Setting our future urban water directions

Delivering integrated urban water management for the benefit of South Australia

SOUTH AUSTRALIA

Government of South Australia
Department for Environment and Water

Introduction to urban water management

South Australia has a predominantly urban population with almost 90% of the state's 1.7 million people living in cities and towns with populations larger than 1000 people. The lifestyle we enjoy in our urban centres today is the result of a long history of water services development and water management that provides us with secure water supplies, reduced flooding and a healthier environment.

Water must continue to be managed so that our urban areas can adapt to future challenges including climate change, population growth and changing development patterns such as a preference for increased housing density. The need for an integrated approach to the delivery of urban water services has been recognised nationally as critical to meet these growing challenges and deliver economic growth and the broad suite of outcomes that the community expects.

Integrating our urban water services

Urban water services include water supply, sewage services and stormwater management. Traditionally, these services have been delivered separately, but it is now considered that a broad range of benefits can be achieved through integrated delivery. For example:

- Using stormwater and wastewater for non-potable uses reduces the demand for drinking water supplies and the volume of water that needs to be treated to a drinking water quality.
- Retaining rainwater and runoff in the urban landscape reduces the volume of water and pollutants that flow to natural environments and can in some circumstances reduce the volume of water needed to irrigate trees and other vegetation.
- Reducing water use in homes leads to less wastewater discharge.

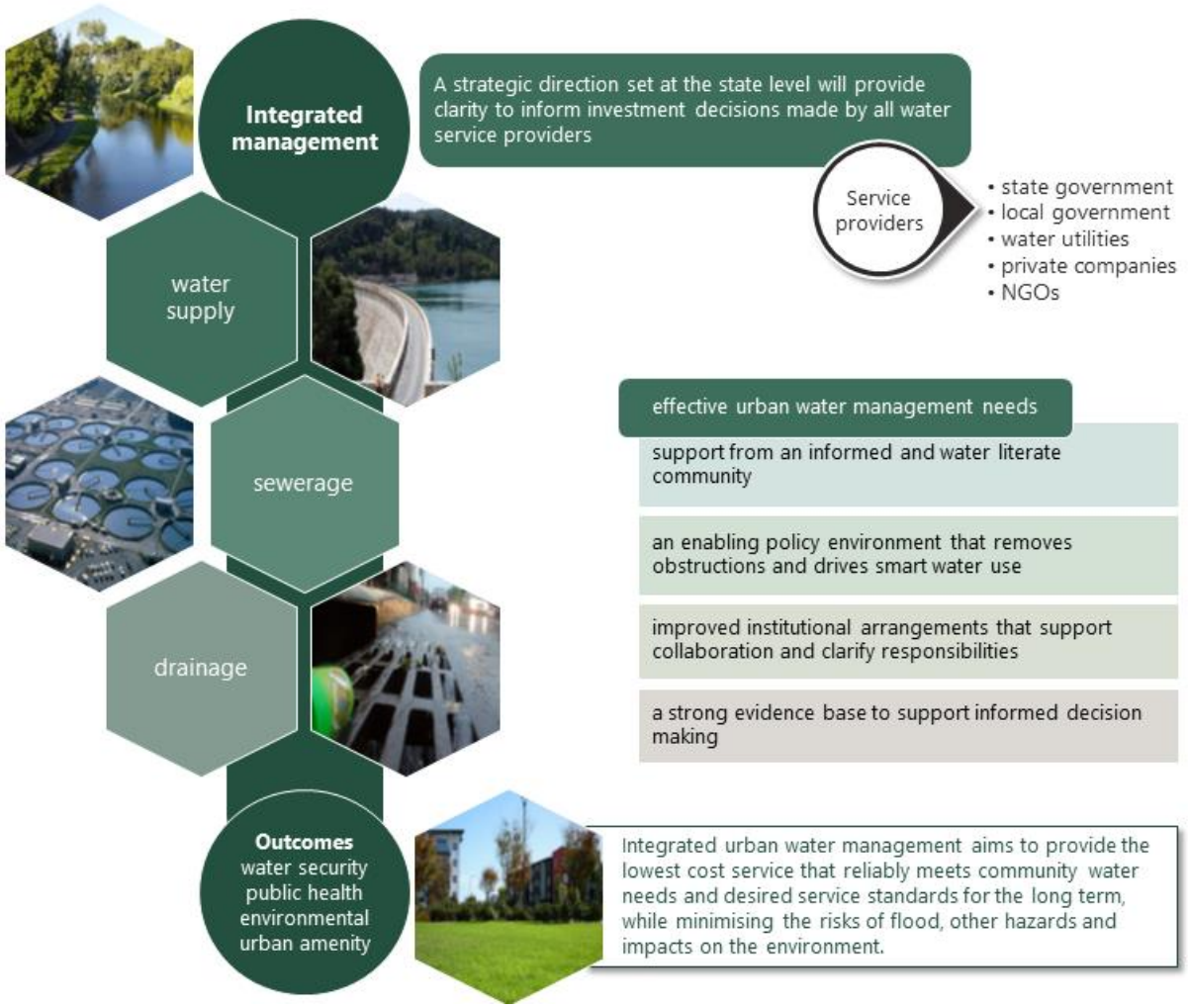
Examples of smart water management in Adelaide are listed at: https://www.environment.sa.gov.au/topics/water/water-in-urban-environments/urban-water-programs-initiatives#water-smart-adelaide.

Integrated urban water management needs more than just good infrastructure; it also requires an enabling policy environment, institutional cooperation and an informed and supportive community.

South Australia has been a world leader in water management, and our previous actions have provided a high level of water security for our urban centres. With current and emerging challenges it is time to set South Australia on the path to integrated urban water delivery and be at the forefront nationally and internationally in delivering the full suite of water security, public health, environmental and urban amenity outcomes that community seeks.

> *"Integrated water cycle management (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."* – Productivity Commission March 2020

Integrated urban water management



Setting the context

Our cities and towns

Almost 90% of the 1.7 million South Australians live in cities and towns with populations larger than 1000 people. Just over three-quarters (77%) of the population is concentrated in the Greater Adelaide area which extends from Gawler to Victor Harbor and from the sea to the hills and Mount Barker. Every city or town is different, and the best approaches to water management are dependent on population, water source availability, geography and climate.

Our climate

South Australia's climate is a significant factor in how we manage urban water. Most of the state experiences a semi-arid climate with hot dry summers, cooler wetter winters and generally low rainfall. Extreme heat days (40°C and above) are common in summer across much of the state.

In a low rainfall climate, local water resources are often insufficient to supply all urban water needs. This has been a driver for the diversification of water supplies in Adelaide and other urban centres. Key diversification strategies that are part of our urban water supply mix today include the transport of water long distances between source and supply point (e.g. River Murray), desalination of seawater, groundwater, and the use of treated stormwater and wastewater.

