly rural supply systems in the Goulburn Valley and the Melbourne urban system using the 'North-South Pipeline', which it built at a cost of $750 million (Melbourne Water 2019). This restricts Melbourne's retailers from using water entitlements legally acquired through the Northern Victoria Irrigation Renewal Project.

In addition, a number of jurisdictions have policy bans that prevent suitably treated recycled wastewater or treated stormwater from augmenting supplies of potable water, or give rise to uncertainty concerning the circumstances under which this may occur and what is required to bring this about. Only two jurisdictions — Western Australia and Queensland — explicitly allow suitably treated recycled wastewater to *indirectly* augment the supply of potable water by returning it to the natural environment.[8] Although, even in Queensland, there are restrictions on the use of the $2.5 billion Western Corridor Recycled Water potable reuse scheme in south-east Queensland (WaterSecure 2009, p. 16).

This is despite national water quality guidelines that all jurisdictions signed up to (box 4.5) that, under certain circumstances, allow recycled water to augment drinking supplies. These national guidelines reflect risk-based scientific assessments of the likelihood and consequences of consumption of a range of substances on human health.

[8] Direct potable reuse involves injecting suitably treated recycled wastewater or treated stormwater into the drinking water distribution system after treatment has occurred.

Box 4.5 National guidelines ensure water quality

There are two key national water quality guidelines for human health. The second of these national guidelines is also relevant for environmental risks.

The Australian Drinking Water Guidelines provide guidance to water regulators and suppliers on monitoring and managing drinking water quality (NHMRC 2016). They provide a preventative management framework that encompasses all steps in water production from catchment to consumer, and aims to assure safe, good quality drinking water. The guidelines undergo a rolling revision to ensure they represent the latest scientific evidence on good quality drinking water.

The Australian Guidelines for Water Recycling provide guidance to water regulators and suppliers on monitoring and managing recycled water to ensure that it is fit-for-purpose (EPHC, NHMRC and NRMMC 2008). These guidelines also provide a preventative management framework, which establishes the minimum level of water quality required for different uses. These guidelines augment the *Australian Drinking Water Guidelines,* by providing guidance on the reuse of water for drinking purposes.

Both guidelines follow a risk-based regulatory approach, where the level of water quality required for an intended use is determined with regard to the extent of exposure to harmful pathogens and nutrients, the frequency of that exposure and the corresponding negative health implications.

State and territory health departments use both sets of guidelines as the basis for setting their own water quality standards that water providers are required to meet for drinking water and different classes of recycled water.

Sources: EPHC, NHMRC and NRMMC (2008); NHMRC (2016).

Bans on integrated options may impose significant costs on the community. For example, the decision to build a pipeline to augment drinking supplies in Toowoomba cost over $100 million more than indirect potable reuse, which was the preferred option on the basis of cost, environmental and reliability reasons (PC 2017, p. 187).

Governments are committed to the use of recycled wastewater and harvested stormwater, but, because the majority will not take the final step of allowing it to be used to augment potable supplies, they often mandate its use for other non-potable purposes which then requires expensive duplication of infrastructure such as the installation of third-pipe networks.

Western Australia has shown that it is possible to use recycled water to augment the supply of potable water in Perth through its Groundwater Replenishment Scheme (box 4.6). This illustrates how an integrated approach to urban water management can safely augment existing sources of water supply and strengthen the robustness of the water supply system. Moreover, such an approach may be cheaper than alternative sources of system augmentation, especially if the integrated water projects are large enough to take advantage of the economies of scale that can arise from the significant fixed costs involved (such as the cost of building a treatment plant to recycle water). The Perth case study highlights that investment in communication and engagement can secure community acceptance of alternative sources of drinking water (box 4.6). Similarly, the stormwater-harvesting scheme used to supplement drinking supplies in Orange demonstrates community acceptance of alternative water supplies as well as technical feasibility (box 4.7).

The water industry has committed to engaging with the community to gain support for progressing all water supply and demand options (WSAA 2019, p. 28). However, governments need to enable these advances and not frustrate more innovative approaches.

Drought conditions in parts of Australia provide an opportunity to change community attitudes towards potable reuse of stormwater and wastewater. Potable reuse can provide, for example, cities and towns that are at risk of running out of water with more resilient supplies of drinking water, potentially at cheaper cost.

Box 4.6 Perth's groundwater replenishment scheme

Water Corporation's Groundwater Replenishment Scheme in Perth is Australia's first full-scale replenishment scheme, using recycled water treated to potable standards to recharge groundwater supplies.

After wastewater is treated at a wastewater treatment plant, it is further treated to potable standards at the Advanced Water Recycling Plant. Throughout this treatment process, the water is monitored to ensure that the strict water quality guidelines are met. Following advanced treatment, the water is recharged into groundwater supplies, where it is stored for later extraction and further treatment before being supplied to the drinking water system.

A three-year trial (from 2010 to 2012) determined groundwater replenishment could be used as a sustainable and climate independent option to increase drinking water supplies. As well as proving technical feasibility, the trial also established a framework for policy and regulation and gained community engagement and acceptance. More than 11 000 community members toured the trial's Advanced Water Recycling Plant and Visitor Centre.

The commissioning of the 14 GL per year scheme was approved by the Western Australian State Government in August 2014 after successful completion of the trial. It started recharging water to Perth's deep aquifers in 2017. In 2017-18, it contributed 2 per cent of water supplied to the Integrated Water Supply Scheme. The scheme is being expanded to double its capacity.

Bettini and Head (2016, p. 26) identified a number of key elements in the Perth experience for building regulatory and community acceptance of potentially controversial options:

- a long time frame for developing understanding, knowledge and acceptance
- an organised and strategic approach to developing the option
- extensive collaboration and partnership, which included engaging with regulators from the outset to ensure co-learning and concept ownership
- significant investment of time and financial resources in communication and engagement, to ensure transparency and opportunity for input, and to build acceptance
- designing and testing regulatory and policy frameworks, as well as technologies
- clear governance arrangements for cross-agency initiatives
- dedicated and collaborative project teams and working groups.

Sources: Bettini and Head (2016); Water Corporation (2017).

Box 4.7 Stormwater harvesting in the City of Orange

The regional city of Orange is located approximately 260 kilometres west of Sydney in the central west of New South Wales. Orange City Council is responsible for water supply, wastewater management and stormwater management in the area.

During the Millennium Drought, the two dams providing the main water supply for Orange reached critically low levels. By late 2007, storages were below 40 per cent, declining further to reach their lowest levels (below 30 per cent) in 2008. Facing severe water restrictions and other demand management initiatives, the community wanted council to act quickly to provide additional water security.

Council considered a range of options including using groundwater, recommissioning the original supply dam, carting water to the city and harvesting stormwater (from both rural and urban catchments). The use of recycled wastewater was not an option, as the City's recycled wastewater was already fully allocated to a local mining operation.

The preferred option was an urban stormwater harvesting scheme for potable reuse. Modelling showed that this approach would have more reliable flows than traditional rural harvesting.

The first stormwater to potable water scheme evolved from concept to operation within 18 months and cost $5 million to construct. It involved 'extensive consultation with the community and government authorities and detailed analysis to satisfy concerns about the safety, reliability and capacity of the scheme' (Orange City Council 2019). The scheme was later extended to include an additional catchment area at a cost of $4.1 million.

Benefits of these stormwater harvesting schemes include:

- providing a more reliable water source by using the large impervious surfaces in the urban environment
- supplying up to 25 per cent of drinking water
- creating four stormwater treatment wetlands to slow and treat stormwater flows as well as provide urban habitat and high amenity landscape
- reducing the risk of erosion by reducing peak water flows.

While Orange continues to face water shortages, these would be much greater without stormwater harvesting.

Sources: Cooperative Research Centre for Water Sensitive Cities (2018); Orange City Council (2019).

Mandating reuse and recycling targets has led to inefficient outcomes

Government mandating of certain solutions relating to the provision of water services is the flip side of the policy bans discussed in the previous section. Both can lead to inefficient outcomes by preventing options from being assessed on their merits.

There is a perception in some parts of the community that increased reuse and recycling and decreased reliance on centralised drinking water supplies are always in the community's best interests. Such perceptions can pressure policy-makers to adopt water recycling targets and subsidies, and mandatory requirements on new dwellings, to reduce potable water consumption, without first undertaking rigorous and transparent evaluation to ensure that

they represent value for money compared to alternative approaches. In addition, policies often focus on the mechanism rather than the ultimate outcome desired.

Investment is often required in order to meet the targets. For example, building code requirements that mandate household water savings targets (such as BASIX in New South Wales) often result in the installation of household rainwater tanks. Where governments have set recycled water targets to reduce the use of potable water sources, investments have typically been made in recycled water plants and third pipe (or purple pipe) networks.

There is little publicly available information on the economic justification for many past government policy decisions, as well as transparent, ex–post evaluation of these interventions. However, available evidence indicates that some have imposed significant costs on the community. For example:

- recycled water is frequently a higher cost supply option when compared to other sources (box 4.8). This is because, unlike in Perth, treatment costs are higher and restrictions on use require the installation of dual reticulation (purple pipes) at the network and household scale. Demand projections for recycled water have often been overly optimistic. In particular, projections for non-potable use in residential settings have often been overstated
- research shows that rainwater tanks that meet building code requirements are high cost alternatives, and that the mandated tanks are often poorly maintained (box 4.9). They do not reduce potable demand to the extent originally envisaged, so supply planners are unable to reliably factor water savings into their planning (Seqwater, Brisbane, pers. comm., 26 March 2019)
- government programs have provided capital subsidies for specific solutions such as recycled water plants or small-scale managed aquifer recharge schemes in the past. Many of these projects have not been used, are underutilised or have been abandoned well within their useful life due to high operating costs, the lack of scale to make the schemes viable, onerous regulatory requirements, as well as capability and risk issues. For example, while decentralised schemes were 'enthusiastically adopted during the Millennium Drought, many of these schemes are in various states of decommissioning across south east Queensland' (Seqwater 2017, p. 55)

There will be opportunities to recycle water that are cost effective in delivering more than one outcome. The issue is that policies that mandate solutions and targets are often set without sound evidence and analysis. Once policy-makers remove inefficient mandates, service providers will be able to pursue opportunities that respond to local circumstances and meet the broad range of outcomes at least–cost.

