NSW Infrastructure Capability Assessment

Water Baseline Report

January 2012

Report Outline

- **Key Highlights**
- Introduction
- Water Industry Overview and Current Situation
- Potable and Recycled Water
- Wastewater
- Stormwater and Flood Mitigation
- Irrigation

Key Highlights

- The water industry is a heavily regulated and asset intensive industry. Creating, renewing and managing assets to maximise asset life is a key function for the industry
- Climate variability and population growth will be the key drivers in operational and capital investment for the future in the potable and recycled water, wastewater and stormwater sectors
- Long term planning is essential for all sectors of the water industry. It is imperative that these long term plans are prepared in consultation with key stakeholders and the community and are reviewed on a regular basis
- The metropolitan, non-metropolitan and rural/irrigation elements of the water sector face quite different challenges
- The metropolitan urban sector is in reasonable shape with respect to meeting future growth in demand from population growth due to unprecedented levels of capital investment and demand management programs during the recent prolonged drought. These supply systems are now reasonably robust with respect to future threats of climate variability with greater reliance on climate independent sources such as desalination and recycling. The priority for these systems is optimising asset management and operations to minimise costs and defer future augmentation of supplies (as future sources such as desalination, storm water harvesting and recycling will be costly in terms of energy requirements)
- Following a decade or more of intensive capital investment in water and wastewater assets, metropolitan water utilities continue to comply with their operating license conditions and targets. Environmental compliance, asset renewals and growth appear to be the key capital investment drivers for metropolitan water utilities
- The non-metropolitan urban sector by comparison, has not seen the same increases in infrastructure spending
- The irrigation sector is facing quite different challenges due to imminent policy decisions in the Murray Darling Basin which will substantially reduce water available for consumptive use. Accordingly, it will not be possible to meet increased demand for irrigation water by investing in new dams, but rather through investing in off-farm and on-farm water efficiency infrastructure to maintain or increase production with less water
- In the case of drainage and flood management, there is some evidence that the level of investment by local government is not keeping pace with requirements to maintain and renew ageing infrastructure. This is likely to be exacerbated by the increased frequency and intensity of storm events predicted under climate variability models

Key Highlights (continued)

Potable and Recyclable

- The condition of the metropolitan water supply and recycled water infrastructure is relatively good
- Cost reflective pricing models ensure the Sydney Catchment Authority, Sydney Water and Hunter Water are able to invest in new assets and maintain existing assets
- The combination of investing in both new sources of supply and water conservation measures has ensured that Sydney's water supply system is now more resilient and reliable
- A number of challenges and issues confronting the potable and recycled water sector include integrated water planning, optimising multi-source water supply systems from a cost and carbon perspective and capital prioritisation

Wastewater

- The metropolitan wastewater systems are managed by Sydney Water and Hunter Water and these systems play a vital role in protecting public health and the environment
- The wastewater system is capital intensive and accounts for up to ~50 % of the costs of water utility expenditure
- A number of challenges and issues confronting the wastewater sector include maximising the opportunities for recycled water cost effective projects, addressing risks for sewerage infrastructure, exploring opportunities to extract renewable energy and nutrients from wastewater and expansion of the wastewater system to the new urban developments in Sydney's north west and south west growth centres

Stormwater and Flood Mitigation

- There is limited public information on the state of drainage assets and the extent to which NSW is prepared for flood events
- A number of challenges and issues confronting the drainage and flood protection segment includes providing appropriate infrastructure in all urban areas, securing a long-term funding mechanism that covers both upgrading and replacing stormwater infrastructure, using stormwater as a resource, management of dam levels in response to major storm events

Irrigation

- The irrigation sector is facing a significant policy shock with the release of the draft Murray Daring Basin Plan
- Under the proposed Plan, sustainable diversion limits will require reductions in consumptive use, particularly for irrigation
- The key issue facing the irrigation sector is modernisation of irrigation systems (such as improved metering, pipelining, channel lining and more efficient on-farm delivery of water) to increase water efficiency, so that levels of production can be maintained with less water

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To inform the development of the 20 year infrastructure strategy for NSW, Infrastructure NSW is conducting a baseline of State economic infrastructure

Purpose of Baseline

This project will provide a baseline for input into the NSW 20 year Infrastructure Strategy and will seek to inform answers to the following questions

- How is infrastructure planned and managed?
- What is the condition of the asset?
- What is the current capacity and ability to meet demand?
- How is the infrastructure performing?
- Where are the critical interfaces and bottlenecks?

Scope

The scope of the Infrastructure Baseline spans regional and urban economic infrastructure owned/ managed by the NSW government across the following sectors including:

- Transport (roads, rail, seaports (excluding airports), freight and intermodal, and infrastructure supporting public transport)
- Water (potable water, wastewater, recycled water, storm water and irrigation across the storage treatment and distribution value chain)
- Energy (gas and electricity across the generation, transmission and retail value chain)

The Infrastructure Baseline will create an understanding of the condition, capacity, coverage and overall performance of existing infrastructure in NSW

Coverage	• What is the extent of the infrastructure sector?
Planning	• How is the infrastructure sector planned and managed? • Who is responsible for short, medium and long term planning?
Condition	• What is the physical quality of the infrastructure?
Capacity	• Is current infrastructure capable of meeting expected demand? • Are there any capacity constraints?
Performance	• Is the infrastructure performing? • How is performance measured?
Key Issues	• Where are the critical interfaces and bottlenecks? • What are some of the key infrastructure issues and risks facing the sector?

This document provides a snapshot of the water sector based on desktop research to identify key issues to guide discussions with key stakeholders

Purpose and Structure of This Document

- Provides an overview of the water sector in NSW
- Each water type (including potable, wastewater, stormwater, irrigation) is then explored in more detail in terms of:
    - Coverage
    - Planning
    - Condition
    - Capacity
    - Performance
    - Key Issues
- This document will guide discussions with key stakeholders to validate key findings, gather additional information and develop a more detailed understanding of the capability and capacity of water infrastructure in NSW

Desktop Research Data Sources

- The document is based on the findings of the Engineers Australia 2010 NSW Infrastructure Report Card and the National Water Commission's National Performance Report 2010/11
- The document draws on a number of publicly available data sources such as:
    - Water strategies, policies and planning documents
    - Australian Bureau of Statistics data
    - Independent Pricing and Regulatory Tribunal reports
    - Water Services Association of Australia reports
    - Organisation and government websites
    - Annual reports

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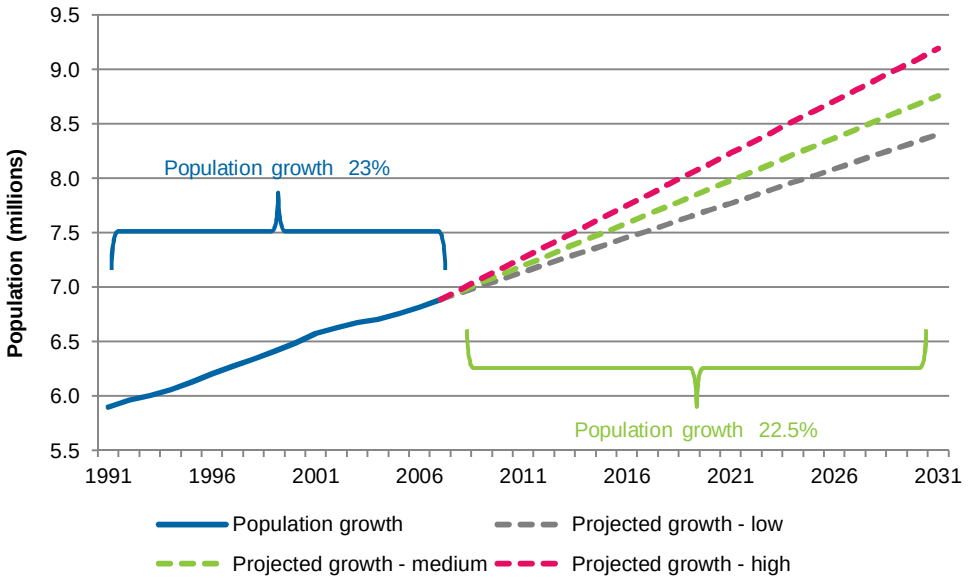
The resilience of the NSW water supply network will continue to be challenged by a number of consumption drivers such as population growth and climate variability

NSW Population [1]



Projected Water Consumption in Sydney [2]

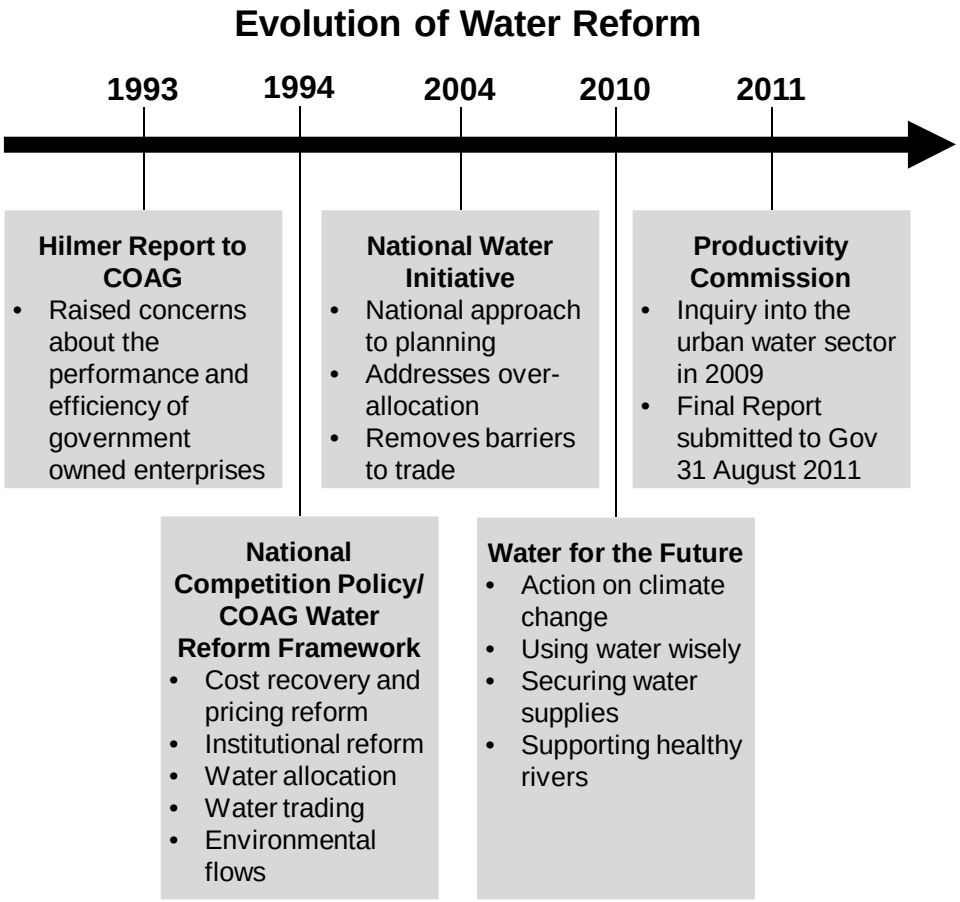
Year	Projected Water Consumption
2008/09	492 GL (actual)
2026	613 GL
2056	709 GL

Consumption Drivers [2]

- **Population growth** – will increase the demand for residential water
- **Economic development** – will increase the demand for commercial and industrial water
- **Climate variability**– will increase water consumption due to expected rising average temperatures, and reduce catchment yields
- **Cost of water** – will help inform consumer decisions through strong price signals and finance water security infrastructure
- **Housing type and density** – will determine residential demand, more densely populated cities are likely to use less water
- **Water efficient appliances** – will help reduce the level of residential, commercial and industrial consumption
- **Rules and restrictions** – will provide short term alleviation during drought and encourage long term water saving behaviour

[1] NSW Government (2008)
[2] WSAA (2010) Implications of Population Growth in Australia on Urban Water Resources

The water sector has undergone significant reform since the mid 1990's to improve resilience, sustainability, water efficiency, pricing and customer focus



Water Reform

1994 COAG Reforms

- Introduction of new pricing frameworks facilitating more accurate cost recovery
- Adoption of an integrated catchment management approach
- Commercialisation of government entities
- Separation of water property rights and land title

2004 National Water Initiative (NWI)

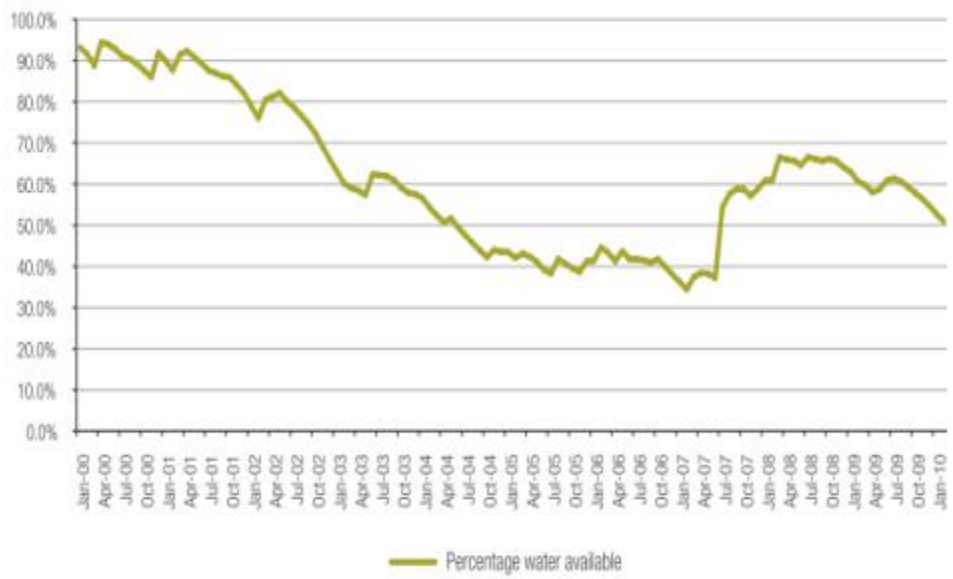
- Refinement of water access entitlements, planning frameworks, best practice pricing, integrated management, knowledge and capacity building and community partnerships

2011 Productivity Commission

- Recommendations;
    - Government role
    - Improved regulation
    - Demand management options
    - Institutional reform and structural, reforms to introduce competition

In line with the reform agenda, in response to population growth and long periods of drought, a range of initiatives has been implemented to ensure urban water supply security

Sydney's Total Dam Storage Level [1]



Overview

- Historically metropolitan Australia has relied heavily on dams for water supply, which are subject to reduced inflows due to climate variability
- Recent investment has diversified the water supply portfolio to improve security
  - Recycled water
  - Desalinated water
  - Groundwater and rain water tanks
- Demand side initiatives have been introduced to reduce residential, commercial and industrial consumption which include;
  - Water restrictions
  - Rebates for water efficient appliances
  - WaterFix program which enabled households to become more efficient with water (completed 2011)
  - Water wise rules
  - Community education

