Water Utility Journal 12: 27-38, 2016.

A whole of water approach for the city of Sydney

P. Mukheibir[1] and L. Currie[2]
[1] *Institute for Sustainable Futures, University of Technology Sydney, Sydney, Australia, e-mail: pierre.mukheibir@uts.edu.au*
[2] *City Sustainability, City of Sydney, Sydney, Australia, e-mail: lcurrie@cityofsydney.nsw.gov.au*

Abstract: Urban water managers and policy makers are struggling with the challenge of transitioning to an approach that considers a whole of urban water approach, where water planning and the urban form are considered in an integrated manner. The recent drive for liveable cities, where water is used to enhance the urban landscape through reuse and stormwater management, has seen a shift in focus. This has brought a number of challenges to bear on institutions charged with water planning and management at strategic, tactical and operational levels. Five central challenges have emerged from the research undertaken by ISF, viz.: a) Legislations and regulations that are prescriptive, overlapping and inconsistent, b) Economic and financial systems that are restrictive and traditional, c) Planning that is uncoordinated and non-collaborative, d) Organisational and professional cultures that are siloed and inflexible, e) Citizens engagement that is uncoordinated, technical and uninspiring. Drawing on the approach adopted by the City of Sydney, the paper will illustrate how a number of these challenges were overcome by local council in their attempt to achieve liveability goals, make the city more resilient to climate change, and reduce pollution levels in the water ways and harbour. The City undertook a consultative process to develop a decentralised water master plan that would both drive and guide future recycling, stormwater management, and pollution control initiatives. Six transferrable lessons and enabling actions were identified that will have relevance to other cities and urban planners aiming to achieve a whole water approach and liveable cities.

Key words: Integrated water management, urban water, One Water, reuse, recycling, liveability, Sydney, Australia

1. INTRODUCTION

Utilities and local government institutions in cities around the world are facing looming capital investments required to refurbish aging infrastructure, upsizing and upgrading existing infrastructure, as well as building new infrastructure to meet growing demands through urbanization and densification. This together with the impending impact of climate change and increased resource insecurity and variability will mean that planners and decision makers will need to adopt a new way of thinking and pooling resources. Customers are also demanding a *liveable cities* approach where water sensitive urban design and sustainable urban water management addresses all the needs of the urban landscape (Brown et al. 2009; Jefferies & Duffy 2011).

A whole of water approach, or *One Water* approach, is a timely and logical response. It regards the urban water cycle as a single integrated system in which all urban water flows are considered as potential resources, providing the potential to enhance the social and environmental landscape (Mukheibir et al. 2015). This approach builds upon the extensive national and global work on Integrated Water Resource Management and Water Sensitive Urban Design, and encourages a shift from merely solving a problem, to one where water services are also viewed as adding value to the urban landscape (*restorative infrastructure)*. Such an approach will bring together all these water streams through workable institutional arrangements and management (see Figure 1).

However, urban water planners and policymakers around the world are wrestling with the challenge of transitioning to a One Water approach (Mukheibir et al. 2014). Foremost of these is the inertia associated with the dominant paradigm of centralized systems and siloed institutions. This dominant paradigm results in the lack of engineering and community understanding of the benefits of integrated systems, such as lower costs, higher resilience to extreme events, more localized availability of water for reuse, etc. A further significant challenge is the complex structure of

regulations that currently exist separately for water supply, wastewater and stormwater management (see Figure 2).

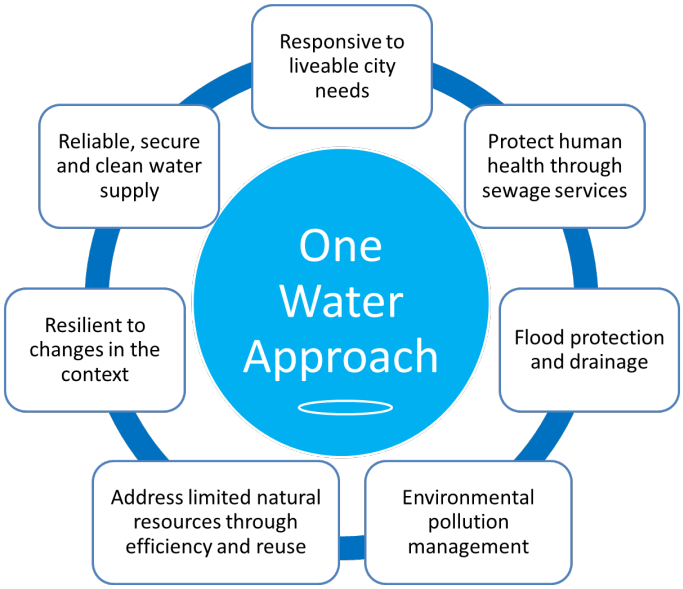

Figure 1. Drivers for One Water.