Box 4.9 Third pipe networks can be costly to the community

Water recycling targets and mandates for non-potable water pipe networks in new developments (purple pipes) are widespread. In a number of cases, purple pipes have been installed, but are not connected to an operational recycling or reuse system. This means that potable water is flowing through the network. One example is Fitzgibbon Chase, a residential estate with 1300 dwellings located in Brisbane, approximately 12 kilometres north of the central business district. Two stormwater harvesting and reuse schemes were implemented:

- stormwater harvesting to supply non-potable water through a third pipe network (called FiSH). The total cost of the FiSH scheme was estimated at $6.65 million, of which the Australian Government provided $3.09 million
- a potable roof water scheme (PotaRoo) that harvests water for injection into the potable reticulation system.

Although the schemes were constructed, they remained unused for at least 18 months due to outstanding planning issues and long-term governance issues. The experience also highlighted the value of understanding the costs, benefits and risks prior to implementation:

> What we have learned from the Fitzgibbon Chase scheme is the value of
>
> - establishing clear governance structures
> - working through specifications and approvals for the scheme at the initial planning stage of developing a scheme
> - clearly identifying scheme costs and benefits to understand the economic viability of the scheme and potential risks to this viability.
>
> Further, where it is identified that costs may exceed revenue, funding mechanisms to recover costs should be resolved prior to decisions being made and the scheme being implemented. (Seqwater 2017, p. 56)

More recently, there has been greater recognition of the costs of mandating third pipe networks. Service providers have seen that initial demand projections were overly optimistic, particularly with the move towards smaller blocks, with limited private open space. Due to the high costs of fitting the pipe infrastructure, it is likely that the demand for other non-potable uses (such as toilet flushing and laundry) can be met, in many cases, at lower cost using alternative supply options, even when a source of recycled water is available nearby. As a result, a number of utilities have shifted away from mandating third pipe networks.

Sources: Economic Development Queensland (2014); Seqwater (2017).

Box 4.10 Rainwater tanks fail cost-benefit tests

Governments encourage the installation of rainwater tanks through regulations. For example, BASIX is a mandatory NSW Government initiative that sets water reduction (and thermal and energy) targets for building new homes and major renovations. While a range of measures can be used to meet the targets, the most common is installation of a rainwater tank.

Although there may be some benefits associated with rainwater tanks (such as reduced water and stormwater infrastructure costs and environmental benefits associated with reduced stormwater flows), Marsden Jacob Associates found that the costs outweighed the benefits by more than $2000 per tank in most cases (MJA 2007).

The Commission has previously found that policies to encourage the installation of rainwater tanks are likely to be inefficient (PC 2011). Harvesting rainwater tends to be more costly than supply from centralised supply systems. For example, research on the cost effectiveness of rainwater tanks in south-east Queensland found that the average levelised cost was $9.22 per kL (Hall 2013). This was substantially higher than the $4.40 per kL for potable water at the time.[9] Similarly, analysis in the Australian Capital Territory has found the cost of water from rainwater tanks would exceed the highest price tier for water use.

Research undertaken on the condition of rainwater tanks, and their ongoing maintenance, has highlighted a number of issues. A survey by the Australian Bureau of Statistics found that only 58 per cent of survey respondents with a rainwater tank claimed to undertake any kind of maintenance in a 12 month period (ABS 2013). This contrasts with guidelines that recommend numerous maintenance activities should be undertaken at a frequency of 3 to 12 months. In south-east Queensland, research has found that those with mandated rainwater tanks had a lower level of motivation compared to those who chose to retrofit a rainwater tank, negatively impacting on tank maintenance:

> The message from this finding is that, among the mandated sample, people felt as though they did not know enough about rainwater tank maintenance and they were not willing to put in the effort to find out more or to engage in many of the maintenance behaviours required. (Mankad, Tucker and Greenhill 2012, p. 20)

Tank condition and maintenance impacts on performance, and the long-term water savings available. For example, a study in Melbourne found that:

> … faulty automatic switches in many cases are causing some significant reductions in water savings potentials. Faulty switches tend to mean that mains water is used to meet tank water demand although rainwater may be in the tank. (Moglia et al. 2014, p. 128)

This has implications for water system planners, and the extent to which they can rely on any water savings from rainwater tanks.

Sources: ABS (2013) Hall (2013); MJA (2007); Moglia et al. (2014); PC (2011); QCA (2013).

9 This is the full cost recovery price of potable water supplied by Queensland Urban Utilities in 2012-13 — based on 'total prudent and efficient capital and operating costs' (QCA 2013, p. 8).

5 Impediments in water services planning and delivery

The aim of IWCM is for the urban water sector to deliver the economically efficient mix of water supply, wastewater and stormwater services that maximises the net benefit to the community across the four outcome areas (water outcomes, health outcomes, environmental outcomes and urban amenity outcomes) (chapter 3). This chapter explores impediments to the integration of urban water planning and services by focusing on:

- obstacles to achieving effective collaboration (section 5.1)
- processes that inhibit the consideration of all options on their merit (section 5.2)
- barriers to integrating local-scale and system-wide planning (section 5.3).

These impediments are generally within the realm of the service deliverers themselves — water utilities and local governments.

5.1 There are barriers to effective collaboration

IWCM requires effective collaboration between different organisations, each with their own priorities. This can include water and wastewater service providers, stormwater managers (in some cases multiple stormwater managers), land-use planning authorities, policy-makers and regulators. Collaboration has improved in some respects (PC 2017c, p. 194). For example, the Victorian Government has initiated collaborative Integrated Water Management Forums (chapter 4). However, further progress is needed.

Introducing formal processes linking water planning and land-use planning (as described in chapter 4) will assist at the planning stage. But collaboration is also required at the decision-making stage, and through implementation and ongoing management.

There are a number of challenges in achieving this collaboration. For example, most agencies have their roles and responsibilities set out in legislation that was not developed with IWCM in mind. They may also have cultures, norms, values and risk appetites that have developed with respect to their own interests and stakeholders, rather than with IWCM as a central consideration. Collaborating imposes transaction costs on the parties involved, and requires one of them to take a leadership role to drive the planning. As the Commission has previously identified, 'in many cases, IWCM options are not investigated because it is not clear which entity should lead' (PC 2017c, p. 192).

Roberts, Browne and Breen (2018) identified project boundaries and multiple stakeholders as a challenge for integrated water management. As many projects straddled physical and administrative boundaries, the involvement of multiple stakeholders made it 'difficult to identify a permanent lead organisation or body to drive ongoing IWM planning and implementation' (Roberts, Browne and Breen 2018, p. 7).

In their analysis of risk factors for 21 residential recycled water schemes, West et al. (2016, p. 280) identified that the large number of stakeholders may find it difficult to collaborate, leading to delays in commissioning projects, when there are 'poorly defined stakeholder arrangements, strained relationships and a lack of agreeance on contractual terms'. The case study of Fitzgibbon Chase (box 4.8) highlighted the potential for lengthy delays when long-term governance arrangements are not in place between relevant organisations before IWCM projects are funded. In this case, a key governance issue was the handover of the schemes to an owner-operator:

> Despite ongoing consultation with the central water provider [QUU], profitability, internal workforce capacity, and a shift in the executive's tolerance for risk led the organisation to become reluctant to accept ownership of the schemes. … the expectation that QUU would be best placed to take on the novel infrastructure at Fitzgibbon was perhaps unrealistic. (Bettini 2015, p. 12)

Effective collaboration requires clear governance arrangements. This includes having clear roles and responsibilities for each organisation in relation to IWCM, processes for effective interaction and collaboration between the organisations, clear decision-making processes and appropriate allocation of risk between the parties.

5.2 Planning processes are not always based on rigorous and transparent assessment of options

To enable the most efficient options to be identified, the benefits and costs of relevant options should be assessed across all the outcome areas to which the urban water sector contributes to (water, public health, environmental and urban amenity outcomes) (chapter 3). Three policy impediments to this being achieved were discussed in chapter 4. These were:

- arbitrary policy bans that prevent some options from being considered
- mandated targets for reuse and recycling
- mandated approaches to be used (such as the requirement to install third-pipe systems).

This section explores a fourth impediment at the planning and service delivery level — a lack of rigorous and transparent assessment of all options using cost–benefit analysis.

Currently, the approaches to balance supply and demand are not always informed by the relative net benefits of different options. In considering supply augmentations, Infrastructure Australia noted that water infrastructure planning should be more rigorous:

> Contrary to National Water Initiative objectives, some capital grant programs have funded water infrastructure projects that do not demonstrate economic viability. This is despite funding being available to support planning and feasibility assessment of projects, and guidelines for project funding requiring a robust business case and demonstrated economic merit in order to proceed to full funding. (Infrastructure Australia 2019, p. 620)

In addition, Infrastructure Australia identified that weak long-term planning for urban water supply led to rushed and expensive decisions during the Millennium Drought (IA 2019, p. 623).