[1] National Water Commission (2011) Urban Water in Australia: Future Directions 2011

The NSW government and water authorities own or regulate almost all water infrastructure in the State

EXAMPLE

Water Infrastructure Industry

Key players	Policy and Regulation	Catchment and Storage	Treatment and Distribution	Retail
Potable Water	• NSW Office of Water • IPART • Australian Competition and Consumer Commission (ACCC) • National Water Commission • Office of Environment and Heritage • NSW Health • National Health and Medical Research Council (NHMRC)	• Sydney Catchment Authority • Sydney Water • State Water • Hunter Water • Gosford and Wyong Councils	• Gosford/Wyong Councils' Water Authority • Sydney Olympic Park Authority • Hunter Water Corporation • Country Energy (Broken Hill) • Sydney Water Corporation • Essential Water • Shoalhaven Water • Local Government	• Gosford/Wyong Councils' Water Authority • Sydney Olympic Park Authority • Hunter Water Corporation • Country Energy (Broken Hill) • Sydney Water Corporation • Essential Water • Shoalhaven Water • Local Government
Wastewater	• NSW Office of Water • National Water Commission • IPART • Office of Environment and Heritage	n/a	• Gosford/Wyong Councils' Water Authority • Sydney Olympic Park Authority • Hunter Water Corporation • Sydney Water Corporation • Essential Water • Shoalhaven Water • Local Government	• Gosford/Wyong Councils' Water Authority • Sydney Olympic Park Authority • Hunter Water Corporation • Sydney Water Corporation • Essential Water • Shoalhaven Water • Local Government
Stormwater and flood mitigation	• NSW Office of Water • National Water Commission • Office of Environment and Heritage	• Sydney Catchment Authority • Sydney Water • State Water • Catchment Management Authorities • Local Government	• Sydney Catchment Authority • Sydney Water • State Water • Local Governments	n/a
Irrigation	• NSW Office of Water • National Water Commission • Australian Competition and Consumer Commission (ACCC) • Murray Darling Basin Authority • Department of Sustainability, Environment, Water, Population and Communities	• State Water	• Murrumbidgee Irrigation Limited • Murray Irrigation Limited • Coleambally Irrigation Cooperative Limited • State Water • Veolia Water	• Murrumbidgee Irrigation Limited • Murray Irrigation Limited • Coleambally Irrigation Cooperative Limited • State Water • Veolia Water • Irrigation Trusts

Regulatory controls such as price, water volume supplied, quality, access and environmental impact govern the sector

Entity	Role	Regulatory Measure
NSW Office of Water (NOW)	• Works alongside IPART in the management of water operational licenses with considerable scientific input into the review and conditioning of such authorisation • Administration of the *Water Act 2000* • NOW also leads the state's water planning, management and information provision functions • Manages the State's surface and ground water resources [1]	Operational license
National Water Commission (NWC)	• Tracks progress in line with objectives from the National Water Initiative to ensure the sustainable use of Australia's water resources • Compiles the National performance Report on an annual basis • Undertakes research on water related topics	Water resource access
Independent Pricing and Regulatory Tribunal (IPART)	• Has a considerable role in licensing both the private sector and Government utilities • Sets water and wastewater prices for Sydney Water, Sydney Catchment Authority and Hunter Water • Assesses applications for water network access and determines price ceilings in the provision of both metro and bulk water • Audits asset management practices in water utilities	Operational license Pricing
Australian Competition and Consumer Commission (ACCC)	• Enforces and monitors the sectors compliance with rules associated with the Water Act 2007 • Has a role in upholding fair trade legislation • Regulates water market rules and water prices for the irrigation sector	Operational license
Office of Environment and Heritage (OEH)	• Oversees the implementation of the Water Act 2000 and the Environment Protection Policy 1998	Water quality
NSW Health	• Monitors the quality of drinking water through a Memorandum of Understanding	Water quality
National Health and Medical Research Council (NHMRC)	• Producers and reviews the Australian Drinking Water Guidelines	Water quality
State Water	• Bulk water provider of water for irrigation and urban areas in regional NSW	n/a
Sydney Catchment Authority	• Bulk water provider to Sydney Water and manages the catchments to protect water quality.	n/a
Sydney Water Corporation	• Water distributor ,water treatment and wastewater collection, treatment and disposal	n/a
Hunter Water Corporation	• Water distributor water treatment and wastewater collection, treatment and disposal	n/a

[1] NSW Government (2010) Water inventory and observation networks in New South Wales Supplementary Report to NSW SWIMP 2010

Potable, wastewater, stormwater and irrigation infrastructure provide water services to the residential, commercial and industrial markets in NSW

Key Statistics [1]

Potable and recyclable water

- 21,015 km of water distribution network supplies 1.7 million households and business customers in Sydney Water's operating area
- 4,856 km of water distribution network supplies 225,000 households and business customers in Hunter Water's operating area
- Non metropolitan water is provided by Local Water Utilities (LWU) who have a total network of approximately 18,948 km. They source their water from State Water whose predominantly use natural infrastructure

Stormwater and flood mitigation

- Large networks of underground drainage and storm water networks generally owned by local government protect urban areas from flooding and urban waterways and are managed for environmental, landscape and recreational objectives

Key Statistics [1]

Wastewater

- Sewage is collected by a network of 23,817 km of pipes and is treated 29 treatment plants in Sydney to standards specified by the OEH
- Sewage is collected by a network of 4,625 km of pipes and is treated 18 treatment plants in the lower Hunter to standards specified by the OEH
- Non metropolitan wastewater is collected by LWU who have a network of approximately 13,101 km

Irrigation

- State Water maintains, manages and operates 20 dams across NSW
- They supply more than 14,500GL of water to some 6,200 customers including 5 large irrigation companies (accounting for 3,794 GL of entitlement water) and a number of smaller irrigation trusts and private diverters

[1] National Water Commission (2010) National Performance Report 2009-10 Urban Water Utilities

NSW's approach to water planning and management requires re-integration after the required crisis response of water providers during the recent drought

Water Planning

- In response to the drought and the need to respond to serious water supply threats, planning and investment decision making processes became disjointed, considerable efforts are now being made to re-integrate the planning process

Strategies and Plans

State	• NSW 2021
Regions	• Water for Life – Metropolitan Water Plan • Country Towns Water Supply and Sewerage Program • $H_2$50 Plan • Water Plan 2050
Entities [1]	• Catchment Management Plans • Environmental Management Plans • Water Quality Management Plans • Sustainable Urban Water Management

Integrated Approach

- An integrated framework moves away from the previous siloed approaches and recognises the interdependencies between different sources of water, reducing reliance on one type of water source
- The *Water Management Act 2000* ensures social, economic and environmental outcomes are achieved through a sustainable approach
- The integrated approach is evident in NSW water strategies such as:
  - NSW Government State Plan
  - Metropolitan Water Plan
  - Hunter H250 Plan
  - Best Practice Management of Water Supply
  - Sewerage Guidelines used by LWU
- Local authorities are also taking an integrated approach for example The City of Sydney is currently developing a Green Infrastructure Master Plan

[1] Engineers Australia (2010) Infrastructure Report Card 2010 NSW

The condition of the metropolitan water infrastructure is generally good as a result of recent infrastructure and demand management initiatives - non-metropolitan infrastructure condition seems varied

Potable and Recyclable

- The condition of metropolitan water supply infrastructure is relatively good
- Condition is monitored through a number of indicators such as water main breaks and the infrastructure leakage index
- Water main breaks are improving
- Water quality complaints are reducing

Wastewater

- Metropolitan wastewater networks in NSW play an important role in protecting public health and the environment
- The condition of wastewater assets is good, with state water distributors in NSW meeting their targets

Stormwater and Flood Mitigation

- It appears that the rate of stormwater asset renewal and maintenance is insufficient to maintain it in its current state

Irrigation

- Much of the states irrigation infrastructure is ageing
- Modernisation is required to enable it to deliver greater efficiency

While the demand management initiatives and new sources may defer the need for augmentation, population growth and climate variability may cause capacity concerns

Potable and Recyclable

- Urban water consumption is declining, partially due to water conservation strategies in response to drought and climate variability
- Alternative water sources are becoming increasingly important to ensure a sustainable water supply

Wastewater

- Capacity issues tend to be localised
- Some regional areas require upgrades to meet environmental license conditions

Stormwater and Flood Mitigation

- There is limited information to form an accurate picture of stormwater capacity and performance
- The majority of stormwater infrastructure is owned and operated by Local Governments
- Climate variability, with increased frequency and severity of flooding, can be expected to put greater pressure on drainage infrastructure

Irrigation

- Reductions to water allocations for irrigation under the forthcoming Murray Darling Basin Plan are expected
- Therefore there is a need to modernise infrastructure to improve the assets efficiency and avoid negative socio-economic impacts such as the collapse of businesses due to inadequate water supply

While metropolitan areas meet regulatory requirements, maintaining ageing assets throughout NSW to respond to changing climatic and technological conditions will be a key challenge

Potable and Recyclable

- Water supply infrastructure is generally good, partly because cost reflective pricing allows investment in asset renewal and maintenance
- In regional areas the low rate base and small scale of operation frequently leads to lower levels of service or environmental performance compared to metro regions
- However inadequate infrastructure investment lead to more severe restrictions during the recent prolonged drought

Wastewater

- Wastewater infrastructure is good, partly because cost reflective pricing allows investment in asset renewal and maintenance
- Similar to water supply waste water in regional areas suffers from lower levels of service or environmental performance because of the low rate base and small scale of operation compared to metro regions

Stormwater and Flood Mitigation

- Harvesting stormwater for reuse is gaining momentum in metropolitan areas
- Capture and storage is a challenge, particularly in urban areas

Irrigation

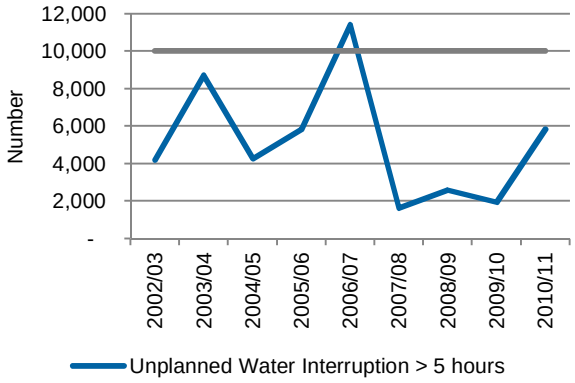
- Levels of service of gravity channel distribution systems are often inadequate to meet the needs of modern efficient on-farm irrigation practice

Metropolitan water utilities continue to meet their operating license conditions

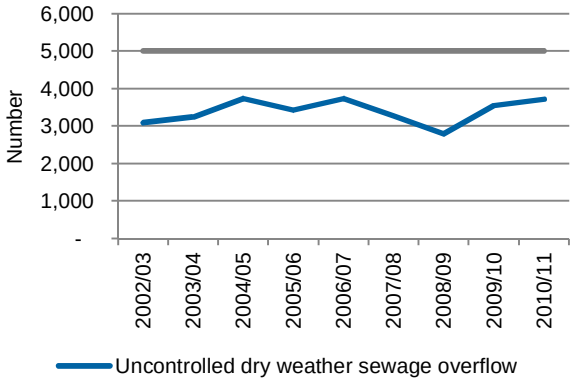
Hunter Water Operating License Performance

Measure	License Target (2010/11)	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Pressure Incidents	4,800	4,805	1,634	1,711	1,972	2,498	1,490	2,096	1,657	2,334
Unplanned Water Interruption > 5 hours	10,000	4,200	8,704	4,284	5,847	11,400	1,623	2,601	1,929	5,845
> than 3 interruptions, greater than 1 hr duration	5,000	2,429	3,119	3,052	4,247	2,857	1,160	2,931	1,250	2,200
Uncontrolled dry weather sewage overflow	5,000	3,090	3,245	3,736	3,426	3,734	3,284	2,794	3,555	3,723
> than 3 uncontrolled dry weather sewage overflows	45	23	17	24	31	19	23	9	9	26

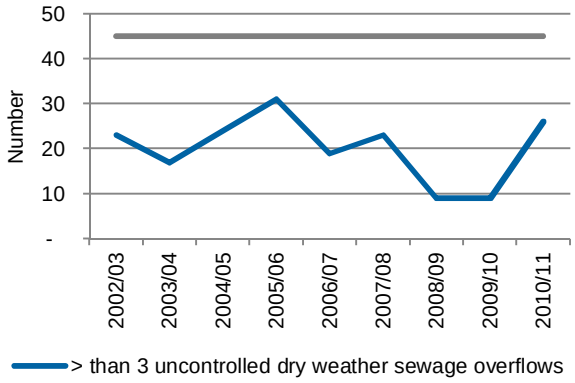
Unplanned Water Interruptions [1]



Uncontrolled Sewage Overflows [1]



>3 Uncontrolled Sewage Overflows [1]



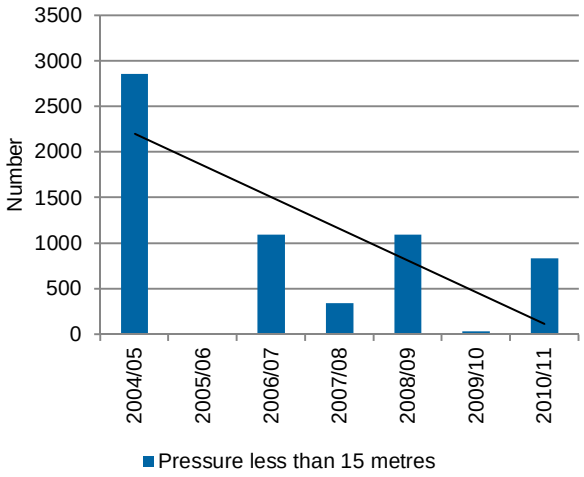
[1] Hunter Water (2011) Hunter Water Corporation Operational Audit 2010/11

Metropolitan water utilities continue to meet their operating license conditions (continued)

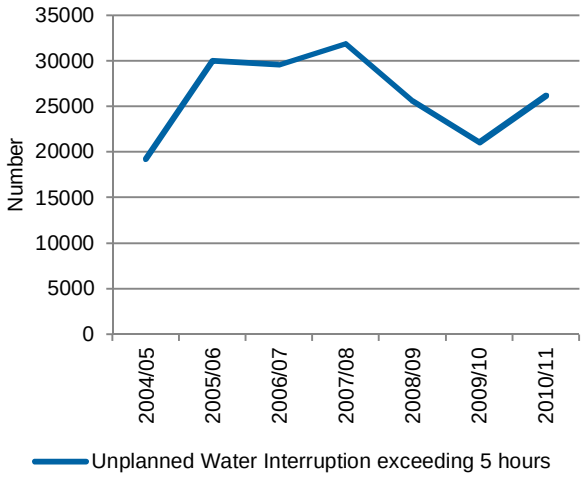
Sydney Water Operating License Performance