Urban form

Traditionally South Australian towns and cities have been low density with a predominance of detached housing. In recent years the urban form has been changing, with a move to increased densification and a higher proportion of medium and high density urban development. In Adelaide this often takes the form of small scale infill development, with single allotments being split into two or more houses.

In the natural landscape, and in low density development areas, rainfall can soak into the soils, wetting the soil profile, providing water for plant growth and replenishing our groundwater and surface water systems. In highly developed areas, there is a greater amount of rainfall that runs off hard surfaces, such as roofs, roads and paved areas. Drainage systems have been constructed to remove runoff, and many natural watercourses in urban areas have been straightened and lined with concrete to drain water away as quickly as possible to reduce flooding. As infill development continues, many of these drainage systems will not be able to provide the level of flood protection that they were designed for because of significant increase in hard surfaces.

The benefits of community access to areas of grass, trees and other vegetation in urban areas (green spaces) has also been well documented. Increasingly the benefits of access to "blue spaces" such as coastal environments, wetlands and rivers and urban water features (e.g. fountains, splash pads) are being recognised. With increasing urban densification and therefore a reduction in private open space, public open space is becoming more important in giving the community access to green and blue spaces. Water is critical to underpinning the success of green and blue spaces.

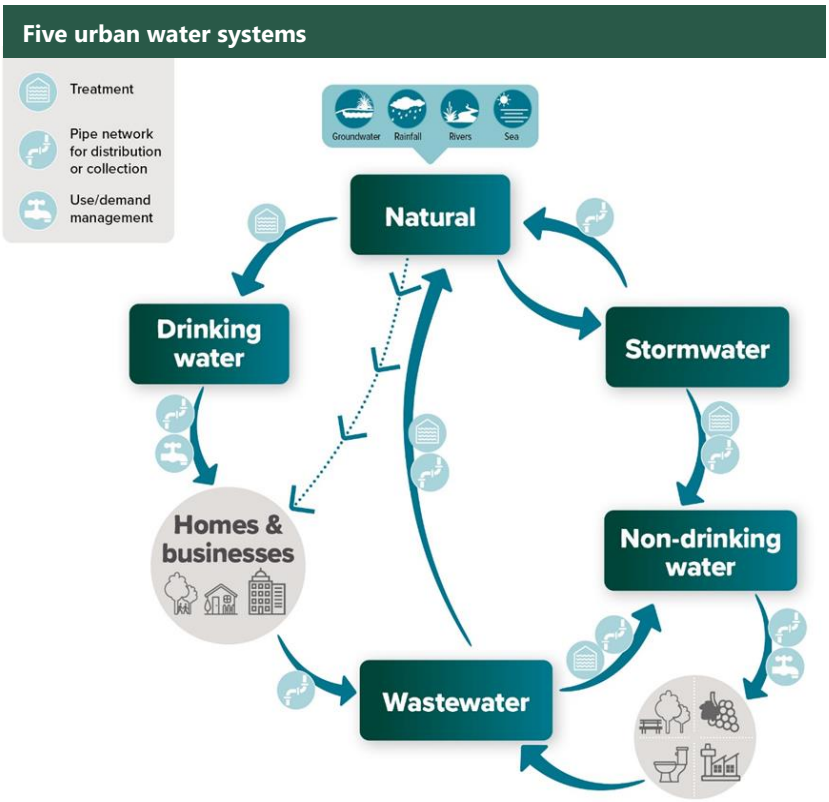
The natural environment

The way we manage water in our urban centres impacts on the natural environment. In particular stormwater runoff and wastewater treatment plant discharges can carry pollution (e.g. sediments and nutrients) to receiving waters, including rivers and the coast. Many of these environments are both ecologically sensitive and make significant contributions to the economy as sites for tourism and recreation and breeding grounds for economic fish species. Increasingly people are expecting our urban water management to play a part in minimising impacts on the environment, particularly through the reduction of stormwater and wastewater flows to rivers and the coast. Increasing the use of these water sources, as well as providing an additional water source, reduces environmental impacts.

Our five urban water systems

The urban water sector can be considered across five related systems. These systems are currently managed independently, and while the level of collaboration across systems has increased, it is timely to consider a more formalised approach to integrated urban water management, as decisions made for one system can impact across all systems. For example:

- increased stormwater harvesting and wastewater reuse will increase non-potable water supply, reduce demand on the potable water supply and reduce impacts on the environment through reductions in discharge
- managing rain where it falls through water sensitive designs will reduce pressure on our stormwater drainage systems, reduce environmental impacts and hydrate the soil

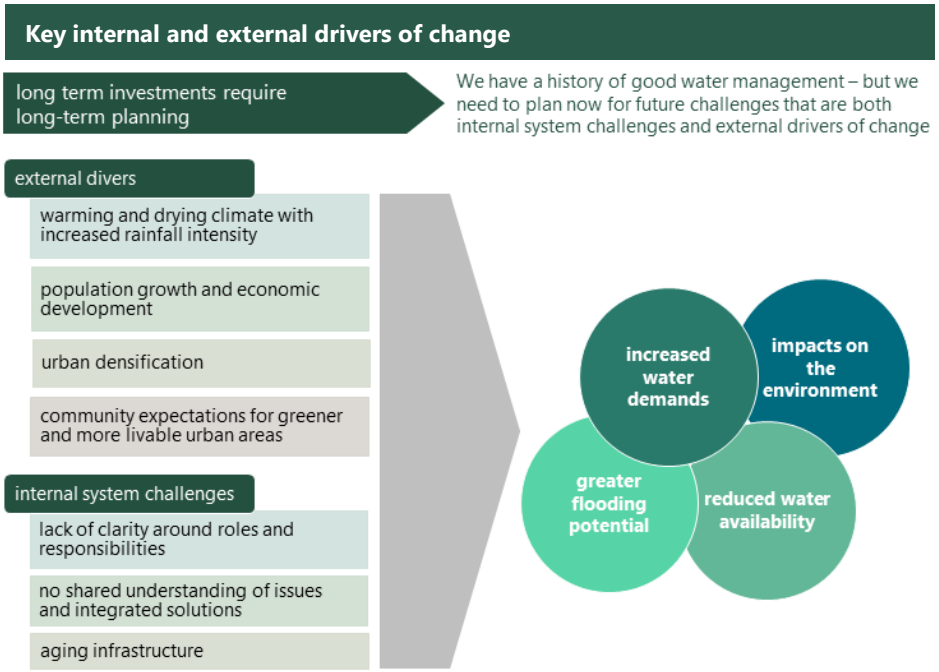


– thereby supporting plant growth and potentially delaying the timing of additional irrigation.

Why change how we manage urban water?

Urban water services have evolved over the years to meet a range of challenges including increased water demands, drought, floods and pollution.

