Sydney WATER

Australia's Urban Water Sector

A submission to the Productivity Commission
November 2010

Introduction

Sydney Water welcomes the opportunity to participate in the Productivity Commission's Inquiry into the urban water sector.

This submission provides an overview of urban water provision in Sydney. It presents information on the industry that may not otherwise be readily available to the Commission, but which is important to understanding the issues facing the urban water sector and the potential for reform.

It also addresses some of the key questions posed in the Commission's Issues Paper. In particular it addresses:

- the opportunity for future efficiency gains
- consumption and pricing issues, and
- the scope for competition.

In 2008, the Managing Director of Sydney Water and two colleagues published an article, *Urban Water Reform: An Industry Perspective* in the *Australian Economic Review*. The article set out where the industry had come from and some of the issues for the future. Much of that paper is relevant to the questions posed in the Commission's Issues Paper and a copy is attached to this submission.

Contents

1 The urban water sector in Sydney

Sydney Water Corporation is the largest water utility in Australia, supplying water, wastewater, recycled water and some stormwater services to over four million people in the Sydney basin. Sydney Water's area of operations extends south including the Illawarra, west including the Blue Mountains, north to the Hawkesbury River and east to the Tasman Sea (see map overleaf).

The *Sydney Water Act 1994* established Sydney Water as a state-owned corporation. Sydney Water is overseen by a Board answerable to two NSW Government shareholder Ministers: the Treasurer and the Minister for Finance. A Portfolio Minister oversees Sydney Water's operational performance under the Act. The Managing Director, who sits on the Board, is responsible for the day-to-day management of Sydney Water. Under the Act, Sydney Water's three equally important objectives are to protect public health, to operate as a successful business and to protect the environment.

To achieve its objectives, Sydney Water has seven corporate goals:

- providing clean, safe drinking water
- helping develop a water efficient city
- contributing to clean beaches, oceans, rivers and harbours
- efficient resource use
- serving customers
- developing a safe, capable and committed workforce, and
- being an economically efficient business.

In accordance with the Act, the NSW Independent Pricing and Regulatory Tribunal (IPART) regulates Sydney Water under a five-year Operating Licence. IPART recommends the conditions of the Operating Licence (including Sydney Water's service standards and operational performance requirements) to the Portfolio Minister. The Minister can accept, or amend the content of the Operating Licence as recommended by IPART, before tabling the licence in the NSW Parliament.