The Commission's analysis of existing decision-making practices suggests there is scope to base decisions on more rigorous and transparent assessment. The Commission has previously recommended that comprehensive cost–benefit analysis should be undertaken and published for all public infrastructure investment proposals above $50 million (PC 2014, p. 40). Smaller projects should also be subject to rigorous and transparent assessment and selection processes, with the approach scaled to smaller-value projects. Information on the options and their respective costs and benefits should be made publicly available.

The analysis should consider alternatives to meet specified objectives and assess costs and benefits across the lifecycle of each project, including ongoing operation and maintenance costs associated with infrastructure investments (suitably discounted to reflect the changes in purchasing power of money over time), as well as a full assessment of the risks of different options (box 5.1). Meaningful customer engagement should also inform the trade-offs between the quality and reliability of services with the cost of providing them.

To achieve a more integrated approach, the process should involve undertaking a social cost–benefit analysis. This would enable wider impacts (such as the effect on bulk supply) to be included, which might otherwise be missed by a private cost–benefit analysis.

Assessment should consider costs and benefits across the entire water cycle, recognising the interrelationships between its different parts. For example, recycling wastewater locally can reduce demand for potable water, avoid costs of transporting wastewater to a central treatment plant and reduce environmental discharges of treated wastewater.

However, the costs and benefits across the entire water cycle may not be considered where multiple organisations are involved or different functions within an organisation operate separately. Collaboration will be key in supporting integration (PC 2017c, pp. 193–194), and this should be a clear expectation.

A cost–benefit analysis that encompasses all of the above features would mean that options can be ranked according to their net benefits across the agreed suite of outcomes. In some cases, implementing a more traditional supply option may still be the best option. However, this can be confirmed by taking an integrated approach to the assessment.

Box 5.1 Costs and benefits to include in an economic analysis

Cost–benefit analysis can be used to assess whether a project is likely to provide positive net benefits to the community. While costs and benefits should ideally be quantified, where that is not practical, they should be described, including some idea of their materiality. Sensitivity analysis should also be undertaken.

Costs

- Direct costs — the present value of all upfront and ongoing expenditure required to construct and operate a scheme.
- Indirect service delivery costs — other service delivery costs include any modifications or additions required to potable water, wastewater and/or stormwater systems (such as treatment or distribution) and the marginal administrative costs required to support a scheme.
- Other environmental, health, amenity and community costs — these costs will be project specific. An example for a recycled water scheme could be the cost of reducing the volume of water available for downstream agricultural users or the environment due to removing treated wastewater flows from inland waterways.

Benefits

- Use value — the benefit that will be gained by water users (individuals or businesses).
- Avoided and deferred costs — where an option being assessed involves replacing one water service with another (such as replacing potable water with recycled water), the net present value of any expenditure related to the provision of the existing service that is avoided or delayed should be included as a benefit for the option being considered *so long as* the avoided or deferred expenditure forms part of the costs of another option being assessed (this is to avoid double counting).
- Other environmental, health, amenity and community benefits — these will be project specific, but could include amenity and recreational benefits, flood hazard reduction and improved environmental outcomes. For example, recycled water can benefit the natural environment by enabling environmental flows in waterways to maintain the health of the waterways and the ecosystems that they support. These benefits will be greatest during times of drought and will increase with climate change.

Sources: IPART (2019b); MJA (2013).

This raises the question about which entity is best placed to consider the costs and benefits for each outcome area. Different entities are responsible for water, public health, environmental and urban amenity outcomes (chapter 3). As such, collaboration between the different entities involved in IWCM planning will likely be required, and there may be a role for governments to coordinate. The approach is likely to vary on a case-by-case basis.

5.3 Local-scale and system-wide water planning are not well integrated

Planning for water infrastructure in large cities generally occurs at two scales:

- at the system-wide, city or metropolitan scale level ('system-wide planning'), which focuses on the centralised water supply system — primarily large-scale centralised infrastructure such as dams, desalination plants and networks of pipelines
- at the local level ('local-scale or decentralised water planning'), which considers smaller, more localised opportunities to provide water services, such as onsite wastewater treatment and reuse, stormwater harvesting, and managing stormwater locally through WSUD measures, such as rehabilitating wetlands and natural waterways and increased use of permeable surfaces. These local-scale options will tend to reduce demand on the centralised system.

As IWCM is sometimes thought of as focusing on local-scale or decentralised options, there is a risk that local options are considered in isolation, and alternatives elsewhere in the system are overlooked. Similarly, system-wide planning may only consider large, centralised options, and not individual or a portfolio of smaller-scale alternatives. The framing of IWCM as decentralised may also discourage consideration of larger system-scale integrated options (such as large-scale recycling or potable reuse) where these are more reliable and cost-effective long-term options for the community.

The Commission's broad definition of integrated water cycle management (chapter 3) involves integration of local-scale and system-wide scale projects to facilitate assessment of all options on their merits. The remainder of this section explores how the water sector might achieve better integration across the different scales.

Roles and responsibilities in water services planning

It is critical that clear roles and responsibilities are assigned for system-wide and local-scale water planning. This ensures that decisions are made by those best placed to make them, are not delayed due to uncertainty over who is responsible, and that decision-makers can be held accountable (PC 2017c, p. 187). Without clear roles, it may also be more difficult to integrate the different scales of planning.

The Commission has previously considered the roles and responsibilities in centralised water system planning. Governments are ultimately accountable for ensuring that there are clear and comprehensive roles and responsibilities (as they determine the policy framework within which water planning decisions are made), and have implemented various arrangements around Australia. The two clearest cases are where government:

- coordinates the planning process and seeks technical input from utilities
- delegates planning to utilities, but reserves the right to approve the outcome (PC 2017c, p. 188).

Where utilities have been assigned the water planning role, they should respond to the objectives, policies and regulations set by government and make decisions within these settings.

Similarly, governments should clearly define roles for local-scale water planning.

Integrating local-scale and system-wide water planning

Integrated water management requires consideration of the interaction between the local and system-wide scales across all water services. To achieve this, there needs to be a clear interaction between local and system water planning to promote economically efficient outcomes. This is particularly relevant where different parties are responsible for system-scale and local-scale water planning or where investment decisions are made by different parties — for example, a bulk supplier and a retailer, a retailer and a private sector provider or local governments and utilities.

Better integrating local-scale and system-wide water planning would enable different scale options from across the water cycle to be considered on an equal footing, and support decisions that are optimal for the system as a whole. It would also allow for smaller-scale decentralised options to be considered together.

Nonetheless, integrating local-scale and system-wide water planning is a complex task that requires two key processes, which could be undertaken iteratively.

First, comprehensive local water planning needs to identify relevant local options. Governments should ensure that place-based IWCM plans are developed for major growth corridors and significant infill development locations (PC 2017c, p. 200). Although the best way to develop these plans is likely to vary based on local settings, the process could be broadly similar to the integrated water management forums established by the Victorian Government (PC 2017c, pp. 194–195).

As this type of planning will be most relevant when urban developments are being planned and designed, collaboration between water utilities and the relevant land-use planning bodies is essential. This collaboration will enable the potential benefits of different scale options to

be considered early in the planning of major growth corridors and development locations (chapter 4).

Second, system-wide planning also needs to consider the local options. Under this approach, water providers would adopt an integrated, system-wide approach to balancing supply and demand for water services. Both large-scale system-wide options and smaller scale local options would be taken into account when determining the size, timing and nature of augmentations. The priorities identified at the local scale would feed into the system-wide analysis. System-wide water planning would ideally identify constraints in the network, so that others could identify local-scale options where the potential to avoid costs is significant.

How integrated planning occurs in practice is likely to vary between jurisdictions based on local institutional and planning structures. Box 5.2 provides an example of more integrated planning.

Box 5.2 Integrating local-scale and system-wide options: Centroc

The Central NSW Regional Organisation of Councils (Centroc) is a regional collaboration of councils located across the Lachlan and Macquarie river catchments in central New South Wales. Water supply and wastewater services are provided by local water utilities, with councils typically managing stormwater. The Centroc members recognised that 'water resource management often needs to be contemplated at a scale or scope different to the organisational boundaries of local government' (MWH Global 2013, p. 3) and have collaborated to improve water service outcomes.

For example, in response to the Millennium Drought, Centroc undertook the *Water Security Study* (MWH Global 2009). In consultation with stakeholders, over 80 options were identified to improve water security, encompassing infrastructure (for example, recycling, groundwater, supply amplification, transfer systems) and non-infrastructure (system operations, demand management, water conservation) solutions. A short list of options for further consideration was selected using economic, social and environmental criteria, as well as consultation with stakeholders. Shortlisted options were combined into scenarios (groupings of the options that embodied a particular theme, such as a region–wide water grid or water recycling and stormwater harvesting for major urban areas). The scenarios were assessed to understand the costs and benefits of different approaches, and region–wide strategies were developed that identified feasible strategies to address the identified long term water security needs of the region. Following assessment and sensitivity analysis, a preferred region–wide strategy was developed, with components of the strategy set out for the region and for each council along with indicative timings.

The *Water Security Study* is further supported by the *Centroc Regional Integrated Water Cycle Management Plan*. The regional plan was informed by integrated water cycle management plans prepared by each council and 'seeks to define the opportunities for regional collaboration to facilitate each member local water utility's (LWU) efficient and effective management of the water cycle' (MWH Global 2013, p. 1).

Sources: MWH Global (2009; 2013).