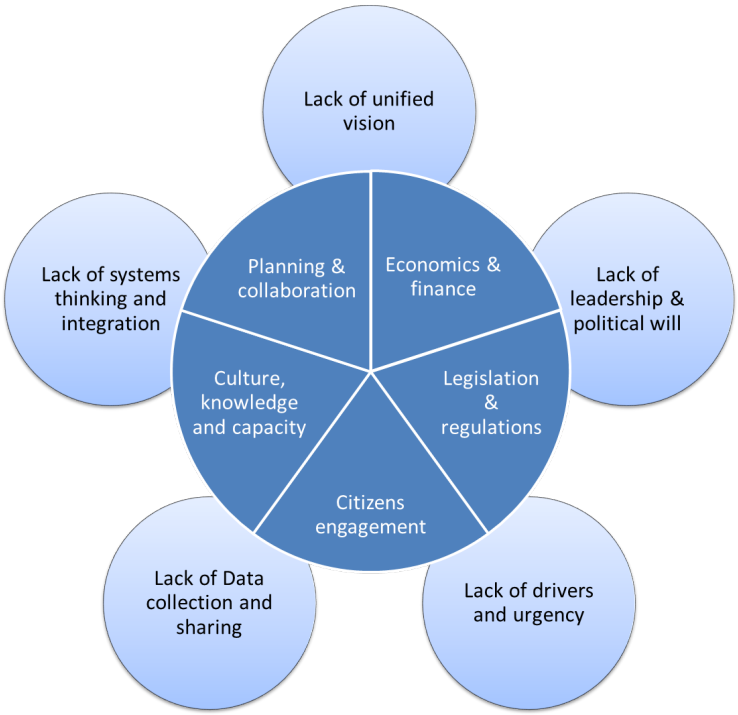

Figure 2. Challenges and underlying causes

Further analysis of the challenges revealed some underlying causes that if better understood could unlock/unblock the path to One Water management:

- the lack of an agreed unifying vision
- a lack of leadership and political will due to short-term political agendas
- no clear drivers or sense of urgency
- poor systems thinking and integration across water, other utilities and urban planning
- Uncoordinated methods and processes for data collection, information sharing and messaging.

These underlying causes could be linked to a number of the challenges discussed above, and are theoretically not too dissimilar to those that hinder other innovative progress at the local government level (Mukheibir et al. 2013) and potentially have influence over a number of challenges across the board for local governments.

The research into overcoming the challenges to One Water (Mukheibir et al. 2014) revealed a number of case examples where the most common cause for poor planning and coordination were cited as poor leadership and vision followed by a lack of integration across departments and between institutions. Various approaches have been deployed to address this issue. The establishment of a state-based institution to drive integrated water and urban planning in Victoria (Australia) firstly required a vision of what cities could look like, and secondly the political leadership to respond to a shift in community values, and to make it happen (LVMAC 2012).

Similarly, on a regional scale, the 3 Rivers Wet Weather non-profit organization in Pennsylvania (USA) was created to support the co-ordination of wet weather solutions across the Allegheny County region (Mukheibir et al. 2015).

To illustrate how some of these challenge have been overcome, the City of Sydney (Australia) is presented in this paper as a case examples (Mukheibir et al. 2015).

2. INSITUTIONAL ARRANGEMENTS FOR WATER MANAGEMENT IN THE SYDNEY REGION

Research has shown that for the One Water concept to be accepted and integrated into infrastructure planning, appropriate institutional structures must be in place (Maheepala et al. 2011) including the decisions made by various institutions that affect the management of water at the different governance scales. State and federal agencies set the policy environment, while local governments and regional agencies are concerned with the regulatory and planning environments.

Water services for the City of Sydney (CoS) are managed by a number of different organizations, which makes planning and co-ordination difficult.

- Sydney Water Corporation (SWC), through a centralized network, provides 34 billion liters of potable water a year to the City of Sydney from dams located more than 70km from the city. This demand is likely to grow by 30% by 2030. Since 2011, mains water is also sourced from a desalination plant located 40km away. Sydney has the oldest and most intricate network infrastructure in Australia, much of which is reaching its design life and operating capacity (CoS 2012a).
- Local governments located in the metropolitan boundary of Sydney do not have the responsibility for water supply planning; this is undertaken by the Metropolitan Water Directorate.
- Wastewater (sewage) is also managed by SWC. The wastewater undergoes primary treatment (the removal of suspended solids) before it is discharged through deep ocean outfalls.
- Stormwater is managed by the CoS, and is collected through a network of drainage pipes which are owned by both SWC (the large trunk mains) and the CoS (the smaller interconnecting pipes) – this requires coordination and collaboration to drive improvements in water quality due to the division in ownership and operation of assets.