Measure	License Target (2010/11) *	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Pressure less than 15 metres	6,000	2,860	n/a	1,094	345	1,093	36	834
Unplanned Water Interruption exceeding 5 hours	40,000	19,214	30,000	29,592	31,892	25,656	21,050	26,205
Uncontrolled dry weather sewage overflow	14,000	21,462	n/a	24,924	18,148	16,028	17,263	9,158

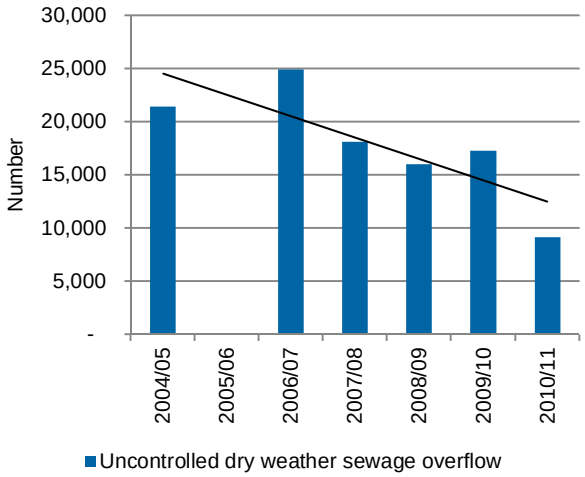
Pressure less than 15 meters [1]



Unplanned Water Interruption [1]



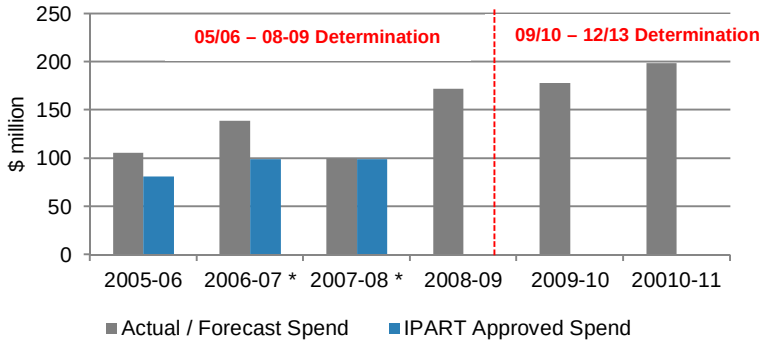
Uncontrolled Dry Weather Sewage Overflow [1]



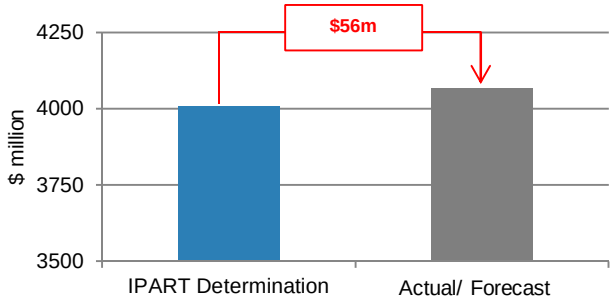
[1] Sydney Water (2011) Sydney Water Corporation Operational Audit 2010/11 & Historic Issues
* NOTE: These change over the years therefore past attainment is not directly comparable with today's license target

Environmental compliance, asset renewals and growth are the key capital investment drivers for metropolitan water utilities

Hunter Water Capital Investment Versus IPART Approved Spend [1] [2]



Sydney Water Capital Investment versus IPART Determination 2008/09 – 2011/12 [3]



Capital Investment Drivers

- Capital investment decisions at Hunter and Sydney Water appear to be driven by:
  - Environmental compliance (eg - wastewater management, increasing capacity of sewer mains) – operating license requirement
  - Asset renewals and replacement – operating license requirement
  - Supporting population growth and new developments
  - NSW Government programs such as increasing the volume of recycled water in Sydney to 70 billion litres a year by 2015
- In previous years, the emphasis of Sydney Water's capital investment programs has also been on ensuring more resilient water sources (such as desalination and recycled water schemes)
- Hunter Water has not invested in more resilient water sources (given the cancellation of the Tillegra Dam project). Following the release of the Lower Hunter Water Plan, it is likely that additional capital may be required to implement the plan's recommendations
- More detailed analysis of capital programs and asset management plans is required to explore the link between capital investment and asset performance
- Minor capital overspend (compared to IPART determination) for both Sydney and Hunter Water
- Hunter Water - Average overspend of $22 million per annum between 2005 and 2008 (reasons for over spend include revised catchment strategies, revised growth rates, accelerated project delivery)
- Sydney Water - Estimated final overspend of $56 million (1.4%) between 2008 and 2012 (reasons for over spend include higher expenditure on new infrastructure due to the abolishment of developer charges by the NSW State Government Dec 2008; higher than forecast information technology expenditure; higher than forecast property management expenditure)

[1] Hunter Water (2009) Submission to IPART on Prices & Annual Reports
[2] Hunter Water (2010 & 2011) Annual Reports
[3] Sydney Water (2011) Sydney Water - Submission to IPART 2012 pricing determination
* analysis within the report indicates that there is some discrepancy within the reported figures
** Further consultation with stakeholders is required to verify data

There are a number of key water infrastructure issues that warrant further investigation and discussion

Potable and Recyclable

- Optimising multi-source water supply systems (dams, desalinated water, groundwater)
- Providing greater customer choice in terms of desired levels of security
- Capital prioritisation and doing more with less after unprecedented increases in capital expenditure over the last few years
- Understanding the impact of higher water prices on capital programs and maintenance

Wastewater

- Understanding the impact of climate variability on wastewater assets will be important
- The expansion of the wastewater system into new urban developments in Sydney's north west and south west growth centers

Stormwater and Flood Mitigation

- Increased investment in stormwater harvesting
- Designing new drainage systems for more extreme storm events predicted under climate variability
- Taking account of sea-level rise in the design of coastal drainage systems

Irrigation

- Modernisation to address ageing infrastructure and the need for increased efficiency are the key issues

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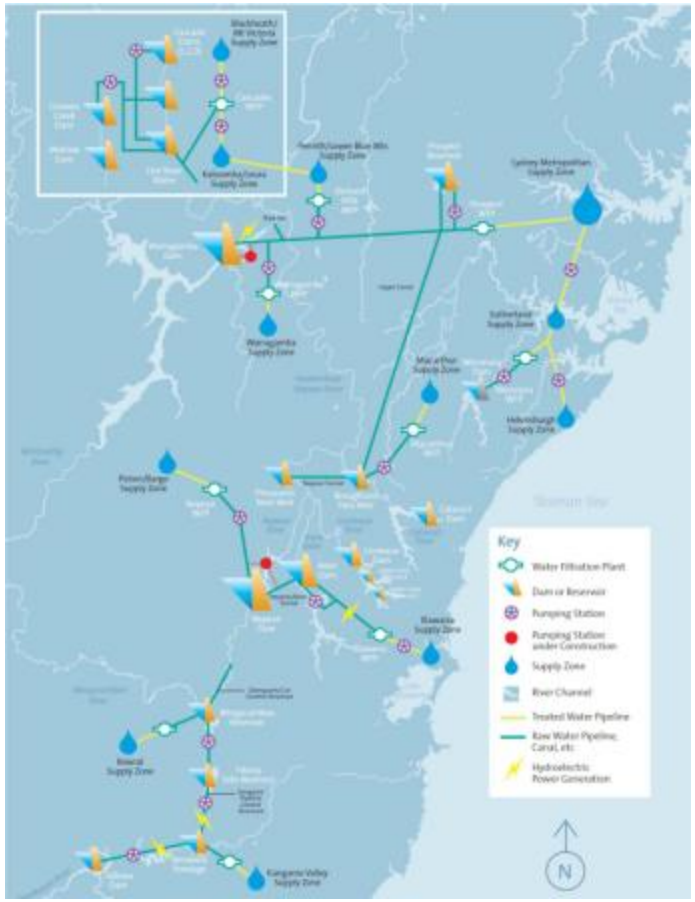
The NSW metropolitan water network supplies water to the Greater Sydney and the Lower Hunter regions

Overview

- The metropolitan water supply system comprises the Greater Sydney (Sydney, Illawarra and the Blue Mountains) and the Lower Hunter regions
- There are three key players
  - Sydney Catchment Authority, who manages over 16,000 km^2 of catchment
  - Sydney Water who distributes and sells fresh and recycled water to the end user
  - Hunter Water who manages the catchments in the Hunter region, distributes and sells fresh and recycled water to the end user
- The metropolitan network supplies 5.2 million [1] people with 737,152 ML of water [2] through 44,697 km of pipes (2008/09)
- While the majority of the network captures fresh water for distribution, Sydney Water owns and or manages a number of water recycling plants including the Kurnell desalination plant and plants at Wollongong, Rouse Hill and St Mary's

Greater Sydney Water Supply System [3]



[1] ABS (2011) 3218.0 Regional Population Growth, Australia
[2] BITRE (2011) Australian Infrastructure Statistics Yearbook 2011
[3] Engineers Australia (2010) Infrastructure Report Card 2010 NSW

The Sydney Catchment Authority captures and stores fresh water for 70% of the NSW population

Sydney Catchment Authority [1]

- Sydney Catchment Authority (SCA) manages and regulates the catchment areas, provides infrastructure and raw water to distributors
- The SCA has five main water catchments; Blue Mountains, Shoalhaven, Warragamba, Upper Nepean and Woronora; and provides water to a population in excess of 4.5 million [2]
- SCAs catchments cover an area greater than 16,000 km^2
- The majority of water in the Greater Sydney region comes from the capture of rain and ground water and is stored in a network of reservoirs
- Lake Burragorang is the largest of SCAs reservoirs covering an area of 75 km^2 and can provide up to 80% of Sydney's water [3]
- In 2009/10 SCA provided 482,169 ML to Sydney Water (99.2%) and Shoalhaven City and Wingecaribee Shire Councils (0.8%)

Sydney Catchment [1]

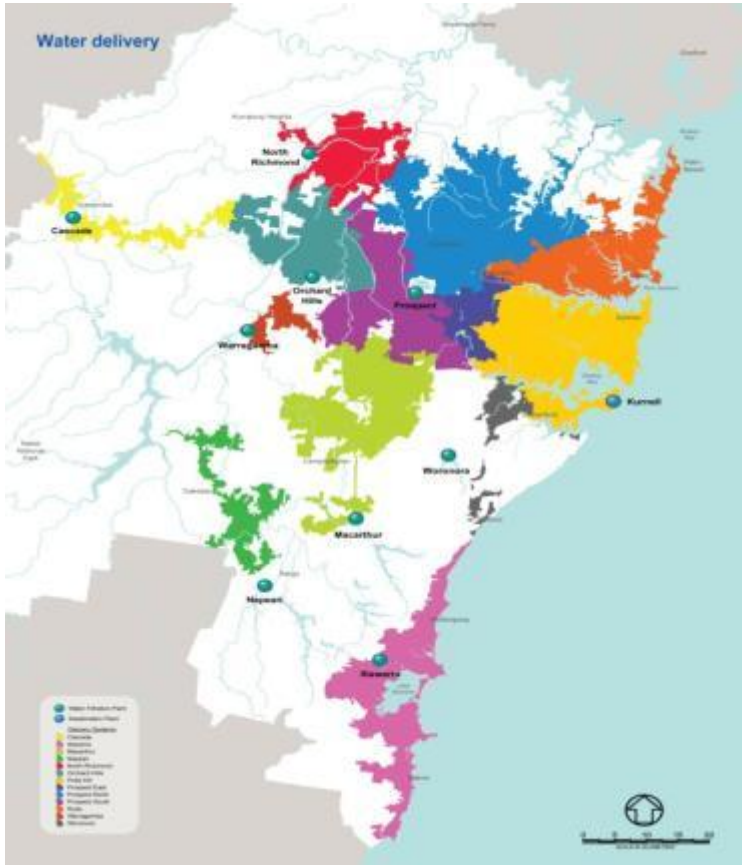
[1] Sydney Catchment Authority (2011) http://www.sca.nsw.gov.au/the-catchments
[2] National Water Commission (2010) National Performance Report 2009-10 Urban Water Utilities
[3] Sydney Catchment Authority (2010) Annual Water Quality Monitoring Report

Sydney Water Corporation supplies over 487,323 ML of fresh and recycled water to more than 4 million people in Sydney, the Illawarra and Blue Mountains

Sydney Water Corporation [1]

- The Sydney Water Corporation's water delivery networks encompass an area of 12,700 km (Sydney, the Illawarra and the Blue Mountains) [2]
- It has a water main length of 21,015 km, with an additional 17,000 km of pipes connecting customer properties to the water mains
- The network is supported by:
  - 276 service reservoirs
  - 10 water filtration plants
  - 171 pumping stations
- Sydney Water's Kurnell desalination plant currently produces 15% of the total demand for water
- A number of other recycling plants within the Sydney region provide recycled water to their local population; Rouse Hill, St Mary's, Quakers Hill, Glenfield and Wollongong [3]

Sydney Water Delivery Systems [2]



[1] Sydney Water Corporation (2010) Annual Report 2009-10
[2] Sydney Water (2011) http://www.sydneywater.com.au/Oursystemsandoperations/images/WaterSystem.jpg
[3] Sydney Water (2011) http://www.sydneywater.com.au/OurSystemsandOperations/WaterRecyclingPlants/

Hunter Water is the catchment manager, distributor and retailer for reticulated water in the Lower Hunter region and has a customer base of over 500,000 residents

Hunter Water Corporation [1]

- Hunter Water provides water supply services to Cessnock, Lake Macquarie, Maitland, Port Stephens and Newcastle in the Lower Hunter region
- Over 200,000 properties are connected to the network, with a population of over 500,000 residents [2]
- The network draws from surface and groundwater resources; Anna Bay Sandbeds, Chichester Dam, Grahamstown Dam and the Tomago Sandbeds [3]
- HWC has 4,856 km of water mains in service with an additional 26.1 m connecting each property to the water main
- The network is supported by:
  - 77 in service reservoirs
  - 85 pumping stations [3]
- Total asset value in 2009/10 was $2,896 million

Hunter Water Area of Operations [4]

[1] Hunter Water Corporation (2010) Annual Report 2009-10
[2] Hunter Water (2011) http://www.hunterwater.com.au/About-Us/Our-Organisation/Our-Organisation.aspx
[3] Hunter Water (2011) http://www.hunterwater.com.au/Water-and-Sewer/Water-Supply/Dams-and-Catchments.aspx
[4] Hunter Water (2011) http://www.hunterwater.com.au/Water-and-Sewer/Water-Supply/Water-Supply-Systems.aspx