Our urban centres continue to face both existing and emerging challenges and it is important that we set the right direction today so that communities, businesses and our environment are ready to face these. This is important particularly given the long investment horizons for much of our urban infrastructure.



Addressing challenges through an integrated approach to urban water management also offers a wide range of benefits, including:

- greener and cooler urban centres, with flow on amenity and health benefits, as well as potential reductions in electricity demands (e.g. reduced air conditioner use) and costs
- reduced flood risks, protecting people, properties and infrastructure
- a healthier local environment in our rivers, coasts and near shore marine environments
- better use of all of our available water resources potentially freeing up water for agricultural development
- new jobs in a wide range of sectors, including new and emerging technologies, which South Australia can also export to the world.

The future of urban water management

South Australia requires a strategic, collaborative and transparent approach to planning for the management of urban water that can address the complex issues faced by the sector. There is no single solution; rather a range of solutions that work together are required, including simple and already proven measures alongside new and innovative ideas.

There is growing national and global acceptance that urban water management is most effective when integrated management of the full urban water cycle maximises community buy-in and economic outcomes, while minimising environmental impacts. This requires multi-sector institutional cooperation and an engaged and water literate community, as well as application of new technologies. Construction of infrastructure alone will not achieve integrated urban water management if institutional collaboration or public acceptance is lacking.

The directions for South Australia's urban water future will be underpinned by a core set of principles and a management approach that:

- provides the lowest cost services across the whole water cycle
- reliably meets community needs and expected service standards for the long term
- minimises the risks of flood, other hazards and impacts on the environment.

Core principles for urban water management	
Alignment of services for place based outcomes	• Different sectors need to work together to deliver place based outcomes and multiple benefits for our communities.
Whole of water cycle decision making	• Decisions need to consider all parts of the urban water cycle – this can lead to innovative and more efficient management approaches.
Take a systems approach	• There is a need to consider the interactions between all parts of the system (natural, potable, non-potable, stormwater, wastewater). • Clear performance standards are required for each part of the system to inform decision making.
Wise use of all water	• Increasing demand and declining natural water sources means a reliable mix of all water sources must be delivered in consideration of long term cost effective delivery and the achievement of environmental performance standards.
Water at the centre of urban design (WSUD)	• Urban design needs to maintain water within the landscape where it falls, reducing the need for other water sources for irrigation, reducing pollution to the receiving environments and contributing to the management of nuisance flooding.
Cross sector management	• Urban water management is delivered by many organisations – the right planning, funding and governance models are required • Institutional collaboration is critical to integrated urban water management
An involved community	• An engaged water literate community is critical to ensure buy-in for all future water management options. • Construction of infrastructure alone will not achieve integrated urban water management if public acceptance is lacking.
Transparent beneficiary pays funding models	• Water and sewerage services are funded through economic regulation - appropriate beneficiary pays funding models are also needed for stormwater management and to achieve additional benefits from integrated water management

Water for the future – All options on the table

Providing water security for our urban centres is about ensuring that an acceptable quantity and quality of water for people, industry, and the environment is available now and into the future. Water security involves both managing demand for water and making sure water is available to meet demands.

While most South Australian urban centre currently have high levels of water security, providing for future water security could become more challenging as water demands grow. Maintaining a high level of water security in the future will involve using the most appropriate portfolio of water supply options, protecting water resources and linking fit-for-purpose water supplies with water demands.

"Town and city water security is meeting needs, over time and under changing supply and demand profiles, across the following dimensions: water quantity, quality (i.e. fit for purpose), affordability and access... and achieving this is done through investment and operations that are economically efficient, financially and environmentally sustainable, and resilient to shocks." – Public report prepared for the Department of Agriculture, Water and Environment (Aither, 2021)

Water supply augmentation options are not a one size fits all. It is likely that there will be a range of options that, operating at varying scales, all contribute to improved water security in the long term.

Adelaide water security

Adelaide has a high degree of water security as a result of: its diverse portfolio of supply options (including climate independent sources), highly networked water distribution system, a highly capable water sector and public awareness of the challenges of drought and the need to carefully manage water. Further detail on water security can be seen in the draft water security statement (https://www.environment.sa.gov.au/topics/water/water-security/water-security-statement).

SA Water is Adelaide's major water retailer and the main supplier of drinking quality water for the vast majority of urban water users. Local councils, SA Water and a small number of private companies also supply non-potable water for irrigation of public space and to approximately 20,000 houses for toilet flushing and gardens. Over the last five years the average annual volume of drinking water used in Adelaide (supplied by SA Water) was approximately 166 GL, with an estimated additional 10 GL of non-potable water used mainly for irrigation of green spaces and some industrial uses.

While Adelaide has a secure water supply, increasing demands, the impacts of climate change on source water availability and the need to continue to provide cost effective water supplies mean that we need to maintain a diversified portfolio of water supply options to meet water security needs. No water supply option on its own is likely to meet all the needs of an urban centre: the reality is that combinations of options need to be considered. With decreased stream flows into rivers and dams, our reliance on rainfall dependent water supply options is a long term risk to water security. In making decisions about long term infrastructure investments it is critical that we factor in future risks as well as a full assessment of all benefits in making investment decisions.

Drivers for changing water demand

Population growth	• The populations of Adelaide and the state's major centres could increase by 25% by 2050 (moderate growth rates) • Increasing population drives increased water demand
Economic development	• Sustained economic growth requires stable water security to meet additional demands
Climate change	• Water demand is tied to heat and dryness of summers • As the climate dries and heats the irrigation season will be extended and the water volumes needed to sustain trees, gardens and parks will increase
Urban greening	• Additional water will be needed to sustain increased greening in public open spaces and private gardens
Urban heat mitigation	• South Australia has already experienced average and extreme temperature increases and this is projected to increase • There are many ways water can be used to cool urban environments

Water security in regional urban centres

Water security in regional areas is critical to support existing water demands and provide water for growth and employment. Each region has its own water security challenges, influenced by the availability of local water resources and water demands. Further information is available in the draft water security statement.

Sourcing and supplying urban water

Maintaining a high level of water security in the future will involve using the most appropriate portfolio of water supply options, protection of all water resources and linking fit-for-purpose water supplies with water demands. Historically urban water needs have been met from natural surface water and groundwater resources. This has depended on significant management and infrastructure investment to capture, treat, store and move water from the resource to the urban areas where it is used.

Further information: *Support Paper 1: Water supply for the future*, Sections 1.4 & 1.5

A range of potential water sources are available across South Australia that can be considered as part of the water supply mix in the future. These include: surface water (rivers and streams), groundwater, seawater desalination, purified recycled water, stormwater, and rainwater collected and stored in localised tanks.

In considering suitable water sources for supply it is also important to consider the supply system that will distribute that water. Currently there are separate systems in place for the distribution of potable and non-potable water supplies. There are additional infrastructure networks for stormwater drainage and sewage.