In addition, the various services and types of water are regulated by a range of institutions as captured in Table 1. The institutional landscape is constantly changing as new departments and government agencies replace old ones, making it even more difficult to navigate this space when planning decentralized schemes.

Regulators and policy departments have grappled with the complex questions of how to regulate owners and operators of decentralised water schemes. A major challenge has been how to regulate the protection of public health and safety, while balancing multiple objectives such as enhancing competition, meeting water security objectives and protecting the environment. In the state of New South Wales, the Independent Pricing and Regulatory Tribunal (IPART) introduced the Water Industry Competition Act (WICA) in 2006 to address some of these issues (IPART 2008).

Australia's first third-party access and licensing system enables the private sector to enter the industry, providing drinking water, recycled water and wastewater services while ensuring water quality and protecting public health and the environment. The Act is currently under review to address the limitations that have been identified during its implementation (these are discussed in section 5.2.2).

Table 1. Institutional landscape.

Scale	Entities	Roles and Responsibilities
National level	Department of Environment (formerly Department of Sustainability, Environment, Water, Population and Communities)	Designs and implements the Australian Government's policies and programs to protect and conserve the environment, water and heritage.
State level	NSW Office of Water (NOW), located in the Department of Primary Industries (DPI)	Water management, including water policy, water sharing plans, water availability and allocations, monitoring, modelling, environmental flows, ecology and water quality; water licensing.
	Independent Pricing and Regulatory Tribunal (IPART)	Determines prices for water and wastewater services for utilities and "utility-like" service providers.
	Metropolitan Water Directorate (MWD) located within the Department of Primary Industries.	Leads a whole-of-government approach to water planning for greater Sydney; provides policy advice on water industry competition and reform; delivers recycling funding and support.
	New South Wales Health	Protect public health through appropriate water quality standards, drawing on the National Guidelines for Water Quality.
	Office of Environment and Heritage (OEH), located in the NSW Department of Premier and Cabinet	Protection of water resources and river health.
	Environment Protection Authority (EPA)	Responsible for environmental regulation and associated activities throughout NSW.
	Department of Planning and Infrastructure (DoPI)	Implements the efficiency program (BASIX) to reduce domestic water consumption.
City level	Sydney Metropolitan Management Catchment Authority (CMA)	The supply of raw water, the protection and management of the catchments and infrastructure, and regulating activities such as development in the catchment. Specifically improve the water quality of Sydney Harbor and its catchments.
	Sydney Water Corporation	Supplies treated water, wastewater, recycled water and some stormwater services to over 4.6 million people in Sydney, and manages the associated distribution networks. SWC is regulated under the Sydney Water Act.
	City of Sydney	Stormwater planning and management, and associated pollution control. Urban planning and infrastructure design.
Local/precinct level	Private developers/owners	The construction of water efficient buildings and precincts, investing in water recycling infrastructure.
	Private operators	Operating decentralized small scale water recycling systems, and delivering a reliable service to their customers.

The introduction of the Australian Guidelines for Water Recycling (AGWR) in 2006 shifted the focus for recycled water from a prescriptive end product management approach to one that focuses on systems-based risk management (EPHC et al. 2006). The guidelines require proponents to undertake scheme-specific risk analysis, rather than comply with prescriptive standards (as was required in the past). The challenge therefore is to steer a sensible course between the extremes of failing to act when action is required and taking action when none is necessary (NHMRC 2011). A lack of action can compromise public health (NHMRC & NRMMC 2011), whereas excessive caution can have significant social, environmental and economic consequences.

The Building Sustainability Index (BASIX) was introduced in 2004 with the aim of delivering equitable, effective water and greenhouse gas reductions across the state of NSW and is regulated

under the Environmental Planning and Assessment Act (DoPI 2013a). BASIX applies to single and multi-residential dwellings and aims to reduce water and greenhouse gas emissions by up to 40% against the state benchmark, taking into account regional variations such as soil type, climate, rainfall and evaporation rates. The benchmark is equal to 90,340 litres of potable water per person per year (DoPI 2013a). The Department of Planning is in the process of reviewing the regulations that drive water and energy efficiency with a view to achieving further efficiencies (DoPI 2013b). However in other states in Australia, these conditions have been relaxed to make housing more affordable (Mander 2012).

National Australian Built Environment Rating System (NABERS) (OEH 2011) is a voluntary rating system that measures the energy efficiency, water usage, waste management and indoor environment quality of a building or tenancy and its impact on the environment . For over ten years, the NABERS six star rating system has helped property owners, managers, and tenants across Australia to improve their sustainability performance, reap financial benefits, and build their reputation. This rating scheme is one of the key drivers for the private sector to contribute to the success of the Decentralised Water Master Plan.