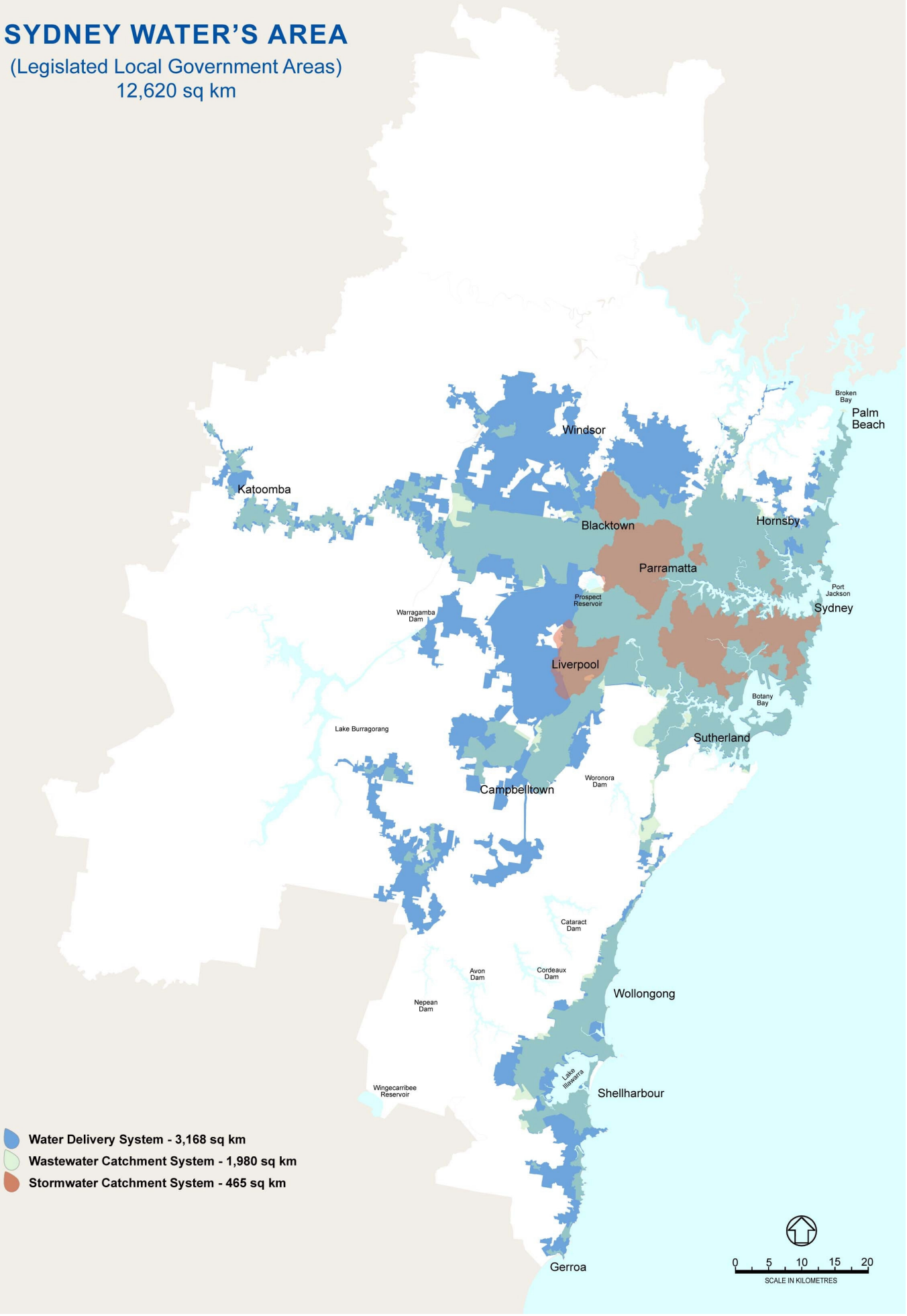
In Sydney, bulk water is separated from water treatment, distribution and retail, and wastewater treatment. The Sydney Catchment Authority (SCA) manages Sydney's storage dams, the main source of drinking water for the region. Sydney Water purchases bulk water from the SCA, and is its major customer. The largest storage is Warragamba Dam, which supplies water to about 80% of Sydney Water's customers. Sydney Desalination Plant Pty Ltd, a fully owned subsidiary of Sydney Water, also produces bulk water, which Sydney Water purchases and supplies to customers.

The price of bulk water supplied to Sydney Water by the SCA, and the prices Sydney Water charges retail customers, are set by IPART. Prices are generally reviewed every four years through a public submission process. IPART makes a price determination for the following four-year period. Prices can, however, be opened up for review at any time at the Government's direction. This is the cost per kilolitre of the most efficient option to augment the water supply. IPART sets the price for water by reference to its long run marginal cost. In its last pricing determination, IPART estimated a long run marginal cost of $1.93 (2008-09 dollars).

Major policy decisions regarding urban water management in the Sydney basin are determined on a whole-of-government basis, through the NSW Government's Metropolitan Water Plan. The Plan is overseen by the NSW Office of Water and outlines the government's long-term measures to secure Sydney's water supply. An independent expert panel, chaired by Chris Davis, reviews the Plan. The Plan includes measures to boost the water supply, and water efficiency and demand management initiatives, as well as ecological considerations, such as river health and environmental flows. Sydney Water comes under the umbrella of the Metropolitan Water Plan as a retailer of water and wastewater services.

SYDNEY WATER'S AREA

(Legislated Local Government Areas)
12,620 sq km



In 2006, the NSW Government introduced the *Water Industry Competition Act* (*WIC Act*). The WIC Act provides a right of access to Sydney Water's monopoly water transport infrastructure for new entrants to the market who wish to provide services. The Act also creates a licensing regime for private, non-potable recycled water services.

In January 2010, the Sydney desalination plant was completed and started supplying drinking water to Sydney households and businesses. Drinking water from the plant is transported to customers via a new 18-kilometre pipeline beneath the seabed in Botany Bay that connects the plant at Kurnell to the main Sydney Water distribution network.

The plant supplies up to 250 million litres of water per day, or up to 15% of Sydney's current water needs. In the event of a severe drought, the plant is designed to be quickly doubled in capacity.