While Adelaide's drinking water supply is networked and managed by a single entity, the different non-potable water supply networks have been developed and are managed separately. In Adelaide there are 15 independent networks, operated by 12 entities, with each one developed independently to service local needs. Although small disconnected systems can be an advantage because of their inherent flexibility and ability to service the needs of specific consumers, there are also a number of potential drawbacks.

Compared with larger centralised water networks servicing and recovering costs from a large customer base, small local water suppliers can face additional challenges, such as the necessity for them to recover costs from small customer base, managing risks associated with the potential loss of one or several major water consumers (such as a large business), and the possibility and complexity involved if a backup water supply is needed in the event that a local water resource becomes unavailable.

Did you know – groundwater supplied Adelaide's water in the past

During the severe 1914-15 drought wells were drilled in Adelaide to supply industry, public utilities, institutions and recreational groups with water - in response to a Government proposal to "cut off supplies to large consumers of water unless rain fell to replenish the reservoirs".

Wartime industrial expansion in the 1940s resulted in a rapid increase in population and rising water demand. Despite Mt Bold Reservoir being completed in the 1930s, drought conditions necessitated the imposition of severe water restrictions in late 1940s and early 1950s and groundwater supplies were again used.

The 1967-68 drought was the last time that groundwater was used for reticulated supply in Adelaide. A network of about 40 wells supplied 10 000 ML during that period.

While investment and operational decisions related to these systems are made independently, in recent years the operators have come together to consider how linking nearby schemes and collaborating on management can improve reliability and efficiency and reduce operational costs.

Managing demands

Providing future water security is about having a diverse range of affordable water supplies and minimising water demand through smart water management. This includes the use of water efficient technologies, promoting water wise behaviours and using smart water sensitive urban design to provide passive irrigation and an alternative source of water.

Further information: *Support Paper 1: Water supply for the future*, Section 1.3

Providing future water security – making decisions with all options on the table

As changing climate and increasing demand continues to put pressure on water resources and the ecosystems they support, it will become increasingly important for South Australia to plan for long-term urban water security. Future water supply augmentation decisions will need to drive the development of the most appropriate portfolio of water supply options to meet the water security needs of each city or town in the face of climate change and drought. These decisions will need to be made in consideration of all parts of the urban water system. Solutions for water security will have to balance additional supply with demand management options, as well as consider all potential water supply options, including those that may deliver additional benefits through their use. In the past water supply, sewage services and stormwater investments were made separately, but it is now considered that a broad range of liveability and water cycle management benefits can be achieved through integrated decision making and investment.

Further information: *Support Paper 1: Water supply for the future*, Section 1.5

No water supply option on its own is likely to meet all the needs of a city or regional town and combinations of options will need to be considered. Our water supplies of the future will need to be diverse, flexible and resilient to enable us to quickly respond and adapt to future changes and as new information becomes available. The table below provides a summary of supply costs, environmental impacts and social impacts associated with a range of urban water supply options. This information is adapted from *All options on the table: urban water supply options for Australia, WSAA 2020,* which collated the latest available data from existing and newly planned projects across Australia estimating national median levelised costs for each water supply option. This information provides a basis to start comparing all potential future water

supply options and identifying those that could provide affordable water supplies with multiple social and environmental benefits in the future. In making future water infrastructure investment decisions it is critical that we start to look at the full suite of costs and benefits.

Possible future water supply options and their estimated costs and benefits *(adapted from Water Services Association Australia)*					
Management action	**Cost $/KL 2019-20**	**Reliability added to water supply**	**Environmental impact**	**Social impact**	**Notes**
Water use efficiency measures	0.41	Water efficiency measures that reduce demand can maintain water supplies and delay or defer the need for investment in new water supplies.	Efficient water use can reduce environmental impacts – e.g. reduced energy use.	Can provide a social benefit through reduced water bills as a result of reduced water use.	Cost effective for achieving small water savings. Projects include water efficient appliances and demand management programs.
Surface water (rivers)	1.08	Important part of existing water supply portfolio, however likely to be a high risk investment in the future as it is rainfall reliant and less resilient to climate change than other options.	Dams impact on the environment through inundation of surrounding land and changed flows to downstream river ecosystems.	Potential impact on Aboriginal cultural heritage by inundating important sites and impacting access to ancestral lands.	Relatively large upfront cost due to scale of infrastructure required, but ongoing costs to operate a dam are relatively low if the dam is located near the community receiving the supply.
Groundwater	1.20	Can offer a reliable supply even in times of drought. Resilience to drought is dependent on the type of aquifer and how long it takes to refill from rainfall (recharge).	Low impact if extraction is within sustainable limits. Can be at risk of over-extraction and salt water intrusion. Over use may not be detected for several decades because of slow renewal and movement of the resource.		Costs can vary significantly dependent on the infrastructure required, including if desalination is needed.
Water sharing between regions (e.g. River Murray supply in Adelaide)	1.33	Generally pipeline interconnectors increase the reliability of a community's water supply- but this can be dependent on the rainfall distribution across the regions.	There can be environmental impacts from construction of pipelines including impacts on flora and fauna, waterways and land. Energy demands are variable dependent on pumping requirements.	Sharing water between regions can maintain the economic and social outcomes in those regions, and particularly in the region receiving water. However community views on sharing water between regions are not always positive and should be considered in options analysis.	Costs to construct can be moderately high depending on the distances involved between regions, length of pipework, terrain, the method of construction and the associated storage requirements.
Purified recycled water for drinking	2.34	Generally a relatively reliable water supply option which provides diversification to the water supply portfolio increasing water security.	Reduces nutrient and other pollutants that would otherwise be discharged to waterways and the sea.	There could be competition for water supplies with other types of water users (e.g. irrigation use of recycled water).	Community support can be a particular challenge for purified recycled water, more because of the "yuck" factor than any technical aspects. Community education and engagement has evolved in recent years, and public acceptance is improving in many parts of the world.