The Melbourne Water System Strategy includes a number of decentralised IWCM projects that have been identified by retail and regional water corporations, and that will deliver around 30 GL of water per year from diverse sources by 2065. The strategy also adopts a goal of investigating the economic and technical viability of decentralised rainwater, stormwater and recycled water projects that could deliver a further 50 GL per year (Melbourne Water 2017, p. 86). Nonetheless, more can be done to better integrate local and centralised options. Marsden Jacob Associates recently made recommendations to Infrastructure Victoria to reform governance so that there is effective consideration of the interaction of centralised and decentralised options:

> Our overall recommendations focus on ensuring that longer-term augmentation and source planning process achieve greater integration at critical decision stages within Victoria's existing long-term planning framework … and that the right participants are involved. We also recommend that centralised and decentralised investment planning use the same investment planning tools and frameworks. This will help ensure that centralised and decentralised investments are evaluated on a level pegging, and within the same planning cycle and timing. (MJA 2019, p. 52)

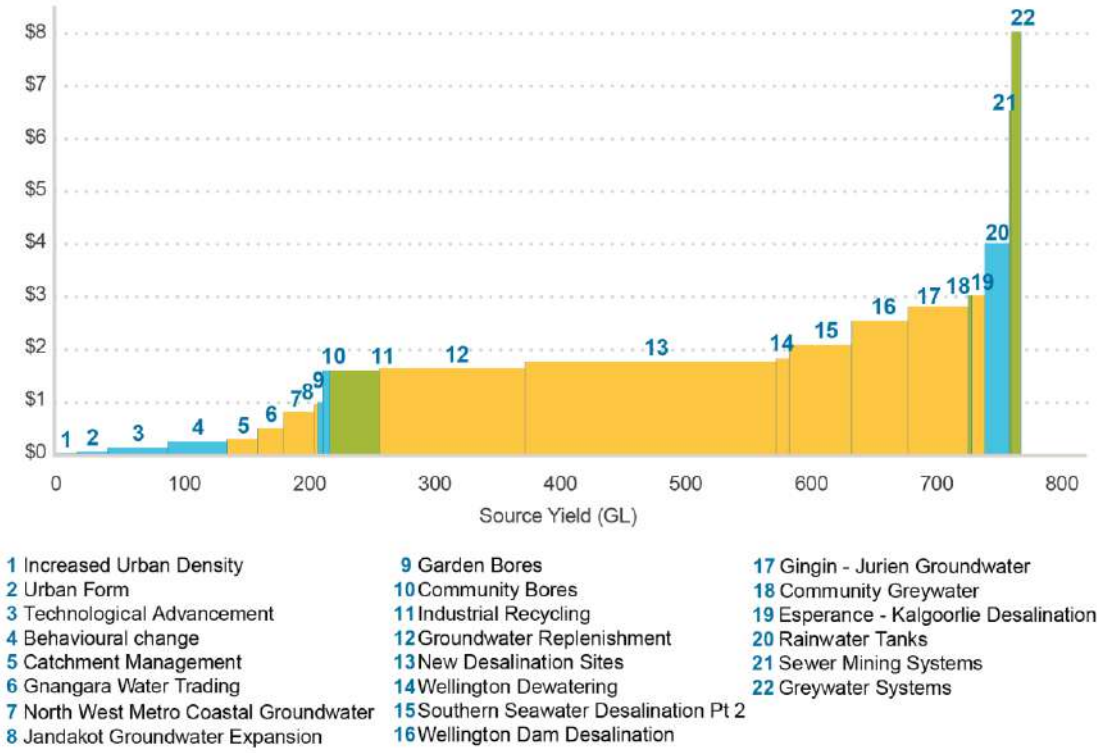
In Perth, Water Corporation (2009) has also considered a portfolio of 22 options of varying scales. In considering which options to progress, Water Corporation analysed and then ranked these options on the basis of their relative cost per kilolitre to produce and deliver the water (figure 5.1).

The role of a benchmark price in integrating local-scale and system-wide options

Pricing also plays an essential role in providing a signal to investors to integrate local and system-wide options. The price of water services supplied by the centralised system effectively sets the benchmark for evaluating the cost-effectiveness of local options (sometimes referred to as a hurdle rate). This is because water users and, in the case of Melbourne, water distributor-retailers can choose to use the central service if it is cheaper than an alternative. For example, a council considering local stormwater harvesting to water green open space can compare the cost with the alternative option of irrigating with the price of potable water from the centralised system. A household considering installing a rainwater tank can compare the cost with the price of using potable supplies from the centralised system. Similarly, a water utility that is considering recycling wastewater for local reuse may compare the option with the alternative costs for both the supply of potable water and for the transport and treatment of wastewater at centralised treatment plants.

Figure 5.1 **Water Corporation's portfolio of options**

Cost (dollars per kilolitre) and yield



Source: Water Corporation (2009, p. 29).

It is therefore important for prices across the system to be set efficiently to send the appropriate signals about the costs involved. If system-wide prices are below the efficient level, there is a risk of under investment in decentralised options, as the cost of purchasing centralised water services are not fully captured. Conversely, if system-wide prices are above the efficient level, there is a risk of excessive investment in decentralised options.

A relevant and up to date bulk water price would provide a benchmark against which local supply options could be tested, and facilitate coordination between decision-makers, such as water utilities, local councils and private service providers.

6 Impediments in the regulatory environment

State and territory government regulations, and the actions of regulators, shape the environment in which urban water providers deliver their services. Regulations and regulators, therefore, play a crucial role in creating the incentives that water providers face to deliver the appropriate mix of services that the community expects from them. While important for all water options, they are particularly influential in determining the viability of integrated solutions, as the simultaneous delivery of multiple outcomes means that integrated solutions may be subject to more regulation than traditional water solutions.

This chapter focuses on two regulatory impediments to the adoption of an integrated approach to urban water management:

- environmental regulations that focus on actions and not outcomes (section 6.1)
- the cumulative effects of regulation that inhibit integration (section 6.2).

6.1 Environmental regulators focus on actions and not outcomes

Regulations that specify what services are to be provided, and how, may impede an integrated approach to urban water management. Specifying the approach to be used can constrain the range of options that may be considered and may deliver:

- outcomes that are inferior to those that could have been achieved for the same cost (such as the delivery of enhanced urban amenity, improved water quality or superior environmental outcomes), or
- the same outcomes at a higher cost.

These impediments often arise as regulation is geared towards the delivery of traditional water outcomes (chapter 3).

Environmental regulation is a case in point.

Historically, discrete point sources (such as wastewater outflows or industrial discharge pipes) were a significant source of waterway pollution and a key contributor to deteriorating environmental outcomes. In many cases, wastewater was released directly into waterways without concern about environmental impacts.

In response, state governments introduced environmental protection legislation and applied controls on the quality and quantity of pollution that could be discharged from point-source polluters — including wastewater treatment plants, sewer overflow points and industrial contributors. This has been highly successful in maintaining, and in many cases improving, water quality standards in urban waterways.

With regulation of point-source polluters in place, the biggest threat to the quality of water in waterways is now from diffuse sources of pollution, such as stormwater runoff from urban areas and from agricultural land, which can pose a significant risk to ecosystems (PC 2017c; State of the Environment Committee 2011) (box 6.1).

Box 6.1 Diffuse pollution can be the major contributor to waterway health

Unlike wastewater, the effect of diffuse pollutants, such as stormwater or agricultural runoff, on the natural environment is variable, and is significantly determined by the unique characteristics of a geographical area. In some instances, the adverse impacts of diffuse pollution can greatly exceed wastewater point pollution. In these instances, it may be more cost effective to limit diffuse pollution than continuing to reduce wastewater discharge limits.

One area where this interaction between wastewater and diffuse pollution is prominent and pressing is in the Hawkesbury-Nepean River in Sydney. Since at least the 1990s, there has been a concerted effort by the NSW Environmental Protection Authority, Sydney Water and environmental stakeholders to reduce levels of point-source pollution that has entered the river system. By reducing the discharge limits in Sydney Water's environmental protection licences, the contribution of Sydney Water's wastewater pollution is now notably less than other sources of diffuse pollution. Diffuse sources now contribute approximately 75 per cent of all pollution in the river.

Diffuse pollution however is notoriously more difficult to regulate and control than point-source pollution. Maintaining or further reducing the caps on point-source pollution for Sydney Water will substantially increase wastewater servicing costs, particularly given the need to absorb the impacts of significant population growth. As Sydney Water's wastewater treatment plants only contribute roughly 25 per cent of total pollution, there may be scope to significantly reduce environmental outcome costs by tackling other sources of pollution.

Sources: DECCW (2010); Fairbairn (2018); Sydney Water (2018).

Yet environmental regulation still primarily targets point sources of pollution (such as wastewater treatment plants). This is because the current regulatory regime was instituted when point-source pollution was the primary environmental concern (PC 2017c, p. 201). Diffuse sources of pollution (such as stormwater) are harder and more expensive to monitor and more difficult to regulate using traditional methods, as it is often the cumulative effect of pollution generated in multiple locations that has the major environmental impact and is, therefore, difficult to attribute to a specific activity or polluter.

Because of the continued focus on point sources of pollution, integrated solutions that achieve the same environmental outcomes by jointly managing the combined impacts of diffuse-source stormwater and point-source wastewater can create difficulties for the environmental regulator. This arises because there is confidence that point-source control will achieve the required environmental standards, whereas diffuse source management introduces additional risk as to whether the desired outcomes will be achieved, and, if they are not, who should be held responsible. This additional risk arises from insufficient knowledge of stormwater flows in the urban environment and their nutrient loads. Existing stormwater monitoring regimes are inadequate to ensure that the desired environmental outcomes are being achieved or to effectively demonstrate who is responsible if these outcomes do not occur. Targeting stormwater flows requires a significantly more sophisticated accountability framework than currently exists.