The Sydney Harbour Catchment and Botany Bay Water Quality Improvement Plans (WQIP) require partnership support from the local councils (of which the CoS is one) and government agencies which manage land draining into Sydney Harbour and Botany Bay. While stormwater quality is not directly regulated, the approach of the City of Sydney is to strive for continuous improvement and control of stormwater runoff into the harbor in order to improve the liveability of the city and its natural environment.

3. KEY DRIVERS TOWARDS ONE WATER IN THE CITY OF SYDNEY

In 2008, the City of Sydney launched *Sustainable Sydney 2030*, the CoS's integrated sustainability strategy, illustrating the Council's commitment to environmental leadership (CoS 2008). The main drivers for the strategy have been cited as "ensuring resilience to climate change (drought) and reducing the pollution levels in the waterways and harbour".

As part of Sustainable Sydney 2030, the Green Infrastructure Plan underpins the strategy and sets clear deliverable targets. One of its cornerstones is the Decentralised Water Master Plan (DWMP), along with three energy master plans (for tri-generation, renewable energy and energy efficiency), and an Advanced Waste Treatment Master Plan. The DWMP sets the path towards a reliable supply and local network of recycled water that can be accessed and used for keeping the City of Sydney green and cool under changing climatic conditions. It also aims to reduce potable water consumption through improved water efficiency and reduce pollutants discharged to local waterways via stormwater run-off. Sydney's climate is characterised by long spells of drought creating uncertainty about water security (CoS 2012a).

More than 50% of the water network infrastructure in the city is older than 70 years and is also reaching its design capacity to meet future growth in population density in the city through infill developments. These sewerage and potable water networks are expensive to upgrade (CoS 2012a). By reducing demand through efficiency measures, and substituting drinking water with recycled water, the operational life in these existing networks may be further extended. Increasing the tree canopy cover in the city to both increase the liveability of the city and reduce the heat island effect was a further indirect driver for stormwater harvesting and recycled water schemes.

In 2007, the Australian federal government set a recycled water target of 30% (of wastewater collected) for the capital cities. While the 2010 status report showed that there had been a significant investment in recycled water schemes across Australia, Sydney recycled only 7% of its wastewater compared to the other the major cities that achieved 20% or greater (GHG 2012).

The stated key objectives of the DWMP are to (CoS 2012a):

- Reduce water consumption across the City of Sydney local government area by 10% by 2030 through water efficiency programs (on 2006 levels), and replace 30% of 2030 potable water supplies through local recycled or alternative non-potable water.

- Reduce water consumption in Council's own buildings by 10% (on 2006 levels) by 2030, through water efficiency programs and the connection of Council facilities to local or precinct-scale recycled or alternative non-potable water supplies.
- Reduce sediments and suspended solids, and nutrients discharged to local waterways from stormwater run-off generated across the City of Sydney local government area by 50% and 15% by 2030 respectively.

4. OUTCOMES TO DATE

The City of Sydney has so far had experience in two major precincts Sydney Park and Green Square which were initially driven by the Sustainability Sydney 2030 vision. Sydney Park hosts the CoS's largest stormwater harvesting system, and will contribute towards the 2030 targets for 30% of water demand to be met through local water capture and reuse and 50% reduction in suspended solids and 15% reduction in nutrients discharged to local waterways via stormwater run-off. Initially, the water will be reused to top up the wetlands and irrigate the park. The subsequent stages of the project will expand the reuse to surrounding commercial, industrial and residential areas. This project is the first of a suite of initiatives being formulated under the DWMP and is being partially funded through the CoS and the Australian Government's Water for the Future initiative.

A major part of the CoS's role in Green Square has been to ensure planning controls allow for appropriate growth and development. The first major infrastructure project in Green Square is a new stormwater drainage system to be built in partnership with Sydney Water. The system will mitigate the risk of flooding (CoS 2014b). The CoS has signed an agreement with a private operator to supply recycled water to future residents in the Green Square Town Centre. The system will utilise the captured stormwater, purify it on site, and then send the water to households for clothes washing and toilet flushing, and to parks for irrigation.

The CoS has to date also implemented water efficiency programs with savings of over 1000MLpa across small to medium enterprises and accommodation businesses since 2009, as well as eleven park-scale stormwater harvesting systems, over 130 rain gardens and 30 gross pollutant traps to improve stormwater quality discharged to local water catchments (Currie 2015).