Possible future water supply options and their estimated costs and benefits *(adapted from Water Services Association Australia)*					
Management action	**Cost $/KL 2019-20**	**Reliability added to water supply**	**Environmental impact**	**Social impact**	**Notes**
Seawater desalination	2.74	Provides a rainfall independent source of water and is an effective way to secure supply.	High energy use, which can be lowered with renewable energy. Can be impacts from hypersaline brine discharge to receiving environments if not managed.	Higher cost than other sources.	High upfront costs related to membrane treatment and energy infrastructure. Ongoing operational costs are also relatively high due to high energy use.
Rainwater tanks	10.17	Highly rainfall dependent. Supply is often at a different time of year than demand and there is relatively limited opportunity for large storages in urban areas.	Low impact of rainwater capture	High upfront costs to install a rainwater tank can reduce accessibility to low income households. Rainwater tanks provide an opportunity to reduce water bills, and allow customers to use water during drought and restrictions which can help maintain green areas and achieve liveability benefits.	Reliability and cost/benefit will both increase with use of larger tanks.
Stormwater supplied for non-drinking use	3.29 precinct 9.24 site-scale	Highly rainfall dependent and can be out of sync with seasonal demands, dependent on the storage system	Reduces nutrient and sediment discharge to the receiving environment.	Can provide multiple benefits to communities, including improved public amenity and health benefits associated with green and blue spaces. Can be relatively high cost but may be able to achieve economies of scale with decentralised stormwater harvesting	WSAA did not include managed aquifer recharge (MAR) in the supply of stormwater. In SA MAR is a key part of stormwater use that would increase infrastructure costs, but also improve reliability as it provides effective water storage across seasons and years to better balance supply and demand.
Recycled water for non-drinking use (including sewer mining)	4.35	Relatively reliable water supply option and provides increased water security. Can reduce peak and overall demand in an urban water system, potentially delaying or deferring higher capital cost water supply investments.	Reduces nutrient discharge to the receiving environment.	Provides an opportunity to deliver water enabled green and blue spaces for liveability outcomes even in times of drought. Opportunities to increase agricultural production and to create local food bowl regions with a secure water supply.	Relatively high cost as a water supply option, but when other benefits are considered can be a viable option in a water supply portfolio
Water carting	20.22	Generally a last resort option – relatively small volumes are transported as a short term supply option	High energy use. Renewable energy can offset the impact.		Can in some instances be the most cost effective option for small, generally more remote communities where the development of an alternative source has a high unit cost.

Drainage and flood management – Managing rain for the next century

Historically, rain and runoff in urban areas has been managed to limit the inconvenience of water ponding on roads and property, and to minimise the likelihood of land and buildings being frequently flooded. As urban centres expanded there was a need to manage the increasing amounts of runoff from hard surfaces such as roads and houses, and protect new development from flooding. Networks of stormwater pipes and drains were constructed to carry water to receiving creeks, rivers and the ocean, and many sections of natural watercourses were straightened, diverted into large pipes or reshaped and lined with concrete. Our urban centres now feature extensive drainage and flood management infrastructure including pits, pipes, drains, levee banks and detention basins. Kerbed roads and in some places open spaces are also designed to safely carry the runoff from 'major' rain events.

Since the mid-1950s our 'minor-major' approach to urban drainage has prevented our urban centres from experiencing frequent major floods; it is also the reason why urban assets such as roads are able to operate effectively for the vast majority of times that it rains. The cost to provide and maintain the infrastructure that provides us with this protection is considerable; between 2014-15 and 2018-19 metropolitan councils collectively spent an average of more than $100 million per year. The replacement cost of flood mitigation and drainage infrastructure across metropolitan Adelaide is more than $4.2 billion ($2018).

Current and emerging challenges

There are a number of significant current and emerging challenges and opportunities that collectively warrant a constructive review of our existing arrangements for managing rain and runoff. Flooding will remain an ever-present threat in many urban areas. The cost to upgrade flood protection and drainage infrastructure in existing extensively built-up and flood-prone areas can be considerable, and in some densely populated areas there may already be too much other infrastructure to fit larger stormwater drains. It is therefore important to consider how we can best keep the costs of stormwater management as low as possible while providing our communities with the appropriate level of flood resilience in a socially responsible

Emerging risks for stormwater

Aging infrastructure	• Most drainage infrastructure was built decades ago • Some will require replacement soon
Climate change	• Projections include increased storm severity and continued sea level rise • When other natural disasters (also from climate change) occur at the same time or closely with urban flooding it can place additional pressure on human and financial resources to respond
Urban development	• The 30 Year Plan for Greater Adelaide encourages infill development to prevent urban sprawl into prime agricultural land • Infill development places greater demands on stormwater infrastructure with more runoff occurring from increased hard surfaces
Changing urban lifestyles	• In many areas, gardens are being reduced in size and replaced with hard surfaces (paving, sheds, carports) – more hard surfaces means more stormwater runoff
Demographic changes	• More people living in towns and cities means potentially more people exposed to flood risk
Under appreciation of urban flood risk	• Urban communities may be unaware that they live and work in flood prone areas • Many of those who have never experienced a flood may believe they face no flood risk and are ill prepared to protect themselves and their property from flood
Emerging maintenance issues	• Drainage infrastructure requires maintenance to work efficiently • Increased focus on urban greening and water sensitive infrastructure may increase the cost of maintenance – e.g. regular clean out of raingardens to allow them to function

manner. We are also facing additional emerging risks that will result in increased vulnerability to flooding and higher flood damage costs over the coming decades if not adequately managed.

Urban watercourses

Watercourses in urban areas include natural features and those constructed as part of a drainage system. Many serve multiple functions, including: drainage and flood management; opportunities for recreation and social and cultural connections; and support for aquatic ecosystems.

The diversity of functions associated with urban watercourses presents a challenge when trying to deal with the complexity of issues that arise and the diversity of stakeholders with a broad range of interests and perspectives. Further complexity occurs where significant portions of the watercourse are contained within privately owned land – this is particularly the case when that watercourse forms an important part of a regional drainage system. Private ownership can lead to substantial difficulties in access by public authorities who may have responsibilities associated with the drainage function of the watercourse and adds to the confusion regarding roles and responsibilities for watercourse and drainage management. In some jurisdictions (e.g. Victoria) water utilities have responsibility for regional drainage systems and are empowered by legislation to undertake that function. An option that South Australia could consider is the inclusion of drainage functions within the scope of the *Water Industry Act 2012* which could provide benefits such as clarity for a licenced water industry entity to access private land to carry out works on their infrastructure (which could include a watercourse where it is part of a drainage network).

Flooding

Floods are a natural occurrence when water covers land that is normally dry. Flooding is the most costly natural disaster in South Australia, with the annually averaged cost of flooding between 1967 and 2013 about $48 million. In addition to the financial costs, flooding also causes significant inconvenience, discomfort and distress.

Further information: *Support Paper 2: Drainage and flood management* Section 2.3

It is not practical to prevent all floods occurring in our urban areas that were often unknowingly built on flood prone land. It is therefore important that communities living within a floodplain have access to information that allows them to minimise the consequence of floods. Both within the state and nationally, there is an acknowledgment that information about flood risk should be readily available. Publically accessible flood maps for some areas of the state are available from https://www.waterconnect.sa.gov.au/Hazard-Management/Flood-Awareness/SitePages/Home.aspx.

While flood maps are widely viewed as critical information for the community, they do have limitations including: the use of different approaches and models which potentially makes comparisons between different projects impossible; and the maps may become less accurate and relevant over time as catchment land uses change. Although many flood maps have been made available, some stakeholders have concerns about sharing this information, because of the limitations outlined above and a fear of liability if information provided in good faith is deficient or misinterpreted.