Undertaking trials of diffuse pollution controls has a double advantage for regulators and potentially the broader community.[10] They can overcome the insufficient knowledge of stormwater flows in the urban environment that is the source of the additional risk, while demonstrating that such controls can produce better outcomes in some instances. Trials have shown that adopting diffuse pollution controls that complement existing point-source controls can be a cheaper way to improve environmental outcomes than simply upgrading existing point-source controls (DEC 2003; EPA (NSW) 2001; EPA (Vic) 2018; OECD 2017; Sydney Water 2019). Undertaking these more outcomes-based trials has required significant flexibility on the part of the environmental regulator and a willingness to work through the risks and test new ways of doing things to achieve the desired environmental outcomes.

Focusing on the desired outcomes, rather than on the point of discharge, is particularly relevant in metropolitan areas that face significant population growth (such as along South Creek and the Hawkesbury–Nepean River in south-western Sydney and Port Phillip Bay in Melbourne). These areas currently have defined environmental limits for a range of pollutants, which will be put under considerable pressure if the predicted population growth eventuates.

For example, projections indicate that population growth will lead to a significant increase in the volume of wastewater in Melbourne requiring disposal and, in the absence of other changes, would lead to nitrogen levels that are roughly 60 per cent higher than the current limit (box 6.2). Maintaining the current level of 3100 tonnes per year in the face of an almost doubling of population growth has the potential to lead to significant increases in wastewater treatment costs.

[10] Diffuse pollution controls can include stormwater harvesting, constructed wetlands, raingardens, swales, tree pits, rainwater tanks, gross pollutant traps, porous asphalt and infiltration chambers.

Box 6.2 Flexible regulatory solutions have the potential to deliver better or more cost-effective outcomes

Flexible, market-based approaches to reducing or constraining a pollutant can provide incentives to achieve a given level of pollution at a lower overall cost or deliver better environmental outcomes for the same cost. For example, pollution in a waterway, or parts of a waterway, can be capped in quantity and quality terms, with permits distributed among polluters that are consistent with the desired target(s). Those polluters that find it cheaper to abate can sell their excess pollution permits to other polluters.

A well-designed market-based solution also encourage integrated, scale-agnostic solutions for pollution across a geographical area and over time, incentivising innovative thinking and new abatement technologies. More flexible arrangements have been used in environmental management across Australia and around the world. Two examples are detailed below.

Hawkesbury-Nepean Offset Scheme

The Hawkesbury-Nepean River is an environmentally sensitive area with a myriad of uses, including providing drinking water, tourism and recreation. Sydney Water contributes to 25 per cent of total river nutrients through its wastewater treatment plants. Due to significant expected population growth in western Sydney, the NSW Environmental Protection Agency has proposed a nutrient trading scheme — as well as tighter nutrient loads and concentration limits — to come into effect from 2024. The scheme will reduce the current cap on nutrient load limits for discharge and assign property rights based on levels of discharge. It will allow Sydney Water to 'trade' water quality between individual treatment plants to find the optimal mix of resources and technologies that meets the Environmental Protection Authority's new water quality targets. The scheme will also allow for trading between regulated wastewater plants and diffuse polluters (such as stormwater) through a system of offsets, creating an environment conducive to finding integrated least-cost solutions regardless of source. If Sydney Water acquires offsets from a diffuse source, it must monitor and measure nutrient reduction, and bear the risk of non-compliance in regards to their licence with the Environmental Protection Authority. Such a scheme may be especially pertinent when considering that diffuse pollution contributes roughly 75 per cent of all water pollution in the Hawkesbury-Nepean catchment. Sydney Water considers the proposed scheme to be 'a pragmatic solution to nutrient management' (2019, p. 11) and IPART has suggested the scheme may be a 'potentially cost-effective option for meeting discharge limits' (2019, p. 67).

Melbourne Stormwater Offsets Program

The *Melbourne Stormwater Offsets Program* has been in operation from at least 2006 and seeks to protect water quality in waterways by targeting the amount of nitrogen in stormwater. The scheme run by Melbourne Water allows developers that find it too costly to reach the minimum stormwater pollution reduction level specified for developments in the Port Phillip and Western Port catchments to offset their increased pollution by making a financial contribution to Melbourne Water for a water quality investment elsewhere in the catchment. The payment is calculated on a sliding scale according to the developer's deviation from best practice. Developers are free to reduce their own discharges by the amount required (say by implementing the best practice solution) or pay the amount determined for their development. This process allows developers to reduce stormwater flows up to the point at which it becomes marginally more expensive to make further reductions than it is to make the offset payment. This provides incentives to implement least-cost solutions to stormwater management across the catchment.

It is feasible that such a system could be widened into a trading scheme with developers able to sell their stormwater abatement to other developers who are deficient.

Sources: IPART (2019); Melbourne Water (2006, 2007); Sydney Water (2019).

One solution that has been trialled and implemented by various regulators is 'bubble regulation' — regulating discharges from groups of wastewater treatment plants rather than each plant individually. This gives the water utility the flexibility to manage their discharges across plants to achieve the same environmental outcome at a potentially lower cost. Such a scheme was instituted by the NSW Environmental Protection Authority in 1996 to allow three participating wastewater treatment plants in the South Creek catchment to adjust their individual discharges, provided they did not exceed the area's limit. This achieved the environmental goals of an 83 per cent reduction in total phosphorus and a 50 per cent reduction in total nitrogen discharges by 2004, with a long-run cost saving of $45 million (EPA (NSW) 2001, p. 11).

An even more flexible approach is to regulate to achieve the required outcomes (box 6.2). Outcomes-based regulation focuses on what government and the community expect from the water sector, and from water providers, while being agnostic towards the actions taken to achieve them (PC 2017c, p. 200).While it may be infeasible to regulate stormwater and wastewater in an identical manner, outcomes-based regulation could encourage point-source polluters (such as a regulated wastewater providers) to offset their pollution by contracting diffuse polluters (such as stormwater service providers) to reduce their discharges. This would functionally integrate stormwater pollution abatement into the existing arrangements for wastewater. This may enable a wastewater provider to achieve their discharge standards by paying a local government to reduce their stormwater flows rather than reduce it themselves, with the result that the same discharge occurs into the waterway, but at a lower overall cost. It would also provide more incentives for stormwater managers and water utilities to work together on integrated solutions.

The Melbourne Stormwater Offsets Program is an example of an offsets scheme whereby developers can reduce discharges of nitrogen (the pollutant that is targeted) from their own developments (on-site) or, if it is cheaper, pay Melbourne Water a specified amount — currently $6645 per kilogram of annual nitrogen load (above the level that is considered to be best practice), plus an administration fee of 8.9 per cent (Melbourne Water 2019) (box 6.2). In its role as scheme manager, Melbourne Water uses the revenue to fund projects to offset the pollution arising from the development (Melbourne Water 2006).

Flexibility in general, and outcome-based regulation in particular, can reduce barriers to a more integrated approach to water management and improve economic efficiency (or deliver improved outcomes, and prompt innovation).

Outcomes-based regulation may not always be appropriate, especially when the costs involved outweigh the potential benefits. This may occur, for example, when the number of entry points of the pollutant is large. However, it should be considered subject to the availability of robust metrics, efficiency of compliance regimes and the transaction costs involved.

6.2 Cumulative effects of regulation can impede integration

The urban water sector is among the most heavily regulated parts of the Australian economy, with most parts of its operation subject to some form of regulation.

Regulation of the supply of water and wastewater services is particularly extensive, and, for the most part, these arrangements generally appear to work quite well (Frontier Economics and ARUP 2017, p. 40; IA 2017, pp. 50–52; PC 2017c, p. 201).

In comparison, stormwater management is lightly regulated, partly reflecting differences in the way the services are delivered (chapter 4).

The current regulatory arrangements also impede the consideration and uptake of options that deliver non-traditional water outcomes (chapter 3). Chapter 4 discussed three policy-related impediments — restrictions, mandates and bans on the use of recycled wastewater and treated stormwater — that impede the integration of urban water services on the basis of merit.

Other regulations impede the integration of urban water services on the basis of merit. Some arise from the cautious approach adopted by health regulators to alternative sources of water that restrict all options from being put on the table and others come from the cumulative regulatory burden that arises from simultaneously producing multiple outputs.

Requirements to use the best quality source of water available

The use of rainwater and recycled wastewater offers the potential for significant water security and environmental benefits, as well as the potential to deliver substantial cost savings.

Jurisdictions take different approaches to the use of rainwater and recycled water. In South Australia, for example, households with a rainwater tank can generally use this water for drinking and food preparation even if connected to the mains supply (SA Health 2019). In contrast, the Victorian Department of Health requires water utilities to use 'the best quality source of water available', which is typically potable water, even where fit-for-purpose rainwater or recycled water is available:

> … reticulated drinking water is used for drinking and food preparation in areas where it is provided. This is because the quality of rainwater is generally not as reliable as mains supply which have been treated to a level that is safe for human consumption. (DHHS 2013, p. 3)

The Aquarevo development in Melbourne illustrates the restrictions on the use of rainwater and recycled water (box 4.2). Despite providing a high level of on-site treatment and meeting drinking water guidelines, this water cannot be provided for hot water use from all fixtures, reducing the potential mains water savings. Such requirements may prevent the 'business-as-usual' consideration of alternative fit-for-purpose sources of water.

Other regulatory requirements

As integrated projects produce more than one outcome, they may have to go through more regulatory steps than traditional water projects that deliver a single outcome (chapter 3).