The NSW non-metropolitan water supply infrastructure provides water to 1.9 million of the NSW population and is managed by State Water Corporation and over 100 local water utilities

Overview

- NSW non metropolitan network has:
  - a pipe network of 108 km
  - an unlined channel network of 5,481 km
  - a lined channel network of 565 km
  - a regulated river length of 7,920 [1]
- The network has a supply capacity of 33,929.2 ML per day
- Total volume of water supplied at rural customer service points in 2008/09 was 1,848,660 ML
- Providing water to 1.9 million residents in non-metropolitan NSW [2]

Players

- The non-metropolitan water supply network has considerably more players than the metropolitan network
- State Water manages the catchment area and provides bulk fresh water to the water distributors and retailers
- There are 105 local water utility providers in non-metropolitan NSW with total asset value of $20.6 billion, which also includes wastewater assets [3]

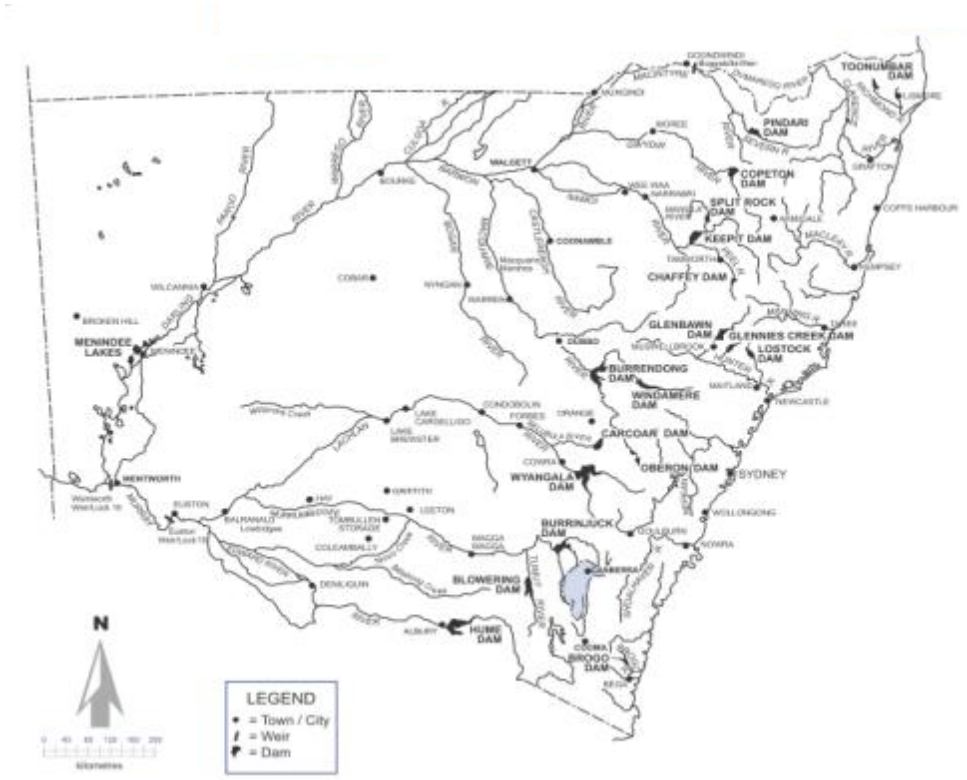
[1] BITRE (2011) Australian Infrastructure Statistics Yearbook 2011
[2] ABS (2011) 3218.0 Regional Population Growth, Australia
[3] NOW (2011) http://www.water.nsw.gov.au/Urban-water/Local-water-utilities/Local-water-utilities/default.aspx

State Water Corporation delivers bulk water to water distributors, retailers, irrigators, farms, mines and electricity generators in rural NSW

Bulk Water Storage

- State Water owns, maintains, manages and operates major infrastructure to deliver bulk water to approximately 6,300 licensed water users (such as irrigation corporations, local water utilities, farms, mines) on the state's regulated rivers
- Historically, this has involved delivery of an average 5,500 GL annually, but in the recent extreme drought conditions, diversions have fallen to as low as 1,110 GL
- Bulk water infrastructure includes the dams and weirs in the main catchment areas
- State Water manages approximately 20 dams and more than 250 weirs
- Key issues are:
    - Dam safety with respect to maximum probable floods (Dam Safety Committee)
    - Drought conditions
    - Environmental flows (especially with respect to the Murray-Darling Basin)
    - Inaccurate flow measurement due to old meters

State Water Network [1]



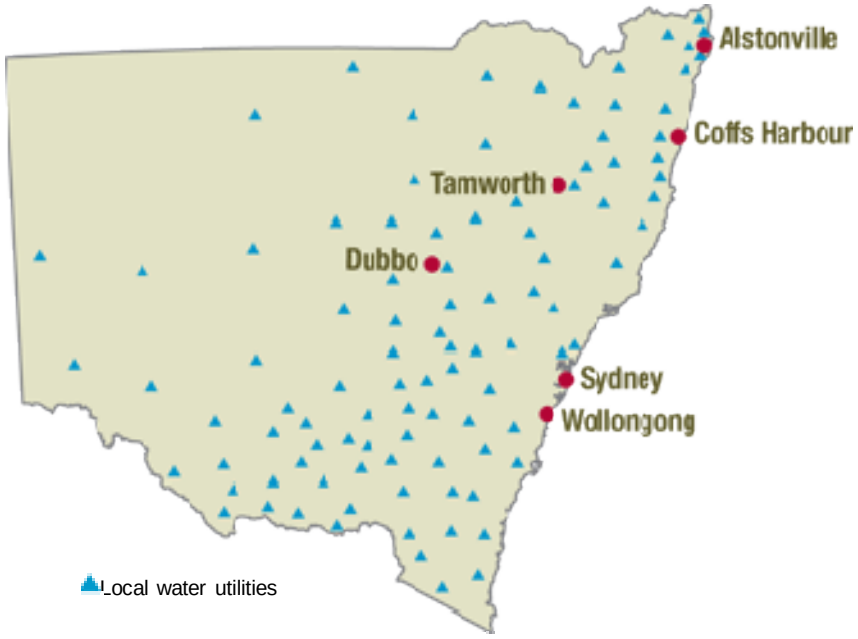
[1] State Water (2011) http://www.statewater.com.au/_Documents/Library/Locations%20and%20storages%20map.pdf

Under the Local Government Act 1993, Local Water Utilities (LWU) draw water from State Water Corporation's supply to provide potable water to non-metropolitan areas

Overview

- There are 105 non metropolitan LWU [1]
- 97 LWU provide water supply services to a population of 1.8 million
- This equates to a water supply coverage of 97.9% of the non metropolitan population
- Total water supplied has decreased over the previous 19 years to 290,000 ML per annum
- Average residential water supply is 175 kL per property which is 47% lower than in 1991, it has been suggested that this is due to strong demand management initiatives (pay-for-use signals)
- 98% of LWU have a two tired pricing scheme; pay for access and pay for usage [2]

NSW Local Water Utilities [3]



[1] NSW Office of Water (2011) http://www.water.nsw.gov.au/Urban-water/Local-water-utilities/Local-water-utilities/default.aspx
[2] NSW Office of Water (2011) 2009-10 NSW Water Supply and Sewage Performance Monitoring Report
[3] NSW Office of Water (2011) http://www.water.nsw.gov.au/Urban-water/Country-town-water/default.aspx

There are a number of strategies, plans and operational frameworks that set out the vision, objectives and standards for the water supply sector in NSW

Strategies and Plans	
State	• NSW 2021
Regions	• Water for Life – Metropolitan Water Plan • Country Towns Water Supply and Sewerage Program • $H_2$50 Plan • Water Plan 2050
Entities [1]	• Catchment Management Plans • Environmental Management Plans • Water Quality Management Plan • Sustainable Urban Water Management

Spatial differences
• Planning in metropolitan regions is predominantly led by the Metropolitan Water Plan • It is guided further with a raft of regulatory measures like operational licences • Planning in non-metropolitan regions is predominantly the responsibility of the Country Towns Water Supply and Sewage Program • Initiatives are rolled out under guidelines such as the Best Practice Management of Water Supply and Sewerage Guidelines and the Local Government Act 1993

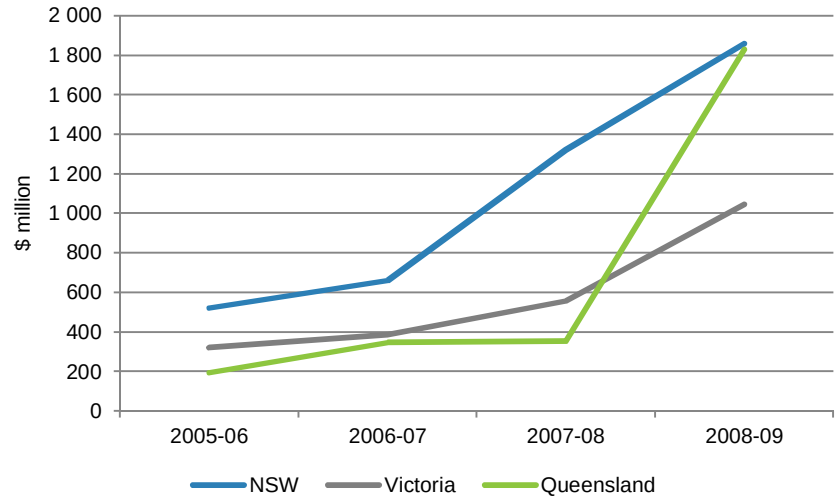
Operational Framework [1]	Function
NSW Standard for Quality Natural Resources Management	• Identifies and defines standards applicable to natural resource management
NSW Water Quality and River Flow Objectives	• Defines water quality indicators • Identifies long term goals and objectives for surface water in NSW

State wide targets for natural resource management	• Identifies 5 water specific targets that will ensure ecological sustainability and will continue to support communities environmentally, economically, socially and culturally for example:
	  • Improvement in the condition of riverine ecosystems
	  • No decline in the condition of marine waters and ecosystems

[1] Engineers Australia (2010) Infrastructure Report Card 2010 NSW

The condition of metropolitan water supply infrastructure in NSW is relatively good

Metropolitan Capital Water Expenditure (Inc Wastewater) [1]



- New investment in metropolitan capital water projects have followed a sharp upward trend since 2006/07 in NSW, Victoria and Queensland
- 2008/09 outlined capital expenditure as being $1,859 million (inc wastewater)

Condition Indicators

- The existing condition of the metropolitan water supply infrastructure is good with reductions in water main breaks and the infrastructure leakage index
- Condition of the water supply infrastructure is monitored by IPART and reported in the NWC National Performance Report for both urban and rural utilities
- The reports have identified a number of measures that provide an indication as to the condition of the entities assets
- They have been identified as:
  - Water main breaks per 100 km
  - Infrastructure leakage index
  - Average length of unplanned disruption
  - Water quality customer complaints per 1000 properties

[1] BITRE (2011) Australian Infrastructure Statistics Yearbook 2011

Sydney Water and Hunter Water have seen a reduction in water main breaks per 100 km and the infrastructure leakage index have been decreasing in recent years

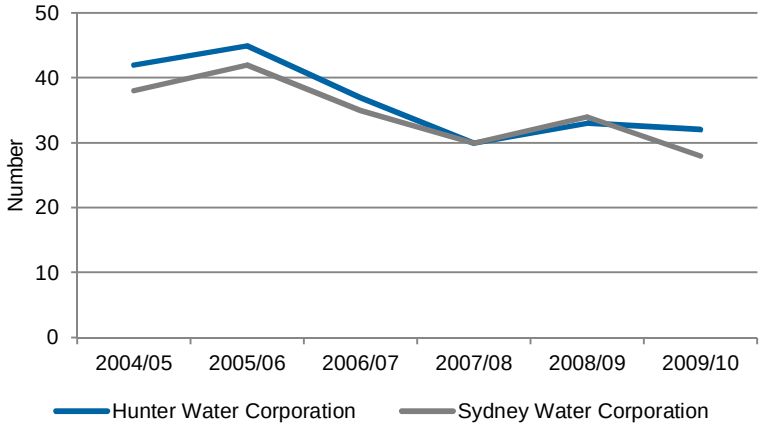
Water Main Breaks

- Historically, water main breaks have been following a downward trend
- The trend indicates improving condition of the water supply infrastructure
- Breaks are typically not a result of pipe age or maintenance activity, instead weather and soil type are the key determinant
- Until the 1970's clay soil was typically used as backfill for pipes, these types of soil tend to swell with moisture and shrink when dry consequently pipes in such conditions suffer more breaks

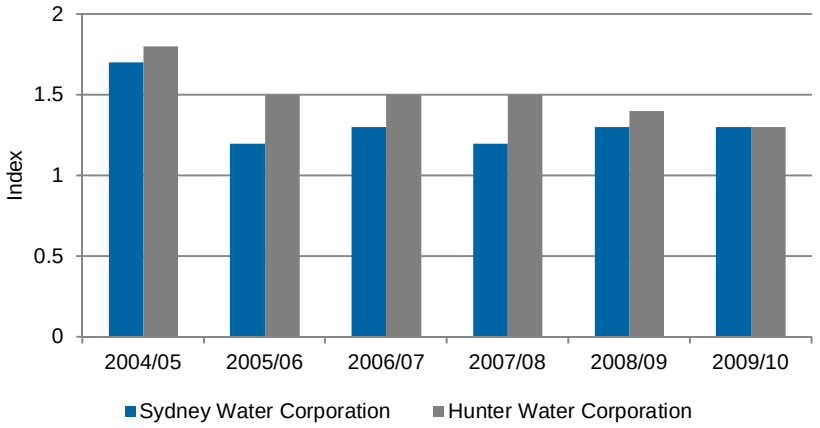
Infrastructure Leakage Index

- The infrastructure leakage index is a non revenue performance indicator which enables comparison of real water losses between suppliers
- It too has been following a downward trend since 2004/05 implying an improving condition of the asset

Water Main Breaks per 100 km [1]



Infrastructure Leakage Index [1]



[1] National Water Commission (2010) National Performance Report 2009-10 Urban Water Utilities