Flood warning can be an effective non-structural flood mitigation strategy if it is timely and targeted. A flood warning system is made up of a number of elements which need to be integrated for the system to operate effectively. These include monitoring of rainfall and river flows, modelling to predict likely flooding, and communications and warning messages. The responsibilities for all elements of the flood warning network and the various roles of the Commonwealth, state and local governments have never been fully defined, which leads to challenges in ensuring that all components of the system are adequately resourced.

Coastal impacts

Studies have indicated that both stormwater and wastewater discharges have negatively impacted on seagrasses off the coast of Adelaide. For stormwater the major pollutants of concern were considered to be suspended solids and coloured dissolved organic matter. More recent studies have also identified that fine suspended solids from urban water courses and stormwater drains are also of concern. Further information is required to understand the major sources of fine sediment and the mechanisms by which they enter the stormwater system and discharge to the coast, in order to enable effective targeting of action to address the issue.

Further information: *Support Paper 2: Drainage and flood management* Section 2.3

Multi-objective stormwater management

Over the last few decades, stormwater management objectives have evolved to keep up with changing community attitudes. In place of heavy drainage-focused outcomes in vogue during the 19th and most of the 20th century, multi-objective stormwater management has become more popular with the aim to mitigate flood risks and the impacts of stormwater on the environment and to realise opportunities to harvest runoff for beneficial uses. A wide range of stakeholders agree that collaboration between organisations and appropriate policy settings are needed to address urban flood challenges and achieve multiple outcomes.

Key to the successful delivery of multi-objective stormwater management is clarifying the roles and responsibilities of those involved in stormwater management, where significant ambiguities exist. Along with this is the need to consider diverse funding opportunities that can deliver multi-objective stormwater management outcomes in an economically efficient manner, alongside the traditional stormwater funding sources provided by fiscally constrained local councils and state government grants.

The River Torrens (Karrawirra Parri) – An example of multi objective stormwater management

Since the 1970s the River Torrens has been re-visioned to deliver a high level of flood protection to urban areas close to the river and to also facilitate a wide range of multi-objective benefits for Adelaide and the wider South Australian community. This process integrated complementary activities such as upgrades to the Kangaroo Creek Dam to offer better downstream flood protection, and the protection of land close to the river system from inappropriate development. Additional measures have since been added, including native fish ladders to help fish movement in the lower Torrens, and riparian upgrades to support a richer biodiversity and improved amenity.

This is continuing with the Breakout Creek Stage 3 redevelopment project set to transform a remaining section of a fenced-off channel dug in the 1930s into an attractive, highly biodiverse area that will also open up more opportunities for community use and for enhancing water quality, while maintaining its flood convevance to the sea.

Multi-objective management examples available at different scales		
Scale	**Issue**	**Examples**
On-site (lot)	Flood Hazard	On-site retention and detention tanks (small lots), pervious surfaces
	Stormwater quality	Well vegetated pervious surfaces
	Stormwater resource use	Rainwater tanks, pervious surfaces
Local (street or neighbourhood)	Flood Hazard	Detention basins
	Stormwater quality	Street sweeping, raingardens, gross pollutant traps
	Stormwater resource use	Street-kerb stormwater inlets, pervious paving in footpaths and car parking areas
Regional	Flood Hazard	Detention dams, detention basins, open space corridors
	Stormwater quality	Constructed wetlands, sedimentation ponds, erosion management
	Stormwater resource use	Large scale stormwater harvesting and use (e.g. through 'managed aquifer recharge')

Water sensitive design at the lot and street level

Further information: *Support Paper 2: Drainage and flood management* Section 2.3

Over several decades the incorporation of small scale infrastructure to make use of stormwater at the allotment or local level has become increasingly popular. This type of activity has the benefit of potentially reducing stormwater impacts on existing infrastructure and the environment, while providing an additional source of water. To increase the uptake of lot scale stormwater management, the new Planning and Design Code has included stormwater related 'Performance Outcomes' and deemed-to-satisfy provisions that should encourage minimum site perviousness and on-site rainwater tanks in residential settings to capture roof runoff for use and to temporarily detain part of runoff (reducing peak flows into the stormwater system). At the street level, passive watering of urban trees can also have benefits for the stormwater network, receiving environments, and the local environment where the additional water can help to support growth and urban greening (for example, through kerb side inlets, the increased use of pervious paving and footpaths, and the use of street raingardens).

Institutional arrangements

Legislation

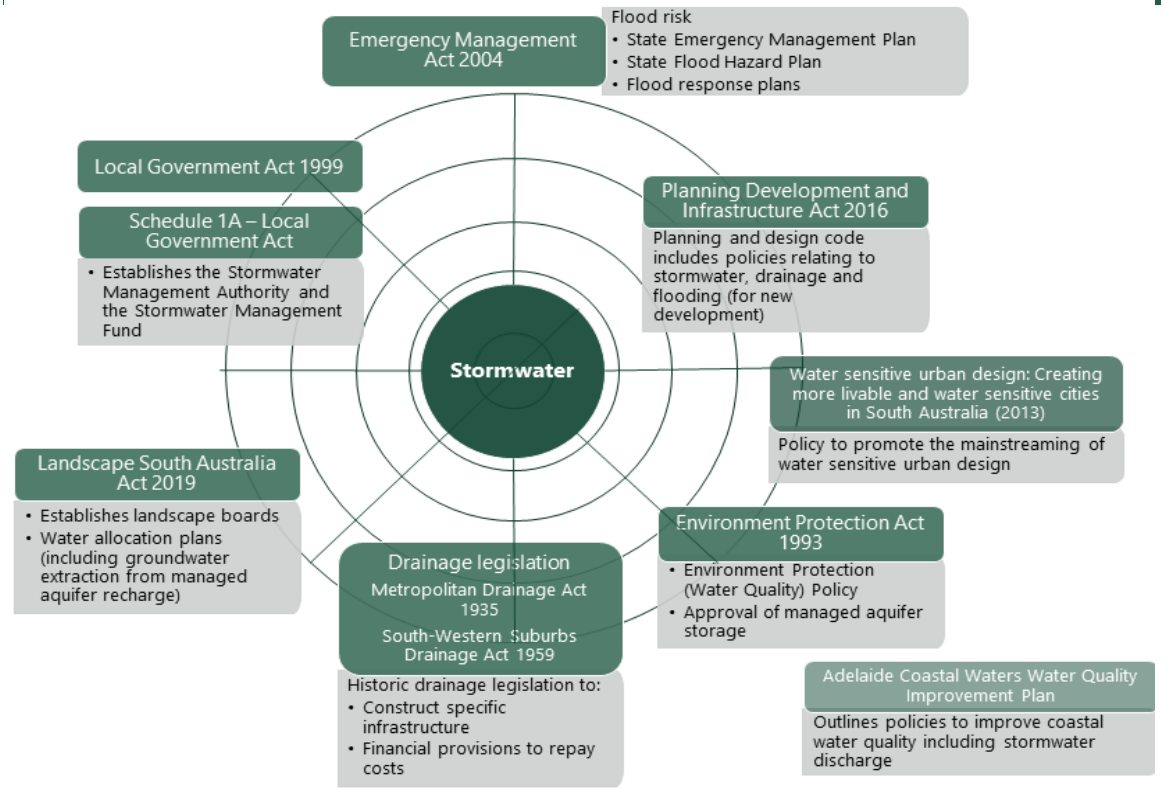
South Australian legislation provides the overarching framework which governs how rain and runoff is managed to provide community flood resilience and other outcomes.