5. ANALYSIS OF THE CHALLENGES AND RESPONSES IN REALISING THE VISION

5.1 Planning Phase

Two key challenges where faced during this phase:

- Poor political leadership, and
- An absence of a systems approach to urban water planning

5.1.1 Political leadership

The initial challenge facing the CoS was a *lack of direct political leadership* and direction from state and federal governments to actively facilitate city-wide water sensitive urban design (WSUD). Whilst broad targets were set at the national and state scales, specific targets/goals for local governments have never previously been suggested.

At a national level, the Australian Government in 2007 committed itself to a national target of recycling 30% of wastewater by 2015, and provided financial support to achieve that target (Marsden Jacob 2012). On current estimates, national wastewater recycling by 2015 is expected to range from 18.7% to 20.3%. At the state level, the NSW Government prepared a plan during the

previous drought to ensure water security, which included a wastewater reuse target to create potable water savings of 70 GL by 2015 (SWC 2010). This target was viewed by the City of Sydney as not challenging enough for local councils, considering that approximately half of the target is already supplied by Sydney Water, and it was not translated to specific council level.

Further, the recent significant replenishment of major urban dam supplies and the commissioning of the Sydney desalination plant in 2010 removed the political drive at state level to supplement water storages with recycled water, and resulted in the deferment of any recycling strategies and initiatives by the NSW state government.

The visions for water planning at all spheres of government have generally been short term, dictated by the short political election cycles and the prevailing environmental conditions of the day. During the drought in the mid 2000's, the focus of the 2006 Metropolitan Water Plan was on large-scale water recycling projects, which took advantage of the major opportunities for financially viable large schemes in the short term. Large scale recycling opportunities are now most viable when supplying large new growth areas in outskirts of Sydney. The more recent focus of the 2010 Metropolitan Water Plan was on smaller local-scale projects. These include stormwater projects carried out by councils to irrigate parks and sports fields to the benefit of the community (MWD 2010). However, given the availability of desalinated water, the drivers for recycled water are not as strong in the short term from a State planning perspective.

In response, the DWMP has been championed at a senior level within the City of Sydney Council, most notably by the Lord Mayor and the CEO for the CoS. The Lord Mayor has twice been re-elected on a platform of environmental leadership, thereby confirming her mandate to pursue the strategy. In addition, the Council undertook an engagement process to test its Sustainable Sydney 2030 vision and it's DWMP with its customers. The key drivers for this Plan were discussed in section 3 of this paper.

This approach has been demonstrated in other leading cities. The Victorian State Government (Australia) appointed the Living Victoria Ministerial Advisory Council to provide independent advice on the changes needed to achieve the government's vision for Melbourne's water system as a smart and resilient water system for a livable, sustainable and productive city (LVMAC 2012). The vision was developed in response to the shift in community values as they pertained to water and the urban environment.

The City of Los Angeles (USA) too recognized the need to create a common vision for water management across water, energy and sanitation institutions (Mukheibir et al. 2015). A city wide vision allowed them to develop and implement a plan that integrates water supply, water conservation, water recycling, run-off management and wastewater facilities planning using a regional watershed approach.

5.1.2 A systems approach to urban water planning

Due to the large number of players and the disaggregated nature of the sector (as illustrated in Table 1), a lack of a systems approach to urban planning has led to opportunities for integrating services in a planned way being missed, or implemented in an uncoordinated manner. An Australian review of institutional impediments to water conservation and reuse found the overarching barrier to be a lack of coordination of policies and regulations that govern conservation and reuse (Hatton MacDonald & Dyack 2004). Implementing a recycling scheme requires navigating a complex and time-consuming regulatory landscape. The complexity relates to two interrelated issues (ISF 2013):

1. The rules and regulations themselves shift as government seeks to improve and clarify current arrangements in this relatively new area of governance.
2. Changes in personnel results in the interpretation of requirements to be contested and changeable.

With the ongoing densification of the city, infill projects are ideal for implementing new ideas; however, the absence of an integrated and holistic water management plan has meant that some of

these potentially viable opportunities have not been taken advantage of. To overcome this, the Council employed consultants to engage with the relevant state departments, utilities and community stakeholders to develop the Decentralized Water Master Plan (DWMP) – a key component of the Green Infrastructure Plan.

Initially it was difficult to establish a representative Reference Group for the DWMP, since decentralized water schemes were not high on the agenda of most state departments and agencies. A 12-month consultation process was required to bring all the relevant stakeholders together and form a common partnership around the strategy. The stakeholders included Sydney Water, the Independent Pricing and Regulatory Tribunal, Metropolitan Water Directorate, NSW Office of Water, NSW Office of Environment and Heritage, NSW Department of Planning and Infrastructure, and neighbouring councils. The plan was finally approved by Council in February 2013 (CoS 2013).