Water quality and the length of unplanned disruptions appears to be improving

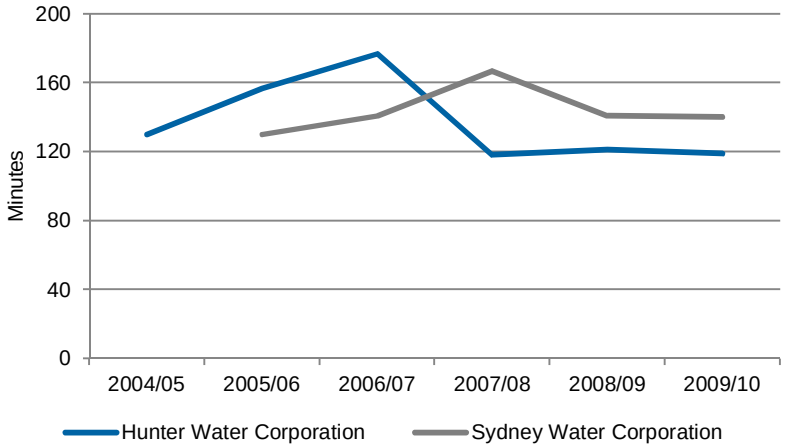
Unplanned Disruption

- Unplanned disruption length has remained relatively stable over the last 3 years
- Hunter Water averages 119 minutes per disruption and Sydney Water averages at 140 minutes per disruption

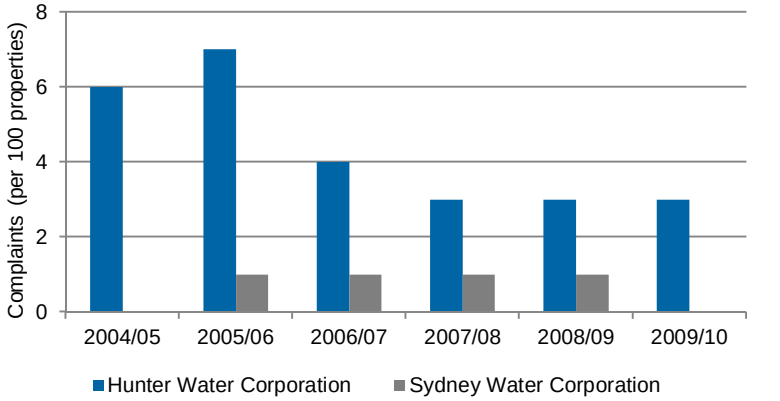
Water Quality

- Water quality complaints have remained stable at Sydney Water over the data period with the number of complaints staying below 1
- Hunter Water have shown a reduction in complaints remaining stable at 3 per 1000 properties since 2007/08
- It is suggested that Hunter Water may have a higher complaint rate because it uses a larger number of water sources
- Water quality complaints typically increase as the quantity of water sources used increases

Average Length of Unplanned Disruption [1]



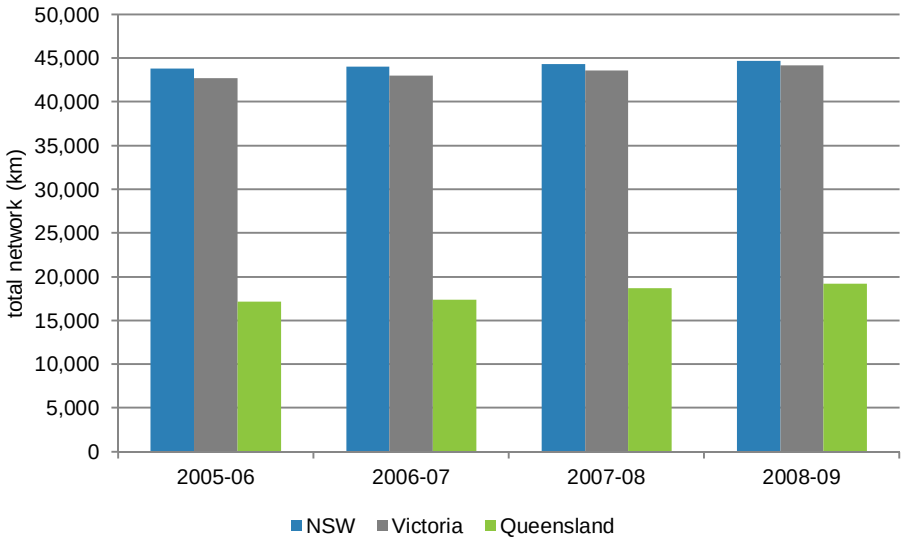
Customer Complaints Regarding Water Quality [1]



[1] National Water Commission (2010) National Performance Report 2009-10 Urban Water Utilities

NSW has the most extensive water network in Australia, totalling 44,697 km in 2009 which has remained constant over the preceding 5 years

Metropolitan Water Mains Network Length [1]



Overview

- Metropolitan water main network lengths have remained fairly consistent over the preceding 5 years throughout other comparable Australian states
- However significant investment has been made in the sector to ensure ageing assets continue to meet strict regulatory requirements for drinking water
- NSW has the most extensive metropolitan water main network however, this would be expected due to the size of the State's urban population
- With the projected population increases the state is expected to experience, the infrastructure will need to ensure it can continue to provide a continuous, safe supply of water, which is essential for life
- Sydney Water's recent investment in a diverse portfolio of water supply sources has resulted in increased water security within the region
- The cancellation of the Tillegra Dam means at this stage it is not possible to determine if the Hunter region has a long term secure water future until the completion of Interim Drought Response Plan and the completion of the Lower Hunter Water Plan by the Office of Water

[1] BITRE (2011) Australian Infrastructure Statistics Yearbook 2011

Water conservation strategies, in response to drought and climate variability have seen significant uptake and have resulted in a reduction in NSW urban water consumption

Current Initiatives [1]

Demand Management Programs

- Residential schemes with incentives to replace household items with large water consumptions with more efficient models i.e. washing machines, toilets
- Encouraging the use of rain water tanks
- Regulatory measures such as Water Wise Rules and the Building Sustainability Index
- Leak reduction programs

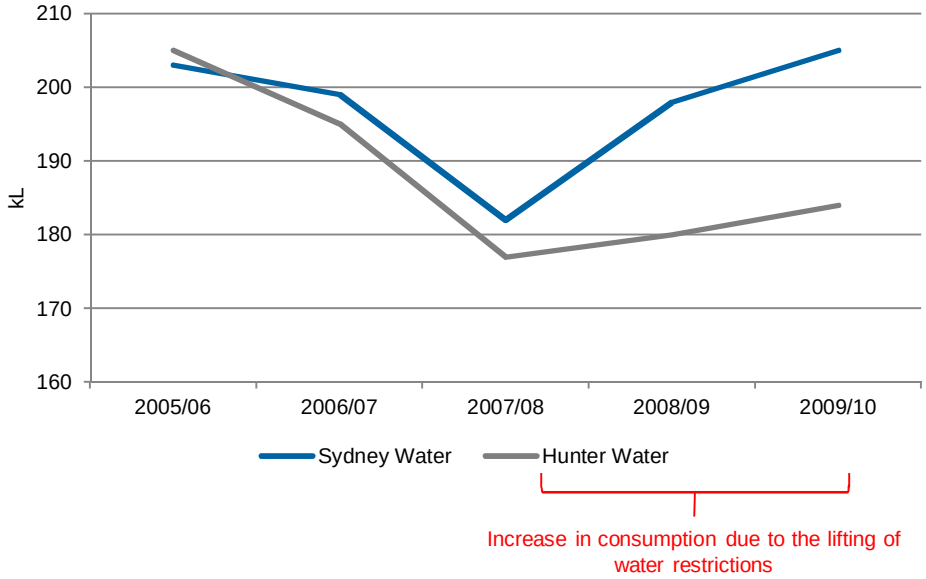
Water Saving Rules

- Hose pipe requirements
- Car washing restrictions
- Garden watering and irrigation systems
- It is important to note that recent climatic conditions have resulted in a lifting of water restrictions in some regions throughout NSW i.e. Hunter Water

What Does This Mean?

- Reductions in water consumption delay the need for additional water sources
- Higher degrees of water security and increased resilience to supply shocks such as droughts

Volume of Metropolitan Water supplied per property [2]



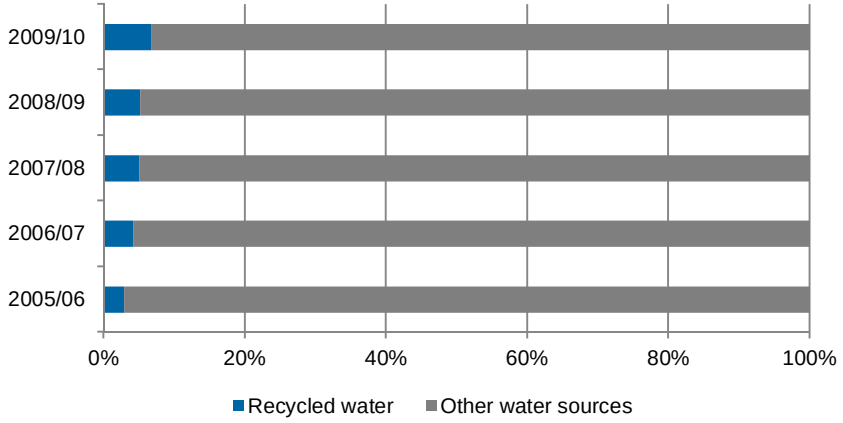
[1] Sydney Water (2011) http://www.sydneywater.com.au/Water4Life/index.cfm
[2] National Water Commission (2010) National Performance Report 2009-10 Urban Water Utilities

The role of recycled water is increasingly important in the management of water demand

Recycling and Reuse

- Recycled water is more commonly accepted as a suitable source of potable water and it's benefits are recognised in the face of changing climatic conditions
- Recycled water projects are now seeing much higher levels of community support, resulting in an increase in their prevalence

Recycled Water as a Proportion of Total Water Supply: Sydney Water [1]



Recycling and Reuse in NSW

- Sydney Water, nationally, has the highest volume increase (32%) in the supply of recycled water
- It currently recycles 33,683 ML a year through water recycling plants such as Wollongong, Rouse Hill, St Mary's [2]
- Hunter Water currently recycles approximately 5091 ML
- Water providers expect to maintain pace with demand, especially in the Hunter and Sydney north and south west growth areas with the integration of recycled water plants into new developments

Case Study – Sydney Olympic Park Authority [3]

- The Sydney Olympic Park Authority harvests storm water run off the Sydney Olympic park
- Much of the run off is sourced from the pavements, roads and rooftops in the town centre, P5 car park and suburb of Newington
- The plant saves the local area 850 million litres of potable water per annum recycles 550 million litres of sewage a year that would otherwise be discharged into the ocean at a lower cost than fresh water supplies

[1] National Water Commission (2010) National Performance Report 2009-10 Urban Water Utilities
[2] Sydney Water Corporation (2010) Annual Report 2009-10
[3] Sydney Olympic Park Authority (2011) http://www.sopa.nsw.gov.au/our_park/environment/water

The Kurnell desalination plant has the capacity to provide a maximum of 260 ML a day, which accounts for up to 30% of Sydney's potable water demand

Case Study – Kurnell Desalination Plant [1]

- Sydney's desalination plant, located in Kurnell on Port Botany, opened in 2009
- It has a maximum operating capacity of 260 million litres of water a day
- The plant currently provides 15% of Sydney's potable water demand, but with the installation of additional filters it will be capable of providing up to 30% of demand
- A wind farm at Bungendore in NSW produces renewable energy to offset the energy use of the plant
- Desalination represents a highly reliable source of water as it does not rely on rain fall
- To protect the environment Sydney Water operates a stringent marine environment monitoring program

Kurnell Desalination Plant – Possible Supply Areas [1]

[1] Sydney Water Corporation (2011) http://www.sydneywater.com.au/water4life/Desalination/

Despite a range of diverse measures to manage water demand the population of NSW is continuing to grow requiring continued investment to increase capacity in the future

Key Projects 2011/12 [1]

Sydney Water Corporation

- 2011-12 investment is estimated at $278 million for:
  - Maintaining water distribution systems
  - Recycled water projects
  - Western Sydney recycled water initiatives

Hunter Water Corporation

- 2011-12 investment is estimated at $49 million for:
  - Enhancement of water infrastructure
  - Interim Drought Response Plan - until long term water resources strategy for the region is implemented

Sydney Catchment Authority

- 2011-12 investment is estimated at $21 million for:
  - Shoalhaven system upgrade
  - General upgrade of assets
  - Warragamba dam
- Continued investigation into the Upper Nepean Transfer Scheme [2]

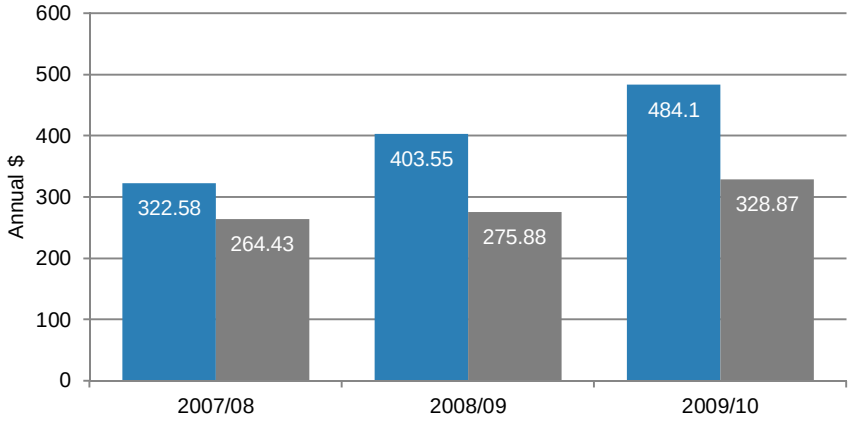
State Water

- 2011-12 investment is estimated at $136 million for:
  - Water for rivers project
  - Copeton dam upgrade
  - Keepit dam upgrade

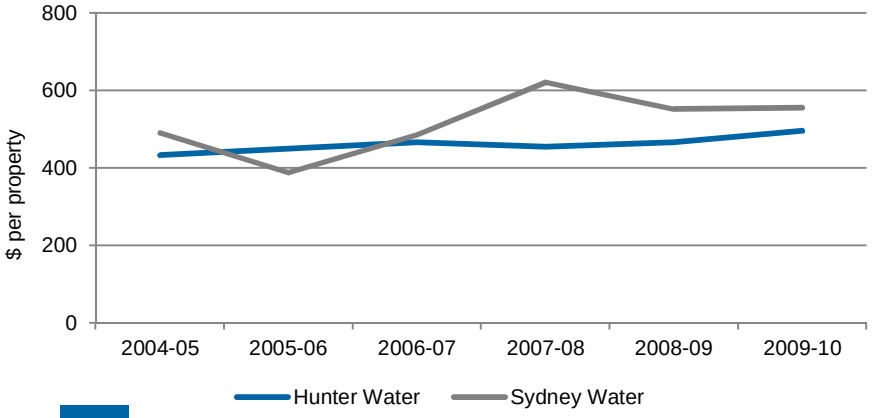
[1] NSW Treasury 2011) Infrastructure Statement 2011-12 NSW Budget Paper No.4
[2] Sydney catchment Authority (2011) http://www.sca.nsw.gov.au/publications/ar2009-10/goal-1/water-supply-assets