A notable feature of our current legislative inheritance is that there is no deliberately-designed legislation which delivers a multi-objective stormwater and urban watercourse management approach addressing all aspects of responsibilities for flood mitigation, preparedness, response and recovery; receiving water quality and environmental protection; and stormwater use.

One outcome of the layered legislative framework governing stormwater and urban watercourse management has been the proliferation of organisations with interests in various aspects of stormwater management. This includes: local and trunk flood and drainage infrastructure servicing; natural resources management; environmental protection; public health; stormwater management planning; flood monitoring and flood warning service provisioning; flood response as part of emergency services provisioning; land use planning in relation to mitigating the impact of floods and minimising the detrimental impacts of excessive stormwater runoff and stormwater quality; and flood recovery as part of national and state disaster response arrangements.

Although the state and Local Government Association have recognised stormwater as a shared responsibility, there is little explicit discernment of what that involves (although the State-Local Government Stormwater Management Agreement, which is not a legally binding agreement, outlines some expectations of each party).

Complexity of stormwater legislation



While a long term state funding commitment exists, and local government commit significant funds to stormwater management, the amount available will not be sufficient to ensure an adequate level of flood protection through traditional infrastructure and also achieve other outcomes should historical precedents in South Australia be followed – for example, where past state governments have contributed 50% of the funding for flood protection infrastructure pursuant to various 'drainage Acts', or provided up to a 50% subsidy to local councils for constructing drainage infrastructure (mainly associated with catchments greater 40 hectares in size).

Roles and responsibilities

The Productivity Commission's research paper, *Integrated Urban Water Management – Why is a good idea so hard to implement* observes that "funding issues that relate to integrated urban water management (IUWM) projects are often symptomatic of other factors, such as lack of clarity about roles and responsibilities". The implication of this for stormwater management is that considerations for resolving funding issues should go hand in hand with clarifying the respective roles and responsibilities of the various stakeholders.

Further information: *Support Paper 2: Drainage and flood management*

Approaches for managing drainage-related infrastructure differ markedly across jurisdictions within Australia and internationally. However, in some management models it is possible to broadly regard the stormwater drainage system as comprising three different elements: private local, public local and regional stormwater systems.

Considering these three elements of traditional drainage systems separately has enabled some Australian jurisdictions to articulate where the primary responsibility sits for each element of their system and this has given rise to appropriate legislative frameworks, governance arrangements and funding mechanisms for each element. For example, in Melbourne, local government is responsible for the local or minor stormwater system while Melbourne Water (a water utility) is responsible for the regional (major) stormwater system.

Water for life – Water to support healthy and enjoyable urban living

The future prosperity and liveability of South Australia will depend on how effectively we build our towns and cities to address and respond to the hot and dry climate that is projected to become more extreme in the future. Appropriate development can create climate resilient urban areas that mitigate heat effects and support the vegetation that makes our urban centres more liveable. Water management is critical to establish and maintain climate resilient towns and cities.

Managing urban heat

Further information: *Support Paper 3: Water for life Section 3.3*

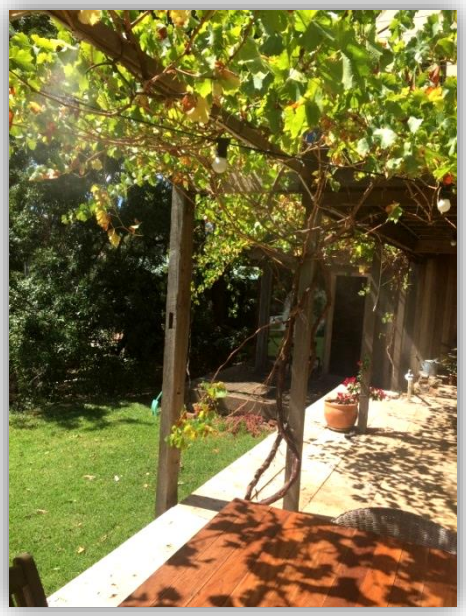
As the climate changes, urban heat will have a significant impact on the future liveability of South Australia's urban centres with longer and more extreme hot and dry periods. Extreme heat creates major challenges for urban living and increases water demands, especially to establish and sustain the green and blue spaces that are so important in adapting to our changing climate.

Our responses to high urban temperatures need to include both adaptation and mitigation actions. Adaptation aims to reduce the impact of high temperatures on residents through applications such as building insulation and air-conditioning, while mitigation reduces the air temperature through actions such as planting trees, retaining water in the landscape and using heat-reflective materials. Heat mitigation will enhance human comfort and lead to lower costs of living as cooling energy demands are reduced.

There are many urban cooling methods that can be applied to mitigate heat in urban environments. The Guide to Urban Cooling Strategies summarises potential approaches and provides practical guidance for moderating urban microclimates and mitigating urban heat island effects in major urban centres across Australia. Water is a key component for many of these approaches.

They include for example:

- **Shading with vegetation** including tree canopies and climbers. Irrigation enhances vegetation condition and performance for optimum cooling by increasing transpiration and denser canopy cover. Passive irrigation can reduce water demand**.**
- **Evaporative cooling** is a highly effective cooling strategy in drier climates like South Australia. Water is evaporated from the soil and air. Water can be added to the soil through irrigation and to the air with sprinklers, misters, fountains and other spray systems.
- **Evapotranspiration** by vegetation is a natural cooling system if adequate water is available either from irrigation or natural groundwater. This can be used to cool many settings including parks, gardens, pathways and carparks.
- **Water cooled pavements,** such as permeable concrete, asphalt and block pavements, prevents the surface from heating and drives evaporative cooling when moisture is available within the pavement material. In South Australia this will require water to be added as there is not adequate summer rainfall. This would be effective for cooling high traffic areas such as hard stand festival areas, high traffic pedestrian streets, malls and arcades.
- **Surface water** on exposed surfaces, water features or contained water bodies can cool the surrounding environment. This includes water play features such as spray parks or splash pads, which are becoming common in Adelaide and regional centres, such as the redeveloped Renmark waterfront.