Collaboration across scales of government is often difficult and requires trust to be built up between the institutions and their staff. As illustrated by developments in Pinellas County (USA), the scarcity of water resources acted as a catalyst for all of its member governments to enter into a Regional System Water Supply Contract. They adopted several laws and regulations to ensure equal water distribution to all beneficiaries (Mukheibir et al. 2015).

5.2 Implementation Phase

More recently challenges facing the CoS in implementing the Plan relate to three key aspects:

- The *financial viability* of alternative water schemes - financing and pricing models and the actual funding for projects and initiatives.
- *Regulatory environment* to encourage integrated water management and water recycling.
- The capacity and knowledge of city council planners and the urban development sector.

5.2.1 Economic investment models and pricing frameworks

The financial viability of recycling schemes has proven to be a major barrier for getting the private sector involved. There are several ways public utility water and wastewater pricing policies affect the financial viability of distributed recycled water systems, including:

- the ability to be competitive due to the low unit price of potable water produced by the central water utility
- the ability to access and account for avoided costs of the reduced burden on the centralised system
- the ability to be price competitive due to the regulated water and wastewater service charge.

The Australian water market is currently not designed for competition. Regulated “postage stamp”, or uniform, pricing where a water utility is able to spread the cost of new potable water infrastructure across its whole customer base, is not an option for recycling schemes – either by a water utility or private developer. Recycled schemes are ring fenced – i.e. a supplier of recycled water can only recover capital infrastructure costs directly from the customers of the recycled water – thereby making potable water much cheaper than recycled water. Even when a distributed recycled water scheme makes up part of an efficient suite of measures to contribute to the supply demand balance, unless it costs less than the average long-run marginal cost of the potable supplied water, it will be difficult for it to be competitively priced by a private supplier.

Demonstrating the financial viability of wastewater and stormwater recycling schemes by reflecting both the avoided costs to the potable water network and the non-monetary costs and benefits (such as those associated with social and environmental criteria) in a transparent and consistent manner has proven to be a key challenge. The private schemes that have been established to date have been mostly driven by developers wanting to establish precincts with a high

environmental rating in order to attract higher paying commercial clients, such as Darling Quarter and Central Park.

The public utility levies a service or access charge for third parties wishing to make use of the centralised network for either discharging waste from their recycling plants. The fear is that private companies will "cherry pick" the easy-to-service sites, leaving the hard-to-service, and therefore more expensive locations to be serviced by the public utility, thereby driving up the price of potable water. A challenge for the regulator therefore is to regulate a reasonable service charge that both provides the water utility with funding to cross-subsidise new infrastructure in difficult to service areas, as well as creating an environment that encourages private sector investment and innovation.

The CoS has seen its role as creating a conducive environment for developers to consider recycling through setting up a planning framework and infrastructural incentives. The CoS has been able to leverage investment for recycling projects through the Green Infrastructure Fund, which is drawn from Council cash reserves to fund initiatives such as Green Square and Sydney Park. (CoS 2012b).As stated in the Development Agreement between the City of Sydney and Transport for NSW for the CBD and South East Light Rail project, the CoS has plans to install a recycled water trunk main along the proposed city light rail alignment in George St as an incentive for prospective recycled water producers and users to locate around this infrastructure. The challenge is to bring potential existing customers into a cluster to take recycled water and to find the necessary funding to design and construct the recycled water infrastructure. CoS intends to carry out further analysis to assess the viability of retrofitting existing buildings to enable use of recycled water with the assumption that a retrofit would take place during future refurbishment works and thus make buildings *recycle water ready*.

5.2.2 Regulations and incentives

As discussed earlier, the regulatory environment at a state level (specifically the WIC Act) is currently under review. A number of the revisions will have a direct bearing on recycling schemes located within metropolitan councils (CoS 2014a). Under the current regulation recycling schemes are not regulated under the WIC Act if the CoS is the asset owner. A recommendation in the review is that metropolitan councils be included in the WIC Act for the delivering of high risk, "utility like" water and wastewater infrastructure. It is important that metropolitan councils, which often do not have extensive experience in delivering or self-regulating high risk, "utility like" water and wastewater infrastructure, are subject to a regulatory framework which protects public health and consumers. This recommendation ensures that high risk projects delivered under the DWMP will be subject to a regulatory framework that protects public health and consumer rights. It clarifies the regulatory process for all parties and reduces the contract transaction costs if licensees with WIC Act are engaged to operate schemes on the CoS's behalf.

A second recommendation that has direct bearing on future decentralised schemes is that entity licensing processes be separated from scheme approval processes. This will mean that a company can be registered as having the necessary skills and capacity to manage such schemes, and that schemes, not companies, will need to follow an approval process. This will have the effect of reducing red tape and licensing costs for applicants, and will create a more level playing field with public utilities by establishing capability on an entity-wide basis.