Water supply infrastructure performance is good, partly because cost reflective pricing allows investment in assets which leads to reliable performance

Average Annual Residential Water Supply Bill [1]



Operating Expenditure per Property [1]



Increasing Costs of Supply

- Hunter Water, Sydney Water and the SCA submit 3 or 5 year Water Plans containing OPEX and CAPEX forecasts, IPART review these submissions and determine the water price for each of the years in the plan, this has resulted in an upward trend
- Prices are anticipated to continue to rise as the energy and operating costs of new sources of supply such as recycling and desalination are significantly higher than historical gravity fed dam supplies
- A price on carbon will accelerate these price increases

Performance Indicators

Supplier performance is audited on an annual basis against conditions in the operational license such as:

- Water quality – customer complaints
- Water pressure – properties who experienced low water pressure incidents
- Water continuity – number and length of disruptions
- Infrastructure leakage – infrastructure leakage index

[1] National Water Commission (2010) National Performance Report 2009-10 Urban Water Utilities

IPART monitors water suppliers performance against the conditions of their operating license, overall water suppliers are meeting their performance targets

Infrastructure Performance Metrics	Sydney Water [1]	Hunter Water [2]	Sydney Catchment Authority [3]	State Water [4]
Water quality	• Water quality complaints have reduced from 0.6 to 0.3 per 1000 properties over the reporting period	• Water quality has been following a long term downward trend	• 100% compliant	n/a
Water pressure	• 36 properties with water pressure > 15 meters head • Downward trend from previous year	• 1,657 properties experienced low water pressure over the reporting period • This reflects performance from the previous 6 audits	n/a	n/a
Water continuity	• 12,666 properties experienced unplanned disruptions • Increase from previous year, although long term trend sees a reduction	• 7,163 properties experienced disruption to their water supply • A reduction of 21% from the previous reporting period	• 0 hours of disruption	• All water deliveries were on time during the reporting period
Infrastructure leakage	• Leaks have declined from the previous reporting period • Reflected in consistent infrastructure leakage index decline from 1.8 in 2004/05 to 1.3 in the 2009/10 reporting period	• Infrastructure leaks have been following a downward trend • A reduction in the infrastructure leakage index from 1.7 to 1.26, 2004/05 to 2009/10	n/a	n/a

[1] IPART (2010) Sydney Water Corporation: Operational Audit 2009/2010
[2] IPART (2010) Hunter Water Corporation: Operational Audit 2009/2010
[3] IPART (2010) Sydney Catchment Authority: Operational Audit 2009/2010
[4] IPART (2010) State Water: Operational Audit 2009/2010

There are a number of key issues for further exploration and discussion

Issue	Description
Integrated Water Planning	• Integrated water planning has the objective of using multiple sources of water and using water close to where it is captured. Traditionally our water and wastewater systems have been large enough to capture the economies of scale • Integrated water systems are going to be more local in scale and will be designed to fit in with the prevailing landscape and will be resilient due to the multiple sources of water • Water will be a key factor in making our cities more sustainable and liveable in the future and it is imperative that the water industry collaborates with all of the institutions and professions that shape what our cities of the future will be like
Optimising multi-source water supply systems from a cost and carbon perspective	• Water supply systems used to comprise of dams on the top of ranges where water flowed by gravity to be treated and then distributed to customers, this is no longer the case • With multiple sources of water from dams, desalinated water, recycled water and ground water (Hunter Water) optimising these systems to which all have different costs and levels of reliability can be a major challenge
Capital prioritisation	• Capital will always be restrained but following unprecedented increases in capital expenditure budgets, to build the infrastructure required to mitigate the climate risks, utilities will be challenged to do 'more with less'
Water price rises are biting	• Recently water utilities have been receiving negative feed back from customers about the increases in water and wastewater bills (most cities have doubled water prices over the last 5 years). Given that utilities should be adopting cost reflective pricing principles capital expenditure budgets may be restrained in order to take pressure off higher water prices and to enable utilities to repay debt • It is essential that utilities have best practice hardship programs, and that the industry educates customers on the value proposition of safe drinking water and sanitation systems
Operating in a carbon constrained world	• The urban water industry consumes of lot of electricity in pumping and treating water and waste water. WSAA has calculated that the impact of the carbon tax is between $10 to $25 per household per annum • Operating in a carbon world has many challenges but also a number of opportunities such as generating renewable energy from mini-hydro schemes in water distribution systems. It is imperative that the water industry adapts to quickly to capture as many opportunities as possible
Skills shortage	• Competition from the mining industry for skilled staff combined with an ageing workforce in water utilities will result in a skills shortage unless resources are devoted to training

Report Outline

- Key Highlights
- Introduction
- Water Industry Overview and Current Situation
- Potable and Recycled Water
- **Wastewater**
- Stormwater and flood mitigation
- Irrigation

Metropolitan wastewater networks in NSW are managed by Sydney Water and Hunter Water and play an important role in protecting public health and the environment

Sydney Water Statistics [1]	Assets
Total length of sewers owned and operated by Sydney Water	23,817 km
Number of sewage pumping stations in service	674
Number of sewage treatment plants	29
Wastewater collected (includes discharge and bypass)	477,202 GL
Number of people with wastewater services	4,268,140
Properties with a sewer main available	1,706,758

Hunter Water Statistics [1]	Assets
Properties where sewer is available	219,764
Properties connected to sewer	211,015
Total sewer mains in service	4625.6 km
Length of sewer main per liable property	21.9 m
Number of sewage pumping stations	380
Number of wastewater treatment plants	18

Wastewater Management

There are three types of household wastewater;

- Blackwater is a highly infectious wastewater from toilets
- Greywater is from a hand basin, shower, laundry and kitchen and is less infectious
- Sewage is a combination of both blackwater and greywater and is very infectious

Wastewater may be disposed of in three ways:

- Centralised through sewerage pipes and treated at large sewage treatment plants. The treated water can be recycled (for washing, gardening, toilets, irrigation) or discharged to rivers and oceans
- De-centralised through sewerage pipes and treated at smaller local community sewage treatment plants
- On-site domestic systems where blackwater and greywater are treated separately and reused
- Wastewater for non-metropolitan areas is the responsibility of local government under the Local Government Act 1993

- Wastewater systems generally represent more than 50% of the costs of operating a water utility. This is largely due to more stringent environmental regulations relating to sewer overflows, odour and treated effluent discharge standard

[1] National Water Commission (2010) National Performance Report 2009-10 Urban Water Utilities

While there is no formal NSW Government sewerage strategy, there are a range of policy objectives that seek to reduce environmental damage and utilise wastewater as a resource

Wastewater Planning and Management [1]

- Recent years have seen increased efforts within the sectors regulatory controls to facilitate the production and use of recycled water, with the aim of reducing environmental damage from waste water
- A nationally consistent, integrated approach to the use of water from sewage, stormwater and greywater sources has been implemented through the *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks*
- The *Water Industry Competition Act 2006* encourages innovation in water recycling and creates a framework for third party access
- 2009 saw the issue of the first license under such a scheme to the AquaNet consortium to develop and operate the Rosehill Recycling Scheme who will provide 5 of Sydney's biggest industrial consumers of water with recycled water [2]

Wastewater Treatment [1]

- There are 2 metropolitan wastewater systems; Greater Sydney and the Lower Hunter region
- With a total of 47 sewage treatment plants
- Non metropolitan wastewater supply schemes are provided by the local government under the *Local Government Act 1993*, with a total of 280
- 95.3% [3] of the non metropolitan population now have access to wastewater services, an increase of 3% [4] since 1996 when the Country Towns Water Supply and Sewerage Program was introduced

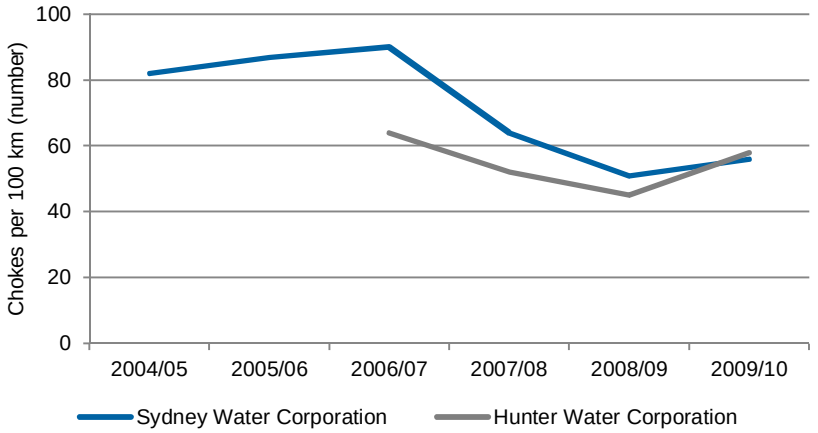
[1] Engineers Australia (2010) Infrastructure Report Card 2010 NSW
[2] Sydney Water (2011) http://www.sydneywater.com.au/majorprojects/WesternSydney/RosehillCameliaRecyclingWaterScheme.cfm
[3] NSW Office of Water (2011) http://www.water.nsw.gov.au/Urban-water/Local-water-utilities/default.aspx
[4] NSW Office of Water (2010) 2009/10 NSW Water Supply and Sewerage Performance Monitoring

Approximately 75% of blockages and chokes in Sydney are caused by tree roots

Condition Indicators for Wastewater Infrastructure [1]

- **Frequency of mains sewer blockages -** Typically caused by fats and tree roots, and can lead to sewage spills, particularly during heavy rains
- **Frequency of sewage spills -** Which occur when the sewerage system cannot contain the sewage flow, with the result that overflows or spills occur
- **Responsiveness to service failures -** notably sewer spills and chokes
- **Compliance with discharge licences**

Number of Chokes per 100 km of Sewer Main [2 3]



NSW

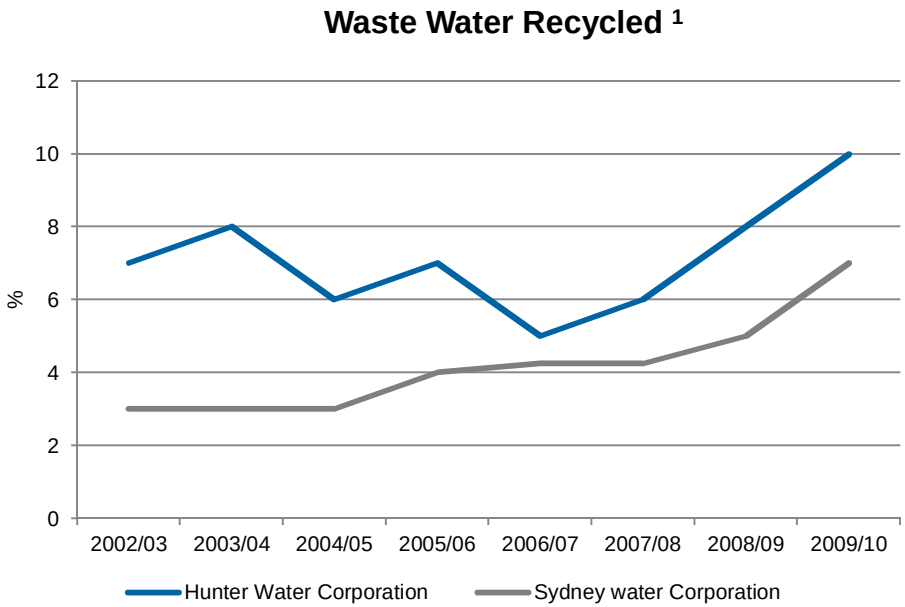
- Sydney Water has identified that 75% blockages and chokes in Sydney are caused by tree roots penetrating the physical infrastructure
- Such a phenomenon is more common in drought conditions as tree routes penetrate deeper into the ground

NSW Condition

- The spike in 2006/07 was at the height of the recent drought and would therefore provide some explanation as to the break in the downward trend
- Since then chokes per 100 km of sewer main have significantly decreased

[1] Engineers Australia (2010) Infrastructure Report Card 2010 NSW
[2] National Water Commission (2010) National Performance Report 2009-10 Urban Water Utilities
[3] Hunter Water (2010) Annual Report 2009/10

The proportion of waste water recycled is growing and whilst still small at present, presents an opportunity for water scarcity in the future, for Sydney in particular



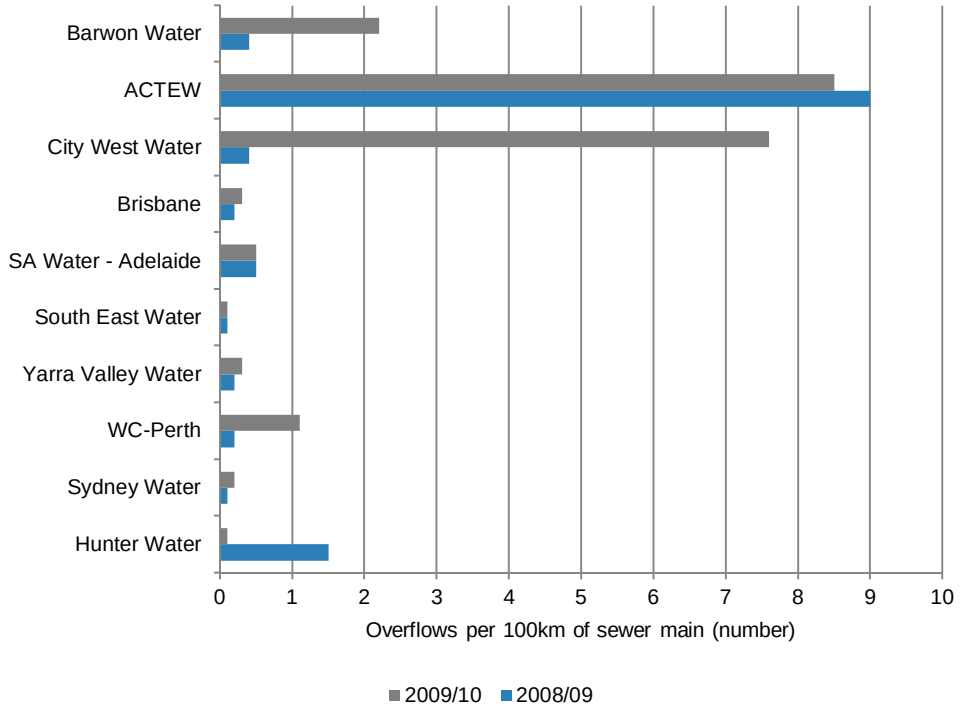
Wastewater Recycling

- Sydney Water's daily volume of wastewater is 1.2 GL, of this more than 26 ML is recycled this replaces water that would have been drawn from fresh sources
- Around 75% of wastewater is processed at Sydney Water's three largest sewage treatment plants – Malabar, North Head and Bondi
- Hunter Water provides wastewater services to almost 500,000 people in the Lower Hunter region
- Over the last few years, Hunter Water has also assumed responsibilities for operations in Dungog and parts of Singleton around Branxton to Whittingham