Urban greening water demands

South Australia's low rainfall and hot and dry summers mean that water availability is potentially a limiting factor for successful urban greening. Additional water will be needed to support the increased levels of greening that are currently being established and promoted. Many trees planted today may not survive without irrigation as the climate warms and dries and certainly will not have sufficient water to transpire at rates that contribute to a cooling effect on hot days.

Estimating irrigation water needs for a city is difficult because of the complexity of the urban environment, with a variety of urban forms, vegetation and soil types. In estimating irrigation water requirements, it is important to consider the total and seasonal irrigation requirements. It is also important for planning purposes to know the short term daily demands that might be required on extreme heat days to keep vegetation alive. Irrigation demands can be also be reduced by capturing and retaining rainwater runoff in the landscape and using it to increase soil moisture levels for vegetation through passive irrigation.

A preliminary estimate suggests that, if Adelaide is to achieve the tree canopy cover target in the 30-Year Plan for Greater Adelaide, then about 10% to 30% of additional water will be required. This amount does not include any additional water that may also be required to sustain other vegetation, such as grasses and other plantings in open spaces, as the climate heats and dries into the future.

Water for nature in towns and cities

Further information: *Support Paper 3: Water for life Section 3.4*

Water supports nature in our urban and peri-urban environments. It is important to consider how our urban water service delivery can also enhance and protect the natural environments in our urban areas and the nearby natural and primary production. This could include enhancement and protection of watercourse and coastal biodiversity, runoff and pollution controls and legislation aimed at reducing litter and plastics entering our environment where it can impact on marine and other life.

How should we supply and fund water for greening and cooling?

Further information: *Support Paper 3: Water for life Section 3.5*

For additional water to be available to support liveability, other water uses will need to continue to be efficient and new supplies will be needed. This will lead to more complex water supply and demand management in our urban centres, with water efficient practices maintained for some activities (e.g. in-home use, industrial uses), while water used for greening and cooling increases. This is at odds with the communication messaging following the Millennium Drought, where low water use gardens were encouraged. Communications campaigns will be needed to change community views about the use of water for greening and cooling, alongside changes to infrastructure and policy to support increased fit for purpose water use.

There is currently an increasing desire to invest in urban greening for the range of benefits that it provides. However, the additional water needs of this increased green cover are not always being fully considered as part of the planning for green spaces or factored into the long term maintenance costs. Water is an essential part of successfully creating liveable urban environments and viable urban green and blue spaces. The full development of green and blue spaces across urban areas will require additional water use, which will come at an additional cost.

The use of a diverse range of water sources to support greening and cooling as well as the broad range of benefits that can be attributed to that water use warrant further consideration of how water used for cooling and greening should be priced and who should pay for that water use. This is particularly important when considering that the greatest benefits of additional greening and cooling may be attributed to the lower socio-economic parts of our urban areas, who can least afford to pay for the additional water use. Where the water used to support these initiatives is recycled water or stormwater, there are also potentially additional environmental benefits from reduced wastewater or stormwater flows to the environment. This also needs to be factored into determining who pays for the benefits of water use.

It is therefore timely for water supply funding and pricing approaches to be reviewed in consideration of the full suite of economic benefits that increased water supply for urban greening and cooling can make to community health and well-being, as well as potential benefits that may be achieved through the use of treated stormwater and wastewater through decreased discharges. Such a reconsideration should also have regard to the cost to society of not adequately providing water for cooling and greening in South Australian cities and towns (as the climate heats and dries) and the costs of not adequately managing drainage systems.

Next steps – have your say

Since the Millennium Drought, and following the high-level directions set in Water for Good (2009), there has been minimal over-arching strategic leadership in urban water management. While there is no immediate water security threat in the state's major urban areas, if a new strategic direction is not set there is the potential for inefficient or sub-optimal investment decisions in the medium-term that could also undermine the state's water management credentials in external markets.

State agencies, water utilities, local government, industry and others are all seeking greater clarity around the future direction for integrated urban water management to guide decisions and ensure prudent and efficient investment in new infrastructure.

In its 20 year State Infrastructure Strategy, Infrastructure SA has specifically called for an urban water direction statement for Adelaide and South Australian towns that optimises the use of all water sources to support growth and greening in a changing climate. The need for this has also been reflected in the recently released Climate Change Action Plan.

Setting a clear policy direction for integrated urban water management will also be a key foundation to inform SA Water regulatory business proposals and provide state government policy guidance to the regulatory determination process (RD24). This will complement and reinforce the directions outlined in SA Water's 2020-25 Strategy.

An enabling policy framework that supports consideration of all water supply augmentation options ("all options on the table") will signal to regulatory bodies the need for all potential water supply options to be considered in water utility planning. It will also ensure that the external costs and benefits identified through integrated urban water management (e.g. environmental benefits, improved urban amenity, and reduced flooding potential) can be appropriately factored into investment and pricing decisions.

An Urban Water Directions Statement will be developed by the end of 2021.

We encourage you to provide feedback on this discussion paper (and supporting papers) and the questions below to feed into the development of the statement.

South Australia requires a strategic, collaborative, and transparent approach to planning for the management of urban water that can address the complexity of issues faced by the sector. It is intended that the Urban Water Directions Statement will provide the policy framework for implementing urban water management in South Australia.

Please provide your feedback on the discussion questions below. Further information to provide background to these questions can be found in this discussion paper and the three supporting papers. We encourage you to read the detail in the supporting papers in responding to these questions.

Submissions due: 1 October 2021

Please send your submission to: DEWWater@sa.gov.au

Questions for feedback

Water supply for the future – all options on the table

1. What key factors should we consider in developing a decision making framework for water supply augmentation that considers all options for providing water security (all options on the table)?
2. Do you have ideas around criteria that could be used to weigh all relative costs and benefits of potential water supply options (all options on the table), including those that can be delivered from an integrated urban water management approach?
3. What community education and capacity building might be required to create a water literate and water wise community that will support investment in all potential water supply augmentation options, demand management strategies and integrated urban water management projects and initiatives?

Drainage and flood management – managing rain for the next century

4. What do you consider to be the primary challenges in managing urban watercourses in South Australia so that they can provide effective drainage of stormwater flows and flood protection? Do you have ideas to address those challenges?
5. What policy and funding approaches could be considered to support multi-objective stormwater management outcomes being delivered at private, local or regional scales?
6. How can we ensure that we have the best possible approach to managing flood risk, including sharing and disseminating available flood mapping data, management of the state's flood warning infrastructure and raising the level of people's awareness and understanding of their flood risk?

Water for life – Water to support healthy and enjoyable urban living

7. How should we meet increased water demands for urban greening and cooling?
8. How should we promote and communicate the complex messages around maintaining water wise behaviours while also increasing water use to support greening and cooling?
9. How should water supply for urban greening, water features and water based heat mitigation be funded noting the significant benefits to health, wellbeing and lifestyle in our urban centres?