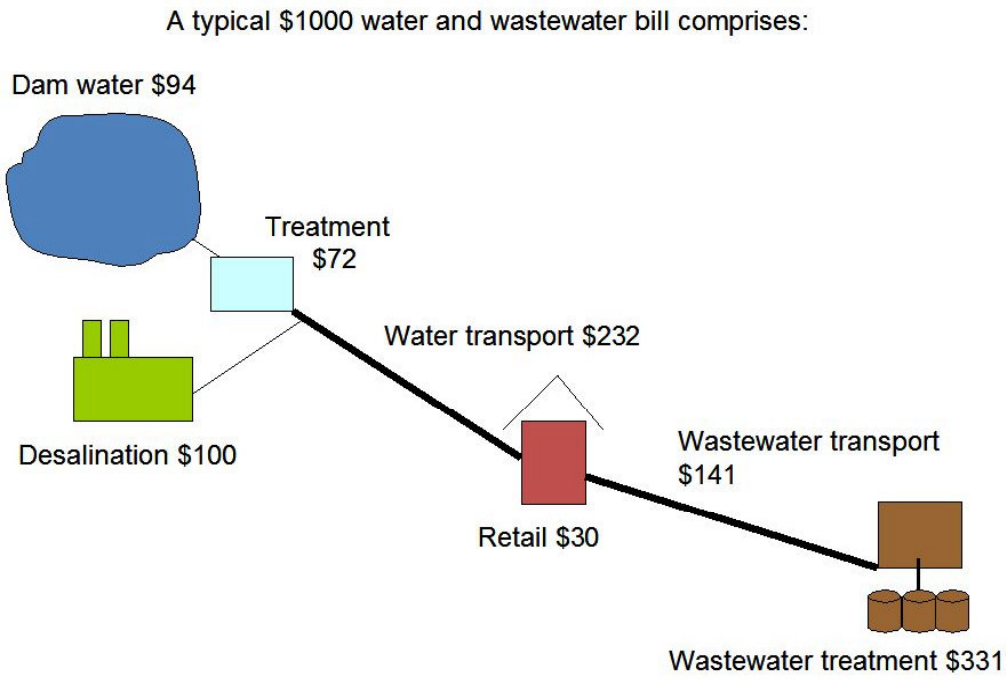
As specified in the Metropolitan Water Plan, the desalination plant will operate whenever total dam storage levels fall below 70% and will continue to operate until storage levels return to 80%.

Sydney Desalination Plant (SDP) Pty Ltd, a wholly owned subsidiary of Sydney Water, owns the plant. In August 2010, the Minister for Water granted SDP Pty Ltd a network operator licence and retail supplier licence under the WIC Act. Consistent with the vertical separation of bulk water supply, it is intended that the prices Sydney Water pays for water from SDP Pty Ltd will be regulated by IPART in the same way as the SCA's bulk water prices.

2 Supply of water and wastewater services

Nearly all the interest of policy makers outside the urban water industry is focused on bulk water supply and, in particular, on scarcity pricing. While this is not surprising given the major investments in securing the water supply over the last decade, it is important to understand that bulk water represents a relatively modest component of costs in the urban water industry. *Figure 1* below sets out the supply chain for water and wastewater. It splits up the costs of the industry by individual component, using the typical bill as a convenient metric.

Figure 1 The supply chain cost for urban water - Sydney



In Sydney, the bulk water component of the supply chain, including the full costs of the desalination plant and water treatment plants (which are privately owned and operated), constitute less than one-third of costs. Features of the supply chain costs that are not generally appreciated outside the industry are that:

- wastewater costs are half the total costs of the industry
- the transport component of the water and wastewater industry is just over a third of total costs
- the largest single cost component – and, in Sydney, larger than bulk water supply and treatment – is wastewater treatment, and
- the retail cost component of the industry is very small.

In future, the drivers of increasing costs in the water and wastewater industry will lie downstream of the bulk water supply as much as in the bulk water component. Three important drivers of costs in the network and wastewater components of the industry are catering for urban growth, energy issues, and wastewater treatment plant issues.

2.1 Urban growth

Sydney Water invests over $300 million a year, or 40% of its capital program, in providing services for a growing population. Greenfield development is proceeding in Sydney's North West and South West growth centres, and in West Dapto. Ultimately the North West and South West growth centres will each have a population the size of Canberra. Economically efficient provision of water and wastewater services is critical.

The centrepiece of Sydney Water's planning for growth is its Growth Servicing Plan. This annual plan provides a clear timetable for government and the development industry of where and when Sydney Water plans to provide urban growth services.

The key principle is timely delivery; a capital expenditure program that meets the needs of the industry and is economically efficient. Once planning and environmental approvals have been obtained, there is a 'hold point' in Sydney Water's planning process to ensure that projects only proceed to delivery where there is proven market demand.

The certainty provided by the Growth Servicing Plan allows developers to make informed decisions about their own projects and investments. This leads to efficient implementation and reduced delays.