The involvement of multiple parties in a single project — such as the developer, the local council, other councils (where the project spans local government areas), state government departments, water utilities, catchment management authorities and regulators — make management of integrated solutions more complicated than traditional solutions (chapter 5). While somewhat dated, the following quote illustrates this complexity:

> For example, in NSW a decentralised recycled water system may trigger six Acts; it may be covered by four specific guidelines and it may require the approval or advice of up to eight authorities, although this situation is currently under review. (Mukheibir, Howe and Gallet 2014, p. 70)

Smaller-scale projects are particularly susceptible to the involvement of multiple agencies across different levels of government and, at the same time, typically have less capacity to manage these relationships effectively. Projects that deliver environmental outcomes are particularly susceptible to the involvement of different agencies.

A range of other regulatory (and other) issues can impede the adoption of an integrated approach to urban water management. A review of 21 Australian residential recycled water schemes identified 34 different factors that impacted on their long-term viability, of which four were categorised as political and regulatory risk (West et al. 2016). Other reviews identify further factors (such as IA 2017; Mukheibir, Howe and Gallet 2014; and Roberts, Browne and Breen 2018).

7 Impediments in funding and financing

Implementing an integrated approach to urban water management entails consideration of broader outcomes and requires collaboration with more stakeholders than normally associated with traditional water management (chapters 3 and 4). Taking an IWCM approach to water planning can result in the development of multi-outcome, cross-sectoral projects, which, despite potentially being the least-cost option, may be difficult to fund under the current arrangements that have been designed to provide traditional water outcomes. This has given rise to concerns within the water sector, which often sees funding as the key impediment to IWCM. This chapter:

- outlines the traditional approach to funding water services (section 7.1)
- explores some challenges to the funding and financing of integrated urban water management projects (sections 7.2 to 7.7).

Many of the funding issues identified arise indirectly as a consequence of policy decisions made by government (chapter 4).

Given the significant variation in integrated water projects, particularly in terms of the outcomes produced and who benefits from them, this chapter does not delve into the specifics of individual projects.

7.1 Traditional approach to funding water services

Beneficiaries typically fund traditional water services

Under current policy settings, urban water and wastewater assets in major cities are funded by water utilities (or state governments for some older assets), with the full costs passed on to water customers. Stormwater infrastructure is often funded by developers, who seek to pass the costs on to homebuyers, or by local government. In those areas where water utilities manage stormwater, they own the stormwater assets, with these costs again being passed on to their customers.

These arrangements are mostly based on the principle of 'beneficiary pays' — that is, that the primary beneficiaries of the services ultimately fund them. Water customers pay for the water that they use and for the wastewater removed from their properties. Stormwater services are paid for by local ratepayers (or water customers for those services provided by

water utilities) who benefit from the removal of unwanted rainwater and local floodwater from the urban environment.

This linking of the beneficiaries of water-related services with those who ultimately fund them and the move towards cost-reflective pricing were integral parts of past urban water reforms to water supply and wastewater management (chapter 3). When the quantum of funding is linked to the underlying cost of providing these services, the beneficiaries receive price signals to guide their behaviour and to enable water utilities to deliver an efficient mix and level of water-related services.

Under the traditional approach to urban water management, there is a clear link between the service that is provided, the desired outcome (that is, the provision of a safe and secure water supply and the removal of wastewater) and the customers who benefit from the provision of that service. The current funding arrangements for water supply and wastewater management are based on that link. The funding arrangements for stormwater services, services delivered by local government and the role of developer charges are less clear, particularly given the wide variation in the role played by developer charges across jurisdictions. To this end, in its 2017 *National Water Reform* inquiry, the Commission recommended State and Territory Governments 'reviewing the role that developer charges play in planning for new developments' (PC 2017c, p. 35).

7.2 Providing multiple outcomes makes the funding of IWCM projects less straightforward

Under the integrated approach to urban water management described in chapter 3, the outcomes required from water management are broadened to include consideration of enhanced urban amenity and environmental improvement. Taking this approach will generate projects that yield multiple outcomes. For example, stormwater infrastructure may be designed to provide urban amenity and improve the urban environment as well as to deliver the traditional outcome of reducing flood risk. An example is the 'Cascades on Clyde wetlands' in south-east Melbourne, which incorporates a wetlands to filter pollutants from stormwater and provide habitat to native flora and fauna, a garden, a playground and a boardwalk around the wetland.

This raises questions about who should fund such projects. Should the costs be borne by only those who benefit from the amenity gains, or should they be spread across all water users, or alternatively all ratepayers or citizens, and to what extent?

Issues about the delivery of multiple outputs are intrinsically easier to manage where the same entity is responsible for providing the multiple services that IWCM projects produce. This would be the case where local governments are responsible for providing both stormwater management services *and* urban amenity in the form of parks, gardens, sporting fields, footpaths and bike paths. In such a case, ratepayers may cover the cost of providing both services. Similarly, a developer that includes a lake in a new development to provide

amenity and act as a stormwater basin hopes to pass the costs through to the local residents in the sale price of their property.

However, more difficult funding issues may arise for other IWCM projects where different entities are responsible for providing the different services that such projects produce (discussed in chapter 3). An example of this would be where local councils are responsible for providing public parks that improve urban amenity and water utilities are responsible for managing stormwater. Economic regulators can allow water utilities to pass on the costs of managing stormwater to water customers where the role is formally assigned to them in their authorising documents, but generally not the extra costs of providing additional urban amenity, as this is not formally included in that role.[11] Under current policy settings, this would preclude water utilities from passing onto their customers the full cost of water-related projects that require the utility to incur extra costs in order to deliver additional benefits to the community, as such projects are unlikely to be approved by the economic regulator.

Nevertheless, the separation of responsibilities across agencies does not necessarily impede funding. In some cases, entities can contract with each other — either through direct purchasing (as is common for local governments that purchase water for amenity reasons) or through joint funding agreements. The latter could occur where an IWCM project is the most cost-effective way of providing the suite of outputs (such as managing stormwater and providing urban amenity). In this case, a local council could fund the additional incremental costs of the investment, which the regulator would otherwise not approve.

Some funding issues arise because the business case just does not stack up

As discussed in chapter 3, a key principle in undertaking integrated urban water management is to ensure that all possible options to meet the desired outcomes are considered *prior* to decision-making. But that does not mean an integrated project will dominate other options.

Projects should not be funded if the business case — as revealed by social cost–benefit analysis (chapter 5) — is weak. A local council, for example, may decide that it is more cost-effective to use potable water to irrigate green open space rather than to use recycled water. In this case, the inability to secure funding for recycled water projects would indicate that ratepayers' funds can be better used elsewhere and would not necessarily indicate a funding problem that needs addressing.

Deficiencies with the business case for IWCM projects can be masked by government funding that makes them appear more financially viable than they are. Without this funding, the projects would not proceed. The basis for these government contributions can be overly vague (for instance, to protect a nationally significant species or to enhance urban amenity for equity reasons, without an adequate assessment of the materiality of these benefits) or

[11] Regulators in some jurisdictions, such as Victoria and New South Wales, are making tentative steps to also consider the willingness of customers to pay for the delivery of non-traditional services (chapter 4).

lack a transparent rationale. An example of this is the Upper Stony Creek transformation project, which sought to turn a concrete stormwater channel in the west of Melbourne into an urban wetland and park (box 7.1). The project would not have been viable without $4.76 million of Australian Government funding, which lacked a clear rationale.

Box 7.1 **Upper Stony Creek transformation project**

This project aims to transform part of upper Stony Creek in Sunshine North from a 1.2 kilometre concrete channel into an urban wetland and park. It was identified under the 'Greening the West' initiative as a project which could deliver environmental and local health benefits. The project involves the collaboration of a diverse range of stakeholders, including: nine local councils; City West Water; Western Water; Melbourne Water; the Victorian Department of Environment, Land, Water and Planning; VicRoads; the Victorian Department of Health and Human Services; Parks Victoria; Port Phillip and Westernport Catchment Management Authority; and community groups.

The project secured $11 million in joint venture funding from: the Australian Government ($4.76 million); the Victorian Department of Environment, Land, Water and Planning ($2.04 million); Melbourne Water ($1.82 million); City West Water ($1.22 million); Development Victoria ($987 000); and Brimbank Council ($100 000) (Development Victoria 2018). Development Victoria is overseeing the construction, while Brimbank City Council and Melbourne Water will maintain the site.

The project ran into some difficulties and highlights the challenges in rejuvenating areas that were historically industrial and the complexities in achieving effective coordination and funding across so many agencies and levels of government.

Sources: Clayton (2019); Development Victoria (2018); DITCRD (2017); Suleyman (2019).

7.3 Funding issues with IWCM projects are often symptomatic of other factors

Many of the funding issues that relate to IWCM projects arise as a consequence of the factors identified in chapters 4 to 6, such as a lack of clarity about roles and responsibilities.

Unclear roles and responsibilities

Ambiguity about who should provide the service is inimical to funding. This is problematic for IWCM projects, as accountability for delivering the benefits is often unclear (chapter 4).

Water businesses have clear roles and responsibilities with respect to water supply and wastewater treatment set out in their authorising documents (chapter 3), but not for urban amenity or enhanced environmental outcomes.

Local governments and state and territory government planning agencies share broad responsibility for delivering amenity outcomes (chapter 3), but their roles in delivering more specific objectives in a coordinated way with the delivery of water services are rarely

articulated (chapter 4). This leads to ambiguity about who is responsible for funding water-related projects that have urban amenity benefits. Linking the responsibility for making decisions on the provision of urban amenity with the need to fund those decisions would strengthen the incentive to fund projects that are in the interests of the community as a whole. It would do this because those who make the decisions are accountable to those who will ultimately supply the funds used (such as ratepayers and taxpayers), which makes it harder to shift costs on to other members of the community (non-beneficiaries).