At a local level the focus of the CoS has been to encourage new developments to include recycling and water efficient systems. For most smaller infill developments that are approved by the CoS, developers can only be *encouraged* to include greater water efficiency initiatives and/or recycling through the approval of their development applications – the City does not have the power to enforce these measures however.

Under New South Wales State law, the Planning Minister is responsible for approving all *major* development projects, i.e. those having state significance. In these cases, the City of Sydney's role is limited to providing advice to the Department of Planning and Infrastructure, addressing essential infrastructure matters where relevant and to making submissions in relation to planning

applications. In such cases, the CoS finds itself in a difficult position with regard to ensuring that new developments follow the intended aims of the DWMP.

Despite these limitations, the collaborative planning approach through the Better Building Partnership (BBP) has thus far proven to be a useful strategy to help facilitate the achievement of Sustainable Sydney 2030 goals. The BBP represents a number of Sydney's leading commercial and public sector landlords who have worked collaboratively to improve the sustainability of Sydney's commercial and public sector buildings. The Better Buildings Partnership provided technical and commercial input into the DWMP (BBP 2015).

Many recycled water projects internationally don't come to fruition because of conflicts with established plumbing codes. San Francisco (USA) tackled the difficult issue of modifying State plumbing codes to include use of non-potable water. They developed a program to streamline the permitting process for the installation of non-potable water systems (Kehoe 2013). This process overcomes a gap in the CA Plumbing Code and lack of guidelines at a State level and ensures appropriate health and construction guidelines for safe and reliable use of these systems. Codifying the roles and actions of SFPUC, Public Health and Building Inspection lead to quick development of the guidelines. To encourage uptake developers can access a non-potable water calculator, a developer's guidebook, technical assistance and funding assistance in the form of grants.

5.2.3 Organizational Culture and Capacity

As with most new ideas or niche activities, an internal champion is needed to drive the new agenda. While the Lord Mayor and CEO drove the vision at a policy level, the Chief Operating Officer was, and remains, a critical person for getting the internal "buy-in" and traction from staff and the support needed to get the Plan approved by the city council. However, competing demands of internal planning staffing capacity, together with varying knowledge of integrated water systems, has made it difficult to get appropriate attention for implementing the strategy. The resources and expertise to analyse the physical and commercial environment to scope up viable projects that would interest commercial operators has proven to be a challenge.

In response, the CoS has established a dedicated Green Infrastructure Delivery Team (comprising four staff), who's role includes developing projects in response to the strategy set out in the Green Infrastructure Plan including recycling projects. In addition a Water Strategy Manager has been employed to develop an implementation plan for the DWMP to identify and priorities water efficiency, recycling and water quality improvement projects. This position is also responsible for the co-ordination of all water related projects across the council and between divisions, external stakeholder liaison and advocacy, and identifying opportunities within the regulatory constraints.

6. LESSONS AND ENABLING ACTIONS

The process pursued by the CoS, and the challenges they have encountered, have revealed a number of key lessons that have applicability for others in the urban water sector wishing to transition to a whole of water approach:

- Champions at two levels were key in progressing the One Water approach. Firstly at a political level to drive the adoption of the Sustainable Sydney 2030 vision. Secondly at the organisational level to drive the implementation of the strategy and address the organisational capacity requirements.
- Creating a dialogue within the CoS that supports and advocates for a common vision has been important to foster internal collaboration between departments.
- Capacity building within the CoS through employing appropriately skilled staff and setting up a dedicated team to implement the strategy and manage related projects.

- Consultation with the community and stakeholders (both public and private) for confirming the vision and to support the implementation of the strategy was paramount in getting the DWMP approved and for setting the framework for further project implementation.
- Collaboration and partnership building with the private sector to gain support for the vision and strategy, and to ensure that development projects are aligned with the strategy and are implemented in a coordinated fashion; and with the public sector to leverage capital finance and to remove administrative and regulatory barriers.
- Approval of modest capital budgets to be allocated to key bulk infrastructure schemes that will create an enabling infrastructural environment for both future suppliers of recycled water and consumers of non-potable water.
- Compliance with the strategy which can be encouraged through the approval of development applications lodged with the CoS.

In addition, it recognised by those driving a whole of water approach that *early involvement at the planning stage* of a precinct development is required if the outcomes of the designs are to be influenced and aligned with the City's vision.

REFERENCES

BBP, 2015. Projects: Water. *Better Building Partnership*. Available at: http://www.sydneybetterbuildings.com.au/projects/water/ [Accessed March 31, 2015].

Brown, R.R., Keath, N. & Wong, T.H.F., 2009. Urban water management in cities: historical, current and future regimes. *Water science and technology : a journal of the International Association on Water Pollution Research*, 59(5): 847–55.