The Department of Planning and the Urban Development Institute of Australia (UDIA) have nominated the plan as a best practice example of agency planning and servicing. The development community has also commented that the plan is a strong model, and has sought government support to introduce a similar approach to other infrastructure services.

It should be noted that access to water does not impose a constraint on population growth in Sydney. There is further scope to increase desalination and recycling to serve growth in coastal areas. As these are areas of high population density, providing these areas with desalinated or recycled water reduces the call on dam water, thereby effectively removing any constraint on the supply of bulk water to inland areas.

See *Box 1* below for a discussion on the need to avoid costs of amplification of Sydney Water's systems in urban infill growth areas.

Box 1 Infill and avoided costs

While government planning generally assumes that 30% of growth will be in greenfield areas and 70% will be infill.

Sydney Water's experience in recent years, however, indicates that greenfield development may account for closer to 20% of new growth, with up to 80% being accounted for by urban infill.

Generally Sydney Water's water, wastewater and in some areas stormwater systems have capacity to accommodate new infill development. In some areas though, there are capacity constraints. In these areas, the costs of system upgrades may be reduced.

These costs can be avoided through a range of potential measures, which may include: small-scale localised recycling units; innovative water efficient design; and stormwater detention.

Existing water saving regulatory measures such as BASIX and the national WELS scheme also contribute to avoided costs of urban infill development.

Another factor that may add to the need for system upgrades in existing areas, is the potential for residential development in odour 'buffer zones' around existing sewage treatment plants.

In such cases, Sydney Water may come under pressure to upgrade these plants including the installation of odour control technology.

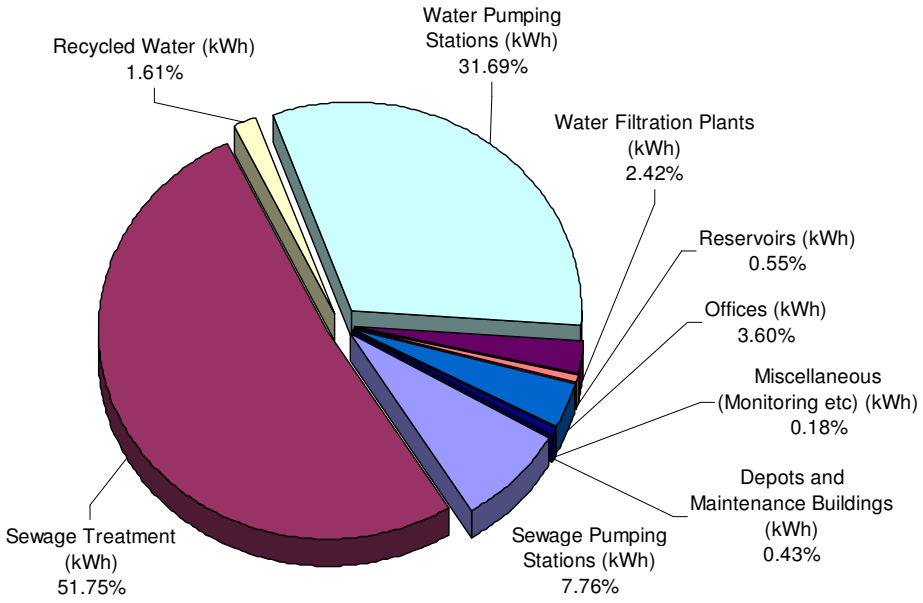
Refer *Section 2.3* of this submission below for further discussion of odour control issues.

2.2 Energy

Increasing energy costs is a major issue for the urban water sector. Desalination aside, wastewater treatment accounts for just over 50% of the energy used by Sydney Water. Water pumping accounts for another 30%. What makes the urban water industry unique, however, is that energy represents both a challenge and an opportunity.

It is a challenge because of the future scope for price rises, and an opportunity because there is significant energy embodied in wastewater, which can be used (and is being used) to generate power. See *Figure 2* below for a breakdown of Sydney Water's energy use.

Figure 2 Energy use within Sydney Water (excluding desalination)



2.3 Wastewater issues: bio-refinery and odour control

Bio-refinery is emerging as a key sustainable source of energy. Sydney Water has been quick to adopt this tool to harness energy from its processes and reduce reliance on fossil fuels.

Sydney Water now has eight cogeneration plants using biogas (a waste product of the wastewater treatment process) at sewage treatment plants. The cogeneration plants capture methane gas during the sludge digestion process, compress it and then use combustion technology to generate electricity. This offsets the electricity used to pump wastewater and operate mechanical equipment.

Sydney Water also has hydroelectric plants progressively coming online. These plants generate renewable energy from water passing through pipes. Together, hydroelectric and co-generation plants generate about 20% of Sydney Water's energy.