[1] NSW Office of Water (2011) 2009-10 NSW Water supply and sewerage Performance monitoring report

In 2009/10 Sydney Water and Hunter Water performed well in sewer main overflows in comparison to other waste water networks nationally

Number of Overflows per 100 km of Sewer Main [1]



Sewer Main Overflows

- Sydney Water saw an increase in overflows per 100 km of 0.1
- Hunter Water saw a significant decrease over this period of 1.4 overflows per 100 km of sewer main
- Compared nationally both entities performed well in comparison to other water suppliers in Australia
- It is worth noting that sewage overflows are more likely during or after heavy rain events [2]

[1] National Water Commission (2010) National Performance Report 2009-10 Urban Water Utilities
[2] Engineers Australia (2010) Infrastructure Report Card 2010 NSW

There are a number of key issues that warrant further investigation and discussion

Issue	Description

Growth in recycled water	• Specific planned or underway large recycled water projects include:
	  • Kooragang Industrial Water Scheme and the Vintage Recycled Water Scheme in Hunter Water area
	  • Rosehill, Camellia and Smithfield large industrial users, and large industrial users in Kurnell including Caltex and Continental Carbon, and schemes at Pennant Hills Golf Club and Kogarah Council

Addressing climate risks for sewerage infrastructure	• Climate variability impacts for sewerage infrastructure occur as a result of;
	  • Rising sea levels, which result in seawater ingress into sewerage networks, causing salt load increases in sewage, flow increases, and concrete corrosion
	  • Ongoing drought, which reduces the volume of flow, causing chokes and treatment challenges
	  • Intense rains, which cause capacity problems
	  • Rising temperatures, which can increase odour complaints
	  • Reduction in sewage flows
	• Both Sydney Water and Hunter Water are addressing these issues via their climate variability and sustainability strategies

Exploring opportunities to extract renewable energy from wastewater	• Wastewater treatment plants can produce sufficient bio gas to make them self sufficient in energy. As the price of energy increases the value of the bio gas also increases. Wastewater treatment plants should be optimised for bio gas production. Bio gas should be utilised for the most value added use • In the UK some water utilities run their car fleets on bio gas. The opportunity to generate green energy should be maximised
Expansion of the wastewater system to the new urban developments in Sydney's north west and south west growth centres	• Several areas in NSW are, or soon will be, provided with dual reticulation systems • Rouse Hill is Australia's largest residential recycled water scheme currently supplying 18,000 houses with the scheme eventually servicing 36,000 homes • On average, houses in the Rouse Hill scheme use 40% less potable water than the Sydney average

Report Outline

- Key Highlights
- Introduction
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- Potable and Recycled Water
- Wastewater
- **Stormwater and Flood Mitigation**
- Irrigation

Stormwater infrastructure includes the minor drainage system, major drainage paths and overland flow paths

Minor Drainage System

- The minor drainage system consists of kerbs and gutters, surface drains, underground pipes and drainage outlets
- The maximum capacity of minor drainage systems is based on the average 5-year recurring storm event (i.e. Average Recurrence Interval of 5 years)
- The key agencies responsible for building and maintaining minor drainage systems are predominantly local government and land developers, RailCorp and RTA
- The main evolution in management of the minor drainage system has been a focus on storm water retention/harvesting (instead of detention/discharge) and water sensitive urban design and storm water quality
- Significant problems remain in areas serviced by older stormwater systems, resulting in chronic localised flooding

Major Drainage Paths

- The major drainage system consists of river and creek systems, open channels, and overland floodways
- The infrastructure carries large volumes of water following the overflow of the minor drainage system preventing local flooding
- The maximum capacity of major drainage paths is based on the average 100-year recurring storm event (i.e. Average Recurrence Interval of 100 years)
- This standard was introduced after the 1974 Brisbane floods, it only applies to new dwellings
- Major floodwaters in major catchments and coastal areas include these major drainage paths but are larger scale
- The key agencies for building and maintaining these major drainage paths are local government however Sydney Water (443 km of channels [1]) and Hunter Water (93 km of trunk drains [2]) have a modest network of stormwater channels

[1] Sydney water (2011) http://www.sydneywater.com.au/AnnualReport/statutory_information/principal_statistics.html
[2] Hunter Water (2011) http://www.hunterwater.com.au/Water-and-Sewer/Stormwater/Our-Stormwater-Network.aspx

Recent flood events in Queensland have questioned current rules and provisions for flood mitigation and stormwater storage

Flood Mitigation Works

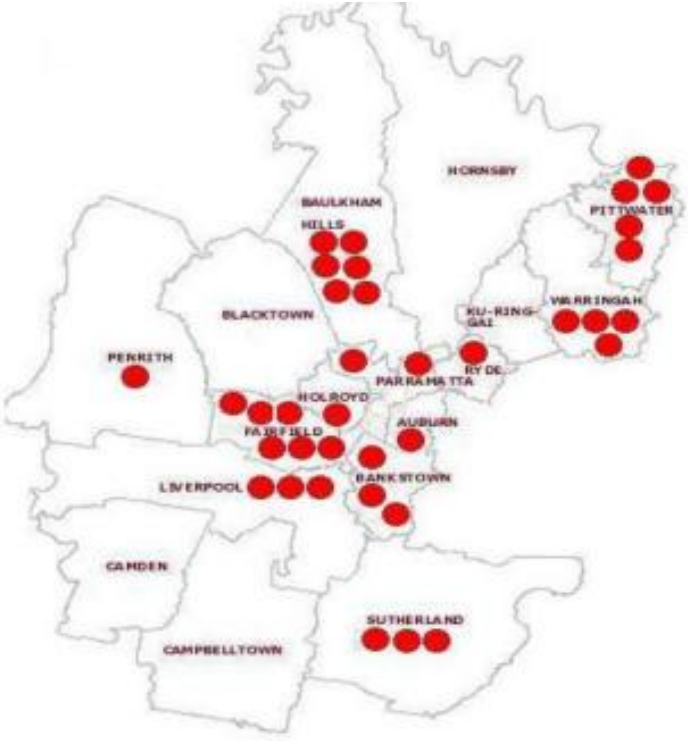
- Flood mitigation works involve maintenance of airspace in storages as well as levee banks along waterways
- Storages maintained by Sydney Catchment Authority, Hunter Water and Wyong Water, and State Water in the west of the State all play some role in flood mitigation. The recent floods in Qld have raised significant questions about the importance of ensuring that operating rules for storages make appropriate provisions for flood protection, especially in periods of high flood risk
- There is an extensive network of urban and rural flood levees throughout NSW managed by Local Government
- Significant investment has gone into upgrading levees protecting major regional centres such as Tamworth, Lismore and Grafton
- Many rural levees are deteriorating in condition, and there is a legacy of illegal levees in many areas which can result in increased risks of flooding

Programs

- The OEH is responsible for administering the NSW Government's Floodplain Management Program, a key component in the NSW Flood Prone Land Policy
- The program aims to provide appropriate levels of flood protection to existing and future development through structural and non-structural flood mitigation strategies
- Grants for maintenance of works by the NSW Government to local councils under this 2010/11 program, total $357,000
- Whilst NSW has been spared severe floods over the last decade of extended drought it should be remembered that floods cause greater loss of life and economic damage than wild fires
- Climate change predictions are for increased frequency and severity of flooding
- In coastal areas this will be exacerbated by increased sea level rises

Efforts have been made to address flooding risks and utilise stormwater as a resource in NSW

Outer Sydney Councils with Completed Floodplain Risk Management Plans [1]



Stormwater Use and Flood Planning [1]

Developments over the last decade that have led to an improvement in flood management have included;

- Flood Prone Land Policy
- Revision of Floodplain Development Manual to redefine 'flood prone' and 'flood liable' to cover all land between the 100-year flood level and the Probable Maximum Flood (PMF)
- Producing a series of Floodplain Risk Management documents
- State and Australian Government provision of funding and technical assistance to local government to prepare and implement floodplain risk management plans
- Local governments, Sydney Water Corp, Hunter Water Corp, and the Roads and Traffic Authority are also required to produce stormwater management plans
- Numerous stormwater harvesting schemes are in operation including Manly, Powells Creek, Richmond, Taronga Zoo
- Costs range from <$1/kL to >$10 kL

[1] Engineers Australia (2010) NSW Infrastructure Report Card

Quantitative assessment of stormwater asset condition is unlikely to provide the full picture of the current capacity and performance

- Condition assessments should assist long term planning covering aspects from capital investment and land use policy to maintenance practices. However these expectations are challenging for a number of reasons including;
  - Current rate capping conditions that exist in NSW
  - Asset management process is unlikely to involve detailed hydraulic and hydrological modelling and monitoring to assess actual performance of the stormwater system to cope with various rain events
  - Extent that systems can cope with anticipated changes in storm frequency and intensity as a result of increased forms of development (infill and greenfill) as well as climate variability
  - Implications for private and public property and community safety as a result of asset failure (that would extend to structural collapse and system failure under certain rain events)
  - Breadth of stormwater infrastructure that would be included as part of the asset review such as the landscape elements of water sensitive urban design features
- These broader factors should inform the analysis of the investment decisions required to more holistically manage urban water resources and particularly where decisions on the contribution of stormwater assets are seen as contributing to urban water investment and returns as part of any economic analysis [1]
- Some regions have undergone extensive flood impact studies ,such as the Hawkesbury – Nepean valley, to ensure the infrastructure is able to adequately cope with a 1 in 100,000 year flood event

[1] Stormwater NSW (2011) Submission to Australia's Urban Water Sector Productivity Commission

Harvesting stormwater for re-use is one of the many ways NSW is securing Sydney's water supply, however storage can be a challenge, particularly in urban areas

- Harvesting stormwater for re-use means collecting, treating, storing and using stormwater from urban areas. The stormwater is collected from stormwater drains or creeks, rather than roofs and is commonly used to water public parks and golf courses
- Harvested stormwater offers both a potential alternative water supply for non-drinking use and a way to further reduce stormwater pollution entering waterways. It is another aspect of sustainable water management, and is an important consideration in water sensitive urban design
- Benefits of harvesting stormwater for re-use include;
  - Reducing demand for high quality drinking water by replacing it with harvested stormwater
  - Reducing stress on urban streams and rivers by reducing stormwater flows
  - Enabling users to access an alternative source of water for non-drinking use
- Challenges associated with stormwater harvesting schemes include finding suitable storage sites in developed areas

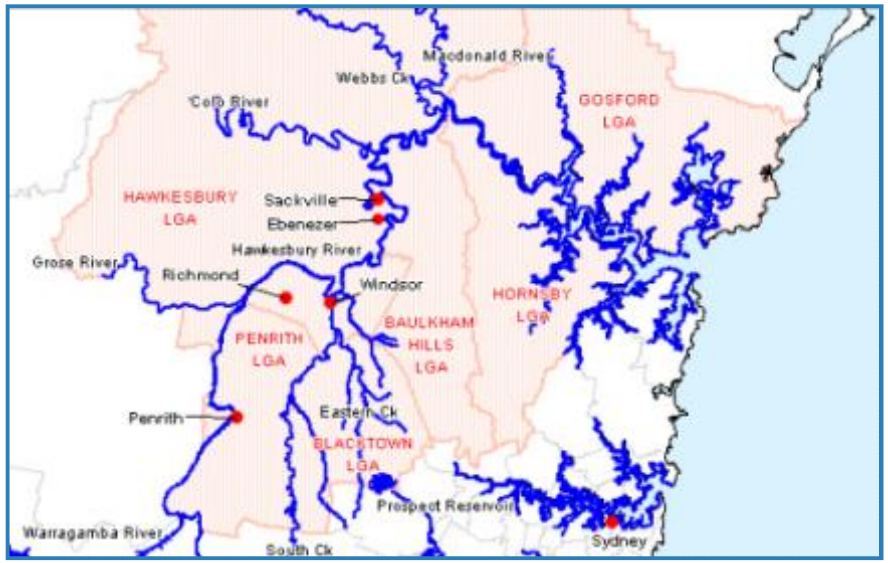
Indicative Performance for Stormwater Reuse Initiatives [1]

Indicator	Moderate Storage	Large Storage
Savings in drinking water supply through substitution with stormwater	2-35%	5-50%
Reduction in yearly amount of stormwater run-off	2-20%	2-40%
100 year ARI peak flow reduction	Negligible	Negligible
Three month ARI peak flow reduction	0-1%	1-2%
Reduction in yearly load of suspended solids discharged to receiving waterways	15-35%	60-90%

[1] Sydney Water (2011) www.sydneywater.com.au/Education/pdf/3-6-6-3-1WSUD.pdf

The Hawkesbury-Nepean Flood Emergency Sub Plan (HNFESP) is a critical part of the State Disaster Plan (DISPLAN)

Hawkesbury – Nepean Region



Flood Emergency Sub Plan [1]

- The Queensland Floods Commission of Inquiry (2011) will have impacts on:
  - The management of dam levels and associated flood mitigation procedures
  - Infrastructure for all jurisdictions in Australia
- The extent and complexity of operations under extreme flood events in the Hawkesbury-Nepean Valley dictate the need for special flood management arrangements. In order planning, capable of being effective in all circumstances, it must take into account worse case scenario floods
- The modelling for the probable maximum flood (PMF) in the Hawkesbury-Nepean Valley assumes; full storage at the Warragamba Dam, fully saturated (wet) catchment and 770 mm of rain across Warragamba catchment in a 72 hour period
- The resulting PMF is estimated to have one chance in 100,000 each year of occurring

[1] NSW SES (2006) Hawkesbury-Nepean Flood Emergency Sub Plan

Key issues for further discussion

Issue	Description
Providing appropriate stormwater infrastructure in all urban areas	• Many older urban areas do not have adequate stormwater drainage and protection from flooding
Securing a long-term funding mechanism that covers both upgrading and replacing stormwater infrastructure	• The current funding mechanism for stormwater does not provide sufficient funds to update and replace existing infrastructure, particularly in those areas that suffer from chronic flooding • A new funding mechanism is required to address this problem
Using stormwater as a resource	• Future approaches to water sensitive urban design will require further investment in capturing and storing stormwater
Impact on stormwater volumes arising from increased urban density	• With increasing urban density arising from the urban infill policy of the NSW Government, the number of impervious areas will also increase resulting in higher volumes of stormwater runoff with potential to overwhelm the existing infrastructure, such issues need to be given higher priority during project development • It also has the potential to erode waterways and destroy ecological habitats, as well as to increase the total volume of pollutants such as nutrients, sediment and litter, being carried into local waterways, ponds and lakes
Addressing climate risks	• Climate variability science indicates that there will be more extreme rainfall events, resulting in more frequent and more severe instances of overland flooding, particularly due to both the heavier rainfall and the large amount of blockage-causing debris that builds up during periods of low rainfall • Managing this risk involves identifying future rainfall patterns, locating areas that are vulnerable to overland flooding, and changing the design specifications of stormwater systems to accommodate the changed rainfall pattern
Management of dam levels in response to major storm events	• The Queensland Floods Commission of Inquiry (2011) will have significant impacts for the management of dam levels and associated flood mitigation procedures and infrastructure throughout Australia • The main recommendations to date are for better defined procedures for managing dam levels in the context of long range weather forecasts and major storm events. This is particularly relevant to Warragamba Dam in the Hawkesbury-Nepean Valley and the associated Hawkesbury-Nepean Flood Emergency Sub Plan (HNFESP) • A critical consideration is the extent to which the 'airspace' behind the dam wall is kept for a water resource as opposed to flood mitigation and the operating rules that should apply during periods of high flood risk