CoS, 2014a. *City of Sydney submission to the Urban Water Regulation Review Position Paper*, City of Sydney, NSW, Australia.

CoS, 2013. *Council Minutes: Item 7 - Report of the Environment Committee - 18 February 2013*, City of Sydney, NSW, Australia.

CoS, 2012a. *Decentralised Water Master Plan 2012-2030*, City of Sydney, NSW, Australia.

CoS, 2012b. *Environment and Heritage Committee - 23 July 2012 - Item 3 - Draft Decentralised Water Master Plan – Public Exhibition*, City of Sydney, NSW, Australia.

CoS, 2014b. Major developments, City of Sydney, Australia. Available at: http://www.cityofsydney.nsw.gov.au/vision/major-developments/green-square/green-square-planning-and-development.

CoS, 2008. *Sustainable Sydney 2030*, City of Sydney, NSW, Australia.

Currie, L., 2015. City of Sydney's vision for a water sensitive city. In *Water Innovation Forum*. Australian Water Association.

DoPI, 2013a. BASIX - Building Sustainability Index.

DoPI, 2013b. *BASIX Target Review: Supporting research paper*, Department of Planning and Infrastructure, NSW Government.

EPHC, NRMMC & AHMC, 2006. *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks*, A publication of the Environment Protection and Heritage Council, the Natural Resource Management Ministerial Council and the Australian Health Ministers' Conference.

GHG, 2012. *City of Sydney - Recycled Water Plan*, City of Sydney.

Hatton MacDonald, D. & Dyack, B., 2004. *Exploring the Institutional Impediments toConservation and Water Reuse - NationalIssues. Report for the Australian WaterConservation and Reuse Research Program,Policy and Economic Research Unit* ,

IPART, 2008. *Overview of licensing regime under the Water Industry Competition Act 2006, WICA Fact Sheet*, Independent Pricing and Regulatory Tribunal, NSW, August 2008.

ISF, 2013. *Navigating the instituional maze. Building Industry Capability to Make Recycled Water Investment Decisions.*, Prepared by the Institute for Sustainable Futures for the Australian Recycled Water Centre of Excellence.

Jefferies, C. & Duffy, A., 2011. *The SWITCH Transition Manual*, University of Abertay Dundee.

Kehoe, P., 2013. *Streamlining Regulations: San Francisco's Non-Potable Water Program San Francisco Public Utilities Commission Presentation.*, San Francisco Public Utilities Commission.

LVMAC, 2012. *Living Melbourne, Living Victoria - Implementation plan*, Living Victoria Ministrial Advisory Council, Department of Sustainability and Environment, Victoria, Australia.

Maheepala, S., Blackmore, J., Diaper, C., Moglia, M., Sharma, A. & Kenway, S., 2011. *Integrated Urban Water Management Planning Manual*, CSIRO.

Mander, T., 2012. Reforms to cut thousands from new home costs. *Queensland Government - Housing and Public Works*. Available at: http://statements.qld.gov.au/Statement/2012/12/14/reforms-to-cut-thousands-from-new-home-costs [Accessed February 18, 2013].

Marsden Jacob, 2012. *Progress against the national target of 30% of Australia's wastewater being recycled by 2015*, Report prepared for the Department of Sustainability , Environment , Water , Population and Communities (DSEWPaC).

Mukheibir, P., Howe, C. & Gallet, D., 2015. *Institutional Issues for Integrated ' One Water ' Management*, Water Environment Research Foundation (WERF) in Partnership with the Water Research Foundation (WaterRF) and Water Quality Research Australia (WQRA): IWA Publishing.

Mukheibir, P., Howe, C. & Gallet, D., 2014. What's getting in the way of a "One Water" approach to water services planning and management? An analysis of the challenges and barriers. *AWA Water*, 41(3): 67–73.

Mukheibir, P., Kuruppu, N., Gero, A. & Herriman, J., 2013. Overcoming cross-scale challenges to climate change adaptation for local government: a focus on Australia. *Climatic Change*, 121(2): 271–283.

MWD, 2010. *Water recycling is reusing water already in the system, Ch 4 of 2010 Metropolitan Water Plan*, Metropolitan Water Directorate, New South Wales.

NHMRC, 2011. *Australian drinking water guidelines*, National Health and Medical Research Council, Australian Government, Canberra.

NHMRC & NRMMC, 2011. *Australian Drinking Water Guidelines 6, National Water Quality Management Strategy*, National Health and Meical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.

OEH, 2011. *About the NABERS program*, National Australian Built Environment Rating System (NABERS), Office for the Environmental and Heritage, NSW Government, Australia.

SWC, 2010. *Water Conservation Strategy 2010-2015*, Sydney Water Corporation, Paramatta.