The hydroelectric generator at North Head Sewage Treatment Plant creates power from treated wastewater falling to an outfall – the first hydroelectric generator in the world to operate on treated effluent.

As energy prices rise, the opportunities for further energy recovery are likely to increase. Technological change is also adding to these opportunities.

Odour from wastewater treatment plants has traditionally been controlled by providing buffer zones around plants to a radius of, say, 400 metres. With the increasing density of development in cities, however, and with increases in capital city land values, there is now pressure to allow development within these odour buffer zones.

For this to occur, further investment in on-site odour control is often required. Odour control works generally involve covering the parts of the plant where particular processes are carried out. It often involves extracting the air and treating it to remove odorous components, for example using 'odour scrubbing' or biological processes.

Sydney Water has identified a number of plants with a high risk of odour impact on surrounding developments. These include Camden, Liverpool, Warriewood, Cronulla, North Head and Wollongong. Odour works were carried out at Warriewood at a cost of $14 million, prompted by pressure to develop land in the buffer area. Substantial expenditure will occur at Cronulla over the next two years for the same reason.

On a community-wide basis, investment in odour control may be appropriate as it allows valuable land to be brought into production or improves the amenity of the surrounding area. Opening up areas within treatment plant buffer zones could also facilitate the wider environmental benefits, in some cases, of infill development as opposed to greenfield development.

The immediate effect, however, could be to increase the energy requirements and hence the costs to the community of upgraded odour control for water utilities. Sydney Water has 29 wastewater treatment plants, many of them in built up areas, and the costs of upgrading all of these would be large.

Proposals for development within treatment plant buffer zones, therefore, need to be assessed on a risk-based, site-by-site basis.

3 The opportunity for efficiency gains

The Commission has posed the question: how great are the opportunities for efficiency gains in the urban water industry? Opportunities for efficiency gains in the water industry are likely to be similar in scale and scope as those in other capital-intensive infrastructure industries.

Major efficiency gains have been made over the last two decades, in the water industry in general, and in Sydney Water specifically. Gains have been notable in areas such as human resource management, capital works procurement and delivery, price reform, renewable energy use and energy efficiency, and the adoption of emerging technologies in water and wastewater treatment.

Emerging technologies, particularly in wastewater treatment, may result in future cost efficiencies. These may include the adoption of nano-technology and advanced microbiological processes in Sydney Water's treatment systems, improvements in nutrient capture from wastewater, and likely improvements over time in energy efficiency and energy recovery.

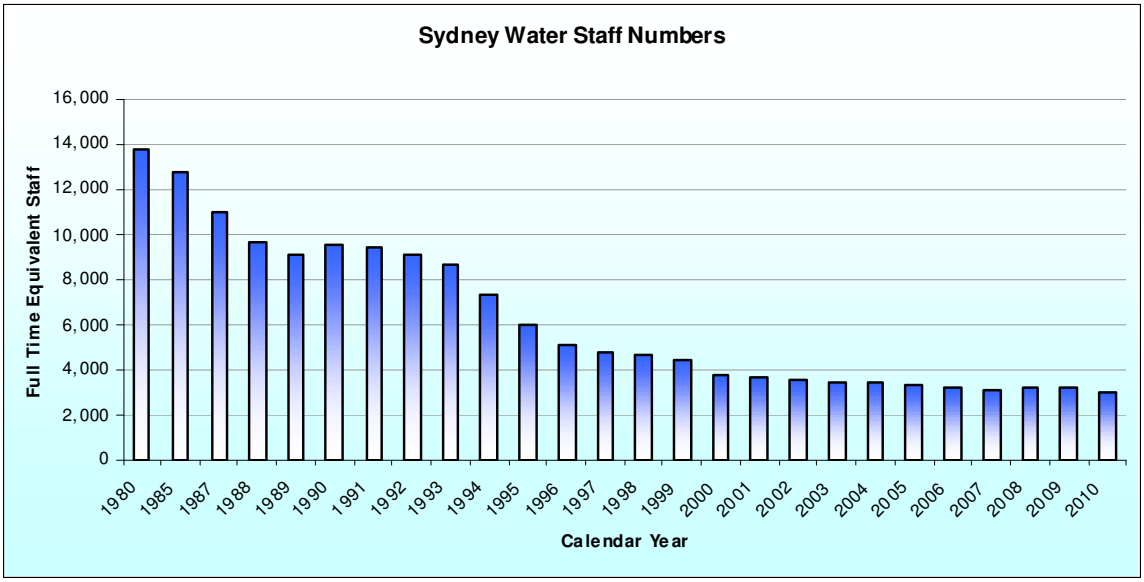
New technology aside, given the efficiency improvements since the early 1990s and the fixed cost nature of the industry, continuing gains in the water and wastewater industry will be incremental. There is reduced opportunity for step change or 'once in a generation' change, as many of the key step changes have already been made.