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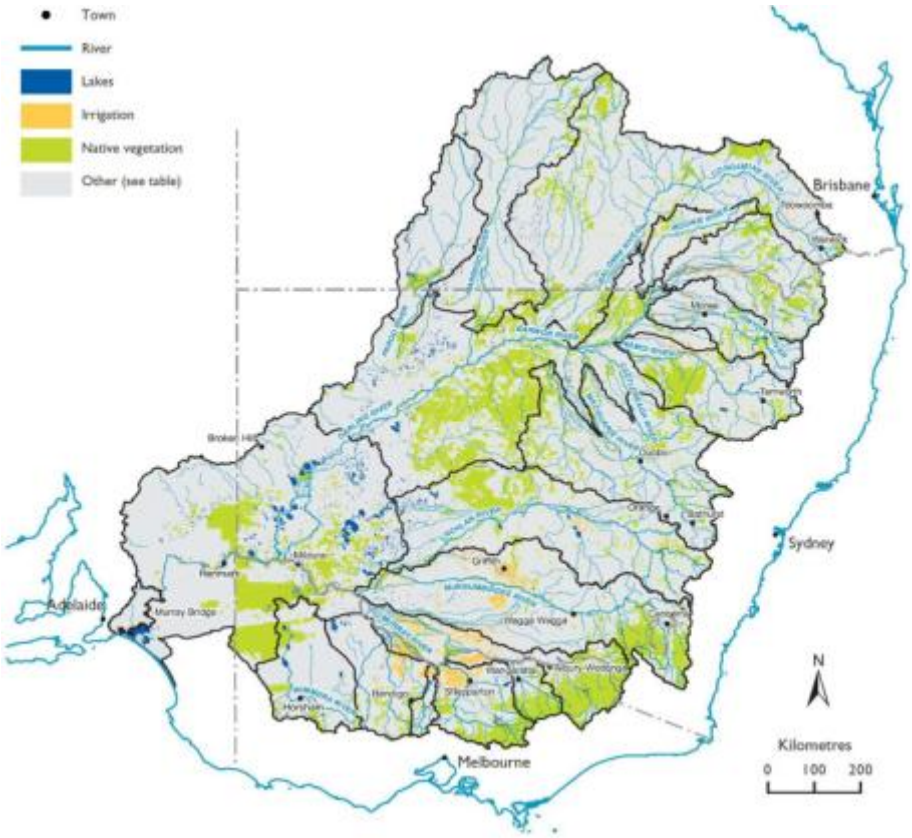
The major irrigation areas are located to the west of the divide, particularly, in the Murrumbidgee and Murray irrigation regions

Irrigation Regions in the Murray Darling Basin [1]



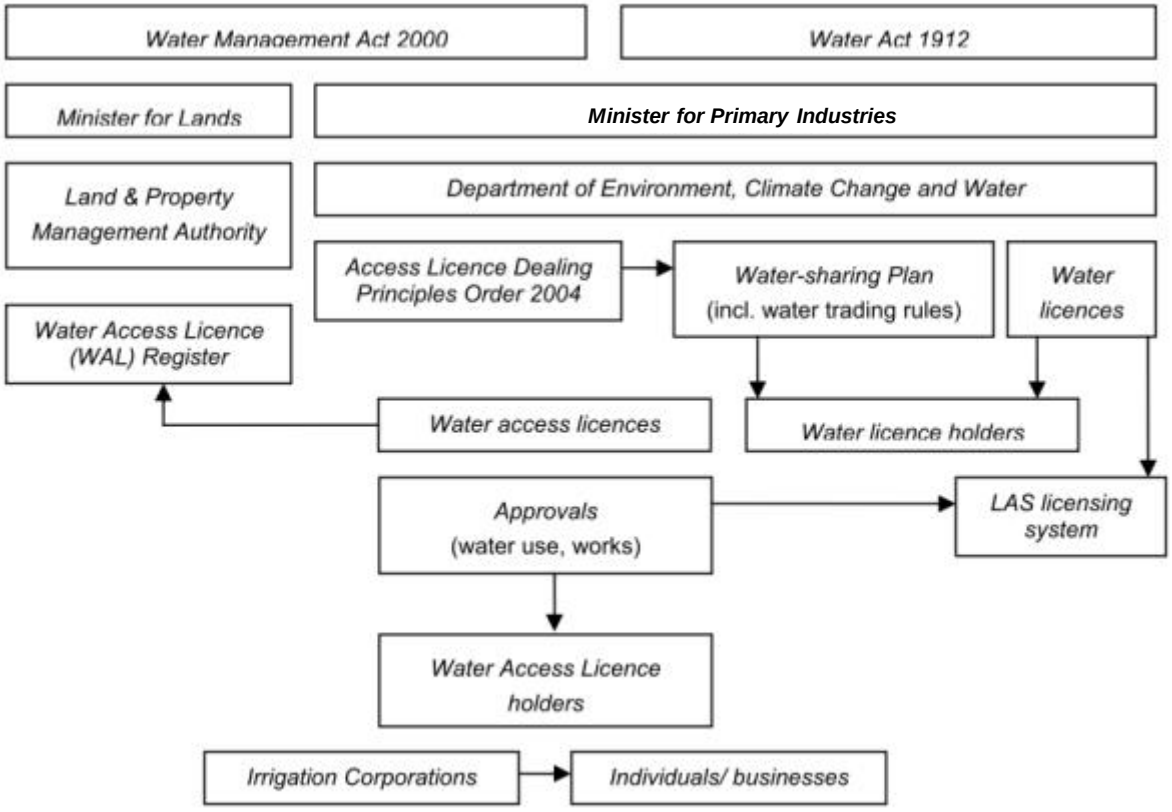
Irrigation Corporations

- A total of 939,000 ha of land, comprising over 11,000 properties, is irrigated in NSW with 4,300 GL of applied water generating about $3 billion in agricultural production
- NSW irrigation infrastructure comprises:
  - Water storages and weirs (managed by the State Water Corporation)
  - Constructed open channels
  - Natural streams
  - Pipelines, pumps, water meters
  - On-farm irrigation systems
- Between 1995 and 2001 the government schemes were consolidated into five state-owned corporations which were then privatised to form five irrigation corporations:
  - Coleambally Irrigation Cooperative Ltd
  - Jemalong Irrigation Ltd
  - Murray Irrigation Ltd
  - Murrumbidgee Irrigation Ltd
  - Western Murray Irrigation Ltd
- The key issue at the moment is modernisation of the state's irrigation schemes (such as improved metering, pipelining, channel lining and more efficient operations) to increase water efficiency
- Some of this infrastructure is being funded through the Commonwealth Water for the Future initiative

[1] Engineers Australia (2010) NSW Infrastructure Report Card

Planning and management of all surface water and groundwater in NSW is the responsibility of the NSW government

NSW Water Governance Arrangements [1]



[1] Auditor General (2007) Improving Efficiency of Irrigation Water Use on Farms

A third of State Water dams were built more than 50 years ago

Major Dams [1]

Blowering Dam, Tumut River (1968)
- 1,628,000 ML
- Rock fill with clay core

Brogo Dam, Brogo River (1976)
- 8,980 ML
- Concrete faced rock fill

Burrendong Dam, Macquarie River (1967)
- 1,188,000 ML
- Rock fill with clay core

Burrinjuck Dam, Murrumbidgee River (1928)
- 1,026,000 ML
- Concrete gravity

Carcoar Dam, Belubula River (1970)
- 35,800 ML
- Concrete arch

Chaffey Dam, Peel River (1979)
- 61,830 ML
- Rock fill with clay core

Copeton Dam, Gwydir River (1973)
- 1,364,000 ML
- Rock fill with clay core

Glenbawn Dam, Hunter River (1958)
- 749,840 ML
- Rock fill with clay core

Glennies Creek Dam (1983)
- 283,000 ML
- Concrete faced rock fill

Hume Dam, Murray River (1936)
- 3,038,000 ML
- Concrete gravity and 4 earth

Major Dams [1]

Keepit Dam, Namoi River (1960)
- 425,510 ML
- Mass concrete gravity dam with earth fill

Lostock Dam, Paterson River (1971)
- 20,000 ML
- Rock fill with clay core

Menindee Lakes, Darling River (1960)
- 1,682,000 ML
- Multiple weir and lake impoundments

Oberon Dam, Fish River (1946)
- 45,000 ML
- Concrete slab and buttress

Pindari Dam, Severn River (1969)
- 312,000 ML
- Concrete faced rock fill

Rydal Dam, Fish River (1957)
- 370 ML
- Earth fill

Split Rock Dam, Manilla River (1987)
- 397,370 ML
- Concrete-faced rock fill

Toonumbar Dam, Iron Pot Creek (1971)
- 11,000 ML
- Rock fill with clay core

Windamere Dam, Cudgegong River (1984)
- 368,120 ML
- Rock fill with clay core

Wyangala Dam, Lachlan River (1968)
- 1,220,000 ML
- Rock fill with clay core

[1] State Water (2011) www.statewater.com.au/Current+Projects/Dam+Safety+Upgrades

A key challenge will be funding the renewal of ageing infrastructure and utilising existing infrastructure more efficiently

It is necessary to upgrade seven major dams to ensure assets continue to operate in line with evolving international standards. The dam upgrades will ensure: [1]

- Dams can withstand extreme flooding
- Dams continue to comply with the NSW Dams Safety Committee standards
- Dams are managed in accordance with standards set by the Australian National Committee on Large Dams
- The highest levels of dam safety are maintained
- The latest developments in geotechnical and dam engineering are used
- Revised rainfall and extreme weather projections can be managed

The seven dams are:

- Keepit ($100m by 2012)
- Burrendong ($20m by 2014)
- Copeton ($50m by 2012)
- Split Rock ($10m by 2012)
- Wyangala ($25m by 2014)
- Chaffey ($56m by 2014)
- Hume ($60m by 2015)

Key Issues

- Dam safety rather than increased demand is the main driver of headworks capital investment
- Most catchments in the Murray-Darling Basin in NSW are considered fully developed and there is unlikely to be additional allocation of water for irrigation
- Under the proposed Murray Darling Basin Plan, sustainable diversion limits will require reductions in consumptive use, particularly for irrigation. Catchments likely to be subject to the biggest reductions include the Murrumbidgee and the Murray systems
- Accordingly there seems to be little prospect for augmentation of storages for irrigation use
- The NSW Government has indicated it will consider new dam building in country areas
- The gravity feed earthen channel systems are ageing and modernisation includes, rationalisation, pipelining, lining and telemetered automatic operation
- A key challenge for State Water is funding renewal of ageing infrastructure, particularly since State Water revenue base is low due to low rainfall
- Water prices in the rural sector struggle to cover O&M costs as well as depreciation on capital
- During the drought State Water has experienced reduced revenue through low allocation seasons

[1] State Water (2011) www.statewater.com.au/Water+Delivery/Dams

Modernising the state's irrigation schemes is aimed at improving irrigation efficiency to offset reductions in water allocations under the Basin Plan

Irrigation Modernisation Approaches

NSW Metering Project

Ultimately, the NSW Metering Project will see the installation of high accuracy, tamper proof and low maintenance meters across the NSW Murray-Darling Basin, benefits of the project will include:

- Improved water measurement accuracy that will save water
- Improved levels of service through real time scheduling and automated system operation
- Improvements to installation options and techniques
- Consistent metering
- Reduced meter reading operating costs
- Regional employment opportunities
- Improved water security and delivery

The On-Farm Irrigation Efficiency Program

This program is part of a national program of up to $300 million of funding for:

- Projects that will increase water use efficiency of irrigated agriculture in NSW
- Will be achieved by investing in improved management, information and technological farm infrastructure
- Will improve water use efficiency, water savings, and increase water-related productivity of irrigated farming eg through replacement of flood and furrow irrigation with drip irrigation and improved metering

Key issues for further discussion

Issue	Description
Increasing difficulty in getting value from infrastructure investment in irrigation infrastructure	• A 2010 Productivity Commission report found that Government-subsidised investment in irrigation infrastructure was not as cost-effective or efficient as water buybacks • The report found that for infrastructure projects financed under the Living Murray Initiative, resulted in the recovered water costing almost 40% more than water recovered by directly purchasing water entitlements • One of the reasons for this was that given the rising scarcity of water over the last few decades, irrigators had already undertaken those infrastructure modernisation projects that provided the greatest returns • From a state perspective buy back of irrigation water by the Commonwealth reduces the level of agricultural production and regional economic activity with flow on social costs to irrigation communities • Investment in water saving infrastructure on the other hand has the potential to save water for the environment whilst maintaining levels of agricultural production and regional jobs
Changing inflows as a result of climate variability	• Climate variability is expected to have a significant impact on the availability of surface water and, to a lesser extent, groundwater • Climate variability is likely to lead to increased average temperatures, which increases evaporation and transpiration rates, and to more variable rainfall patterns including droughts • Climate variability may also increase the frequency of bushfires that reduce runoff rates. Accordingly improvements in the efficiency of on-farm and off-farm irrigation infrastructure will be an important part of strategies to adapt to a future with less water
Improvements in irrigation infrastructure	• Irrigation infrastructure upgrades typically include lining channels, decommissioning channels, converting open channels into pipes, installing automated water management systems, and laser grading paddocks for efficient water spread • Given the increasing cost of water and its scarcity over the last decade, irrigators have had a strong incentive to invest in efficient infrastructure • With lower allocations over the last decade due to drought SWC has experienced impacts on revenues through water charge
Stress on water-dependent ecosystems	• The challenge in achieving improvements in irrigation infrastructure is adapting irrigation to the sustainable water supply • The Basin Plan is likely to recommend a reduction in consumptive water usage meaning that the volume of water available to irrigators will decline. This means that water efficiency needs to increase, water needs to be used on the most valuable agriculture produce • The water market is assisting in allowing water to move to higher value uses

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