Lack of clear objectives for urban amenity and enhanced environmental outcomes

City plans, such as those listed in table 4.1, set out high-level aspirations, and sometimes targets, for the provision of green open space and amenity. In broad terms, until these outcomes are turned into more precise objectives, there is not a strong basis for normal project assessment processes, which typically begin by identifying a specific problem that needs to be solved, so that options for addressing it, their potential costs and any trade-offs that may be required can be identified. Until there are precise objectives and clear linkages between those objectives and urban amenity and environmental outcomes, it will be difficult to develop project proposals that are precise enough to justify funding.

7.4 Addressing the underlying factors will resolve many funding issues relating to IWCM projects

Addressing these underlying policy areas will go much of the way to resolving many of these funding issues.

Clearly assigning roles and responsibilities for the provision of urban amenity and environmental outcomes will assist the urban water sector by determining who has responsibility for making decisions in these areas and the sector's role in contributing to these outcomes.

Linking funding with decision-making will provide decision-makers with information about the true cost of providing these non-traditional benefits and reduce the incentive for them to try to shift this cost onto another party (chapter 4). This would imply that water customers would not be expected to fund the extra cost of providing urban amenity *unless*:

- this role has been formally assigned to water utilities; or
- a project that delivers amenity benefits is also the least cost option for the provision for water supply, wastewater management or stormwater management.

This linking of funding and responsibility for decision-making would also improve accountability, as decision-makers would have to justify the expenditure required and raise the necessary funds.

Such an approach would provide greater guidance about what services the urban water sector should be responsible for providing and should fund. If this greater clarity over roles and responsibilities flows through into the formal instruments that direct regulated water utilities, economic regulators will be able to include the provision of these wider non-traditional benefits into their pricing assessments, thereby enabling water utilities to fund approved projects from their customer base. This would also potentially enable the additional assets needed to provide these non-traditional benefits to be included in their regulated asset bases if they were not funded through developer charges.[12]

7.5 But some funding issues may remain

Funding should cover the full cost of the project

Funding should cover the full long-run capital and operating costs of IWCM projects, adjusted for the effects of changes in purchasing power over time (chapter 5). This is consistent with the pricing principles set out for the urban water sector in the *National Water Initiative* (box 7.2) and is the same as that used for traditional water assets. It also enables financially viable long-run provision.

This will determine the overall funding requirement for a project, but not where these funds should come from.

This raises the question of how to fund projects that span multiple agencies.

Funding IWCM projects may require cooperation across agencies

As IWCM projects also produce non-traditional water outcomes that may be the responsibility of other agencies (chapters 3 and 4), funding IWCM projects will frequently require cooperation across agencies.

[12] The regulated asset base of a water utility consists of those assets that the economic regulator will allow the utility to earn a rate of return.

Box 7.2 **National Water Initiative: Principles for urban water tariffs**

The *National Water Initiative* contains 10 principles to guide urban water price setting:

1. Cost recovery — water businesses should be moving to recover efficient costs consistent with the NWI definition of the upper revenue bound: to avoid monopoly rents, a water business should not recover more than the operational, maintenance and administrative costs, externalities, taxes or tax equivalent regimes, provision for the cost of asset consumption and cost of capital
2. Tariff structures — two-part tariffs (comprising a service availability charge and a water usage charge) should be used to recover the revenue requirement from retail residential and non-residential and bulk customers
3. Cost-reflective tariffs — the water usage charge should have regard to the long-run marginal cost of the supply of additional water
4. Setting the service availability charge — should be calculated as the difference between the total revenue requirement in accordance with Principle 1 and the revenue recovered through water usage charges and developer charges. The service availability charge could vary between customers or customer classes, depending on service demands and equity considerations
5. Pricing transparency — urban water tariffs should be set using a transparent methodology, through a process which seeks and takes into account public comment, or which is subject to public scrutiny
6. Over recovery of revenue — where water usage charges lead to revenue recovery in excess of upper bound revenue requirements in respect of new investments, jurisdictions are to address the over recovery. In addressing the over recovery, revenues should be redistributed to customers as soon as practicable
7. Differential water charges — water charges should be differentiated by the cost of servicing different customers (for example, on the basis of location and service standards) where there are net benefits in doing so
8. Setting developer charges — developer charges should reflect the investment in both new and existing assets required to serve a new development and have regard to the manner in which ongoing water usage and service availability charges are set
9. Capping developer charges — developer charges should not exceed the costs of serving new developments which includes investment in both new and existing assets required to serve a new development
10. Revenue from developer charges — revenue from developer charges should be offset against the total revenue requirement either by excluding or deducting the contributed assets from the required asset base or by offsetting the revenue recovered using other mechanisms.

Source: NRMMC (2010).

Funding should be linked to the benefits produced

Funding for IWCM projects should be linked to the extent of the benefits received (the so-called beneficiary-pays principle). The highly varied nature of these projects means that who benefits, and the extent to which they benefit, will vary from project to project.

Table 7.1 at the end of this chapter provides examples of the main beneficiaries from a range of services provided by typical IWCM projects.

Funding can be linked to the extent of benefits in different ways. One way is for each party to contribute to funding in proportion to the benefits that they receive. Another way is for water customers to cover the least-cost way of providing the water-related service, with the other beneficiaries funding the remaining costs in proportion to the benefits that they receive.

The rationale for this second approach is that the water-related service would have been provided anyway, albeit in a slightly different form, with the cost of this service being determined by the least-cost alternative traditional water solution. This would mean that water customers would pay no more for the water service received, with the additional cost being recovered from those that benefit from the additional outcomes being delivered.

The value of the additional funding needed could be determined as the difference between the total cost of the project and the least-cost alternative traditional water solution. This information would be available from the assessments of the costs and benefits of each option that should occur as part of the project selection process (chapter 5).

This cost-based approach could be similarly extended to include additional non-traditional benefits, such as delivering enhanced environmental outcomes.

An advantage of this cost-based approach to apportion the funding of services that deliver multiple outcomes is that it avoids the problematic need to value each benefit produced.

7.6 There is a limited but well defined role for government funding

As discussed in chapter 3, governments have primary responsibility for delivering a number of the outcomes to which the water sector contributes. For example, in relation to urban amenity:

- local governments are primarily responsible for delivering local urban amenity
- state and territory governments are primarily responsible for ensuring city-wide/major urban amenity and environmental standards (including environmental enhancement).

In addition, the Australian Government has a significant responsibility for ensuring the protection of environmental values of national significance (for example, endangered species and meeting obligations under international treaties).

These responsibilities mean that there may be a limited and well-defined role for government funding of some IWCM projects. This role would primarily relate to areas where there are negative externalities (such as addressing adverse environmental outcomes from stormwater) or public goods (such as some types of urban amenity or improved

environmental outcomes). The nature of these benefits means that funding should largely be confined to local, state and territory governments rather than the Australian Government.

An illustration of where state and territory government funding might be warranted is an IWCM project that also aims to improve water quality in the receiving waterways. State and territory governments have primary responsibility for ensuring environmental outcomes are delivered (and can sometimes act as the beneficiary on behalf of the wider community, which could not at the individual level itself coordinate funding). So, if a traditional water solution to stormwater disposal cost $1 million and the IWCM project selected cost $2 million and produced at least $1 million of environmental benefits, state and territory government funding to the tune of $1 million (50 per cent) may be warranted. Some Australian Government funding may be appropriate if, for example, the receiving waterway was a Ramsar wetland, a designated site of international importance.

Arguments have been made for government funding of urban amenity on the grounds of 'intergenerational equity' where, it is argued that governments should fund water-related urban amenity in new areas as residents in established areas did not pay the full cost of the amenity that they receive. Yet it is not clear that this is indeed the case, as residents in established areas already incur higher property prices as a result of the additional amenity, so may indeed be paying the full cost of that amenity. It is likely to be true that some cross-subsidisation may have occurred in the past, such as from taxpayers at the time to the then property owners, but this does not imply that this is an issue for current property owners. To the extent that there may be an issue today, it might be more one of 'spatial inequity', whereby state and territory governments do not provide the same level of major or higher-level water-related amenity (above that provided by local government) in new areas as in established parts of the city. This raises the question as to who should pay for growth. Further investigation is required to answer this question.

7.7 Funding should be based on the best way to raise the funds needed

The final key issue relating to the funding of IWCM projects is how each party should finance their contribution.

Each party is generally best placed to determine the most effective financing mechanism for them to use to raise the required funds, subject to the prevailing legal and other constraints that they may face. For instance, the mechanisms used by regulated water utilities will also need to be acceptable to their economic regulators and to their government shareholders, and consistent with their authorising instruments.

There are already reasonably clear principles across the water sector, and government more generally, to guide each entity in their choice of financing mechanism, the rate at which it is set and who will pay. These include:

- the pricing principles set out in the *National Water Initiative* (box 7.2)
- general taxation and public finance principles, such as raising the required revenue:
  - as efficiently as possible (at the lowest overall economic cost to society)
  - in an equitable (fair) manner
  - as simply as possible
  - in a way that minimises administration, collection and compliance costs
- provides appropriate incentives to inform consumers by:
  - aligning the funding mechanism with the benefit from the outcomes being produced
  - linking the amount charged to the quantum of benefit received
  - avoiding costs being shifted on to parties that do not benefit from the services being provided/avoiding cross-subsidisation.

It is often not possible to meet all of these principles, but the principles at least push financing decisions in the right direction.

To illustrate how the funding discussion outlined in this chapter could operate, table 7.1 canvasses some hypothetical IWCM projects. For each project, the table outlines:

- what the primary outcomes produced might be (benefits produced)
- who might primarily benefit from these outcomes (the beneficiaries)
- who might contribute to the funding of the project (the funder)
- which possible funding mechanism could be used.

More detailed analysis would need to be undertaken to ascertain the most appropriate funding arrangements for any given project.