3.1 Efficiency gains over the last 20 years

Corporatisation in the late 1980s and early 1990s began a process of continuous improvement in the water industry. In NSW this is supported by a regulatory regime that involves efficiency reviews each price determination — usually every four years.

By way of illustration, in 1980 Sydney Water had nearly 14,000 staff. In 2009-10, Sydney Water had 2,987 staff (see *Figure 3* below).

Figure 3 Sydney Water staff numbers



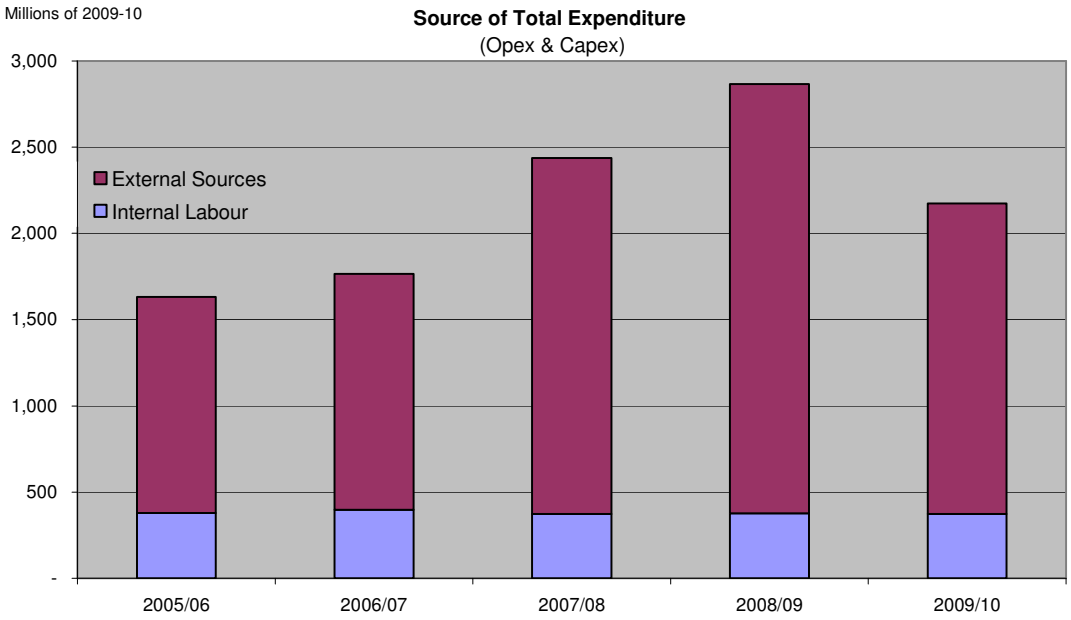
Some of the reduction in numbers was the elimination of excess staffing, rationalising non-core business activities and increased private sector involvement. Sydney Water makes extensive use of the private sector to deliver services.

Figure 4 below shows that in the past five years, over 80% of expenditure was delivered by external sources.

Major categories of expenditure delivered by the private sector through competitive processes are:

- all major capital projects
- water treatment services provided by the private sector under 'build, own, operate' contracts
- about $250 million of planned maintenance a year is delivered through alliance contracts
- the Gerringong/Gerroa wastewater treatment plant is operated by the private sector, and
- contracting for a wide range of services including meter reading.

Figure 4 Source of total expenditure



The core message is that while there may not be significant competition in the urban water and wastewater markets, Sydney Water makes extensive use of competitive forces to deliver efficient water and wastewater services.

3.2 An industry dominated by fixed costs

The second reason that the opportunity for efficiency gains is incremental is that the majority of costs in urban water are capital and capital-related costs. IPART, like most economic regulators in Australia, uses a building block approach to estimate the revenue required by a utility to cover its efficient costs. The costs comprise operating costs, a depreciation (or return of assets) and a return on assets. The return on assets represents the opportunity cost of investing in the water industry compared with other alternative investments.

IPART determined that Sydney Water required $2.3 billion in revenue in 2009-10 to cover its costs. Of this, about half ($1.2 billion) comprises a return on assets and depreciation (return of assets). In addition, a proportion of Sydney Water's operating costs are capital costs of other providers.

Purchases of bulk water from the SCA are nearly $200 million, of which 80% is fixed costs. Treatment costs for water purchased from the private operators are more than $120 million, of which 70% is fixed costs.

Overall, up to 65% of Sydney Water's costs are direct capital costs. They are functions of past investment decisions, but have been reviewed many times and found to be efficient.[1]

Of the remaining $500 million in operating costs, however, half is maintenance costs. Sydney Water has achieved gains in the *way* it performs maintenance, and will continue to do so in the future. The *level* of maintenance required is, however, for the most part, a function of the assets and the technology used over the last 100 years.

It is not efficient to prematurely replace capital to achieve small reductions in maintenance costs. Therefore a substantial component of maintenance is also a capital-related fixed cost that cannot be avoided.

Once this is taken into account, up to 75% of Sydney Water's costs are capital-related and largely fixed.

In Australia, the urban water sector is structured in many different ways ranging from vertical integration to full separation. The high degree of private sector involvement and the high proportion of fixed costs begin to answer the question of why no model is clearly superior in cost terms.

The organisational structure of a utility does not change its underlying cost structure. Whatever structure is adopted the key issue is providing utilities with incentives to continue to pursue efficiency gains and make the right investment decisions.

[1] *As discussed in section 4, the Regulatory Asset Base (RAB) is less than one half of the replacement cost (MEERA value). The 'line in the sand' was not the result of an optimised replacement cost calculation, rather it was the asset value that the then prices could support. Any optimised replacement cost valuation of the assets would be much higher than RAB value.*

4 Consumption and Pricing

The issues paper requests information on the future demand for water and factors affecting consumption. It also seeks views on the scope for more efficient pricing including scarcity pricing. This section addresses these issues. It first analyses historical trends as a starting point for assessing possible future outcomes.

4.1 Consumption

As well as changes to organisational resourcing and processes, there have also been substantial changes in the way customers consume water.

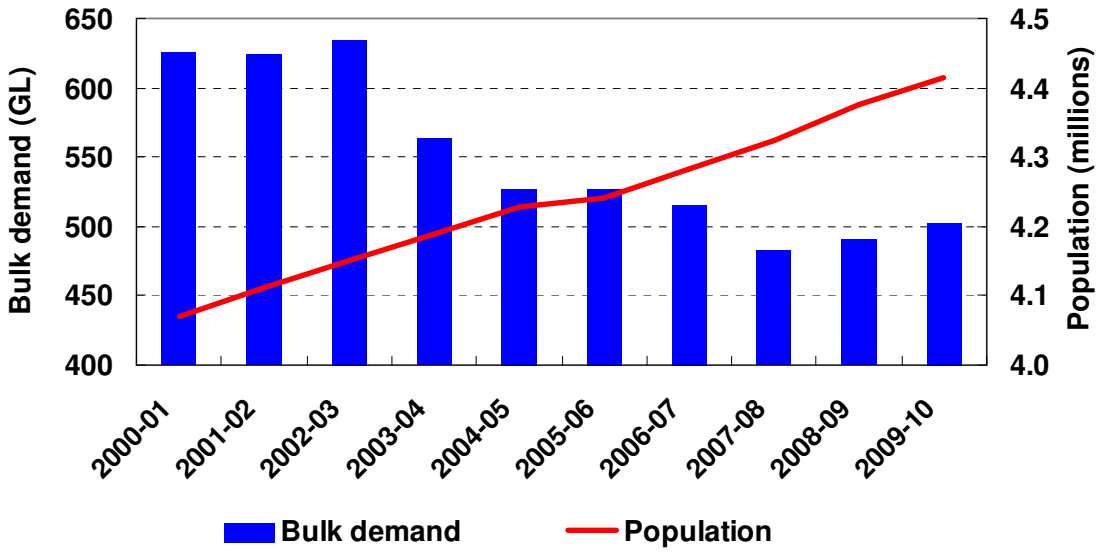
4.1.1 Bulk water demand

Sydney's total water use has declined by about 20% over the past 10 years, while the population has increased by about 10% (see *Figure 5* below).

Bulk demand in 2000-01 was around 625 GL (one GL is equal to one billion litres) with a population of just over 4 million.