Table 7.1 **Examples of possible funding of IWCM projects**

Benefit produced	*Beneficiary*	*Funder*	*Possible financing mechanism*
Traditional water outcomes			
Potable water	Potable water customers	Water Utility	Potable water charges
Recycled water	Recycled water customers	Water Utility	Recycled water charges
Wastewater	Wastewater customers	Water Utility	Wastewater charges
Stormwater (trunk)	All water customers	Water Utility	Stormwater charges
Stormwater (local)	Local residents	Local Government	Stormwater charge/ special levy/ municipal rates
Non-traditional water outcomes			
Urban amenity (sporting fields)	Users of sporting fields	Local Government	User charges/ municipal rates
Urban amenity (local park)	Local residents	Local Government	Special levy/ municipal rates
Urban amenity (major park)	All residents	State/Territory Government	Community Service Obligation (funded from consolidated revenue)
Environment (reduced wastewater discharges)	Wastewater customers	Water Utility	Wastewater charges
Environment (enhanced environmental health)	All residents	State/Territory Government	Community Service Obligation (funded from consolidated revenue)
Environment (endangered species)	All residents	State/Territory Government / Australian Government	Community Service Obligation (funded from consolidated revenue)
Environment (international treaty)	All residents	Australian Government	Community Service Obligation (funded from consolidated revenue)

8 Progressing integrated water cycle management

In the 2017 *National Water Reform* inquiry, the Commission identified that the urban water sector is facing a number of challenges 'that are likely to influence the direction of future water reforms in Australia'. In particular, the Commission recommended that governments should recommit to a renewed NWI through COAG with significantly enhanced policy settings with respect to urban water management 'to ensure innovative and efficient provision of services in the future under the combined pressures of population growth and climate change' (PC 2017c, p. 321). The Australian Government has agreed in principle to renew the NWI to 'better prepare Australia for the challenges ahead' and 'reflect lessons learnt and changing priorities in water reform' (DAWE 2019).

This paper delves deeper into the key challenges and expectations facing the urban water sector highlighted in the 2017 *National Water Reform* inquiry and the adequacy of current arrangements to facilitate the delivery of an integrated approach to meeting them. The paper sets out an expanded definition of, and approach to, integrated water cycle management, as well as a policy development framework that is used to identify ten key impediments to adopting an integrated approach to urban water management.

These ten key impediments point to where action is needed to progress IWCM towards becoming the new business-as-usual way of planning and managing urban water resources. This would assist urban water providers to make better decisions and deliver lower cost solutions for providing the full suite of community water needs in our major cities. These issues and possible policy responses will be explored further in the Commission's next review of progress on national water reform to be undertaken later in 2020.

As the process for renewing the NWI begins, it is hoped that this piece of work, together with the Commission's 2020 inquiry, will provide a useful contribution to the discussion in reforming urban water policy at the national level.

A Consultation

This appendix lists the organisations that were consulted in the preparation of this paper (table A.1). The Commission is grateful for their assistance.

Table A.1 **Consultation**

Organisation	*Jurisdiction*
Aither Pty Ltd	National
Audit Office of New South Wales	New South Wales
Barwon Water	Victoria
Cooperative Research Centre for Water Sensitive Cities	National
Department of Agriculture and Water Resources	National
Department of Environment and Natural Resources	Northern Territory
Department of Environment and Water, Water Group	South Australia
Department of Environment, Land, Water and Planning	Victoria
Department of Natural Resources, Mines and Energy	Queensland
Department of Planning, Industry and Environment	New South Wales
Department of Planning, Transport and Infrastructure	South Australia
Department of Primary Industries, Parks, Water and Environment	Tasmania
Department of Water and Environmental Regulation	Western Australia
Environment, Planning and Sustainable Development Directorate	Australian Capital Territory
Environmental Protection Authority	New South Wales
Essential Services Commission	Victoria
Essential Services Commission of South Australia	South Australia
Flow Systems Pty Ltd	New South Wales
Greater Sydney Commission	New South Wales
Independent Pricing and Regulatory Tribunal	New South Wales
Infrastructure NSW	New South Wales
Infrastructure Victoria	Victoria
Local Government Association of New South Wales	New South Wales
Melbourne Water	Victoria
New South Wales Productivity Commission	New South Wales
Professor L. Case and Dr B. Cooper, University of Adelaide	South Australia
Queensland Urban Utilities	Queensland
SA Water	South Australia
Salisbury Council	South Australia
Seqwater	Queensland
South East Water	Victoria
Sydney Water	New South Wales

(continued next page)

Table A.1 (continued)

Organisation	*Jurisdiction*
The Balmoral Group Australia	New South Wales
The City of Sydney	New South Wales
University of New South Wales, Water Research Centre	New South Wales
University of Western Australia, Cooperative Research Centre for Water Sensitive Cities IP2 team	Western Australia
Victorian Planning Authority	Victoria
Water Corporation	Western Australia
Water Sensitive SA	South Australia
Water Services Association of Australia	National
Western Water	Victoria

B Glossary

Bulk water	The harvesting and storage of water using large-scale infrastructure such as dams and desalination plants.
Community service obligation	Government payments to commercial entities to provide services that are not sustainable otherwise.
Consumption-based pricing	Pricing where a charge is applied to each unit of water consumed.
Corporatised utility	A utility that is fully owned and operated by the state but has a separate legal and financial status akin to a corporation.
Diffuse pollution	Pollution which originates from many sources, such as stormwater and runoff from agricultural land.
Direct potable reuse	Mixing suitably treated recycled wastewater or stormwater directly with drinking water in the water supply distribution system.
Environmental flow	A flow of water through to a river, wetland or floodplain to improve or maintain environmental outcomes (and other public benefit outcomes, where possible).
Environmental outcomes	Maintaining ecosystem biodiversity, environmental health and ecosystem function.
Externalities	Non-market effects of consumption or production decisions on people other than those directly involved.
Financing	The manner in which the money used to pay for infrastructure is raised. Financing can take the form of water charges, developer charges, rates, taxes, user charges, etc.
Fit-for-purpose water	Water that is treated to a standard that is appropriate for its intended use.
Funding	Refers to who ultimately pays for infrastructure. In the case of water infrastructure, this can be water users (such as customers), other beneficiaries of the infrastructure (such as towns protected from flood) and/or governments.
Gigalitre	One billion (1 000 000 000) litres.

Greenfields	Undeveloped or agricultural land being considered for, or undergoing, urban development.
Groundwater	Water located underground in permeable soil or rock (referred to as aquifers). It includes both naturally occurring water and water pumped underground for storage. However, it does not include water held in underground tanks, pipes or other works.
Health outcomes	Maintaining or improving human health, or reducing the likelihood of adverse health events. The water sector primarily contributes to health outcomes via providing drinking and non-drinking water that meets water quality standards and through the safe disposal of wastewater.
Indirect potable reuse	When suitably treated recycled wastewater or stormwater is added to a water body, such as an underground aquifer or dam, with the intention that it will mix over time before being treated again to supply drinking water.
Integrated Water Cycle Management	Integrated management of water resources in the urban environment in a way that achieves the full suite of water security, public health, environmental and amenity outcomes that the community seeks. It encompasses all urban water, regardless of its source, and the provision of the full range of water services and water infrastructure at least–cost, regardless of scale or ownership.
Least cost provision	Achieving the desired objective or outcome at the lowest overall economic cost.
Megalitre	One million (1 000 000) litres.
Outcomes-focused regulation	Regulations that specify the outcome to be achieved without prescribing the means to achieve that outcome.
Point-source pollution	Pollution originating from a single identifiable source.
Potable water	Water that is safe to drink or use for food preparation.
Recycled water	Water that has been used and reclaimed during the process of disposal, where it is usually treated and pumped to its next use. Includes water that is reclaimed from wastewater and stormwater.
Stormwater	Water that enters the drainage system after rainfall.

Stormwater management	The management of stormwater in the urban environment to move water quickly away to a downstream point to reduce flooding.
Surface water	Water that flows over or collects on land and in natural or artificial waterways.
Upper-bound pricing	The definition of full cost recovery under the National Water Initiative. It involves recovering all of the costs of providing water services, including a market-reflective return on the capital used to provide them and the full recovery of that capital.
Urban amenity	The overall quality of the built form and natural environment impacting on the level of human enjoyment, and public and private spaces. Other elements of amenity include landscape amenity (features such as the provision of high quality green open space, trees, plantings and lawns that add to the quality of the landscape in a city environment), level of noise, air quality and sunlight. The word 'amenity' is often used to describe a pleasing or agreeable environment.
Urban cooling	Process of reducing the urban heat island effect, which is primarily achieved through natural or aquatic open spaces and tree coverage that absorb heat from the surrounding environment.
Urban heat island effect	Phenomenon whereby an urban or metropolitan area is significantly warmer than surrounding areas due to the use of building materials and human activities.
Urban water providers / utilities	Providers of water services — water, wastewater and stormwater services — to major metropolitan areas, typically government-owned water utilities, private-sector providers and local government stormwater managers.
Urban water services	Services related to the supply of water for fit-for-purpose use, the disposal of wastewater and the management of stormwater.
User charge	A charge for provision of a product or service.
Wastewater	Water that has been consumed and transformed by residential or commercial use. Also known as sewage.
Water outcomes	Outcomes that arise from the provision of water services to customers.

Water security	The reliable availability of an acceptable quantity and quality of water for health, livelihoods and production, coupled with an acceptable level of water-related risks.
Water sensitive urban design	Designing buildings and landscapes to reduce or slow stormwater runoff (including by increasing the extent to which water infiltrates the soil), to reduce pollution, and to provide opportunities for stormwater reuse.

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