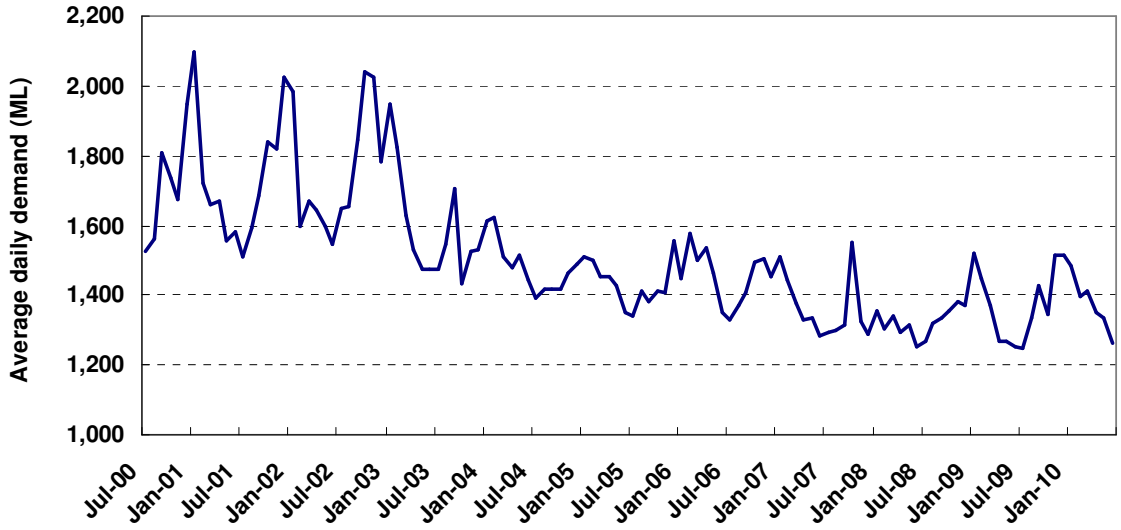
In 2009-10, bulk demand was around 125 GL less at 502 GL, with a population of around 4.4 million.

Figure 5 Bulk demand, 2000-01 to 2009-10



The trend in demand is characterised by a reduction in water use during both summer and winter (see *Figure 6* overleaf). In 2009-10 the percentage reduction in water use during summer and winter was largely equal at about 20% compared to the corresponding demand in 2000-01.

Figure 6 Average daily demand, July 2000 to June 2010

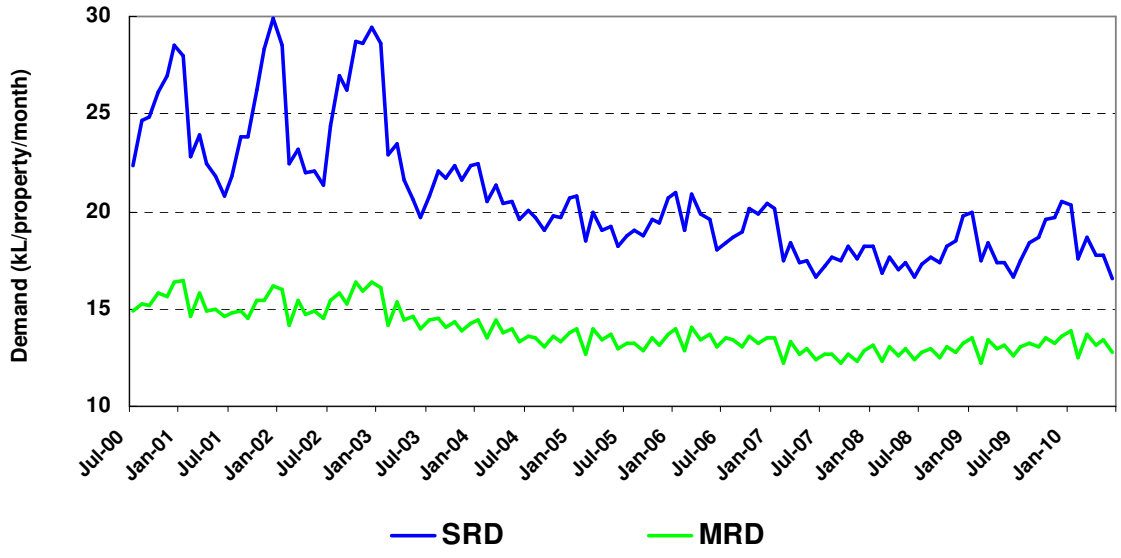


4.1.2 Metered residential demand

Residential demand accounts for approximately 65% of total water use. Of this, around 70% is used by single residential dwellings, consisting of detached and semi-detached houses. Almost all single residential dwellings have an individual water meter.

Multi residential dwellings include units, flats and townhouses and account for the remaining 30% of residential demand. Common meters, where one single meter serves an entire block of units, serve the majority of multi residential dwellings. Both single and multiple residential dwellings have reduced their average water use over the past 10 years by about one quarter and 14%, respectively (see *Figure 7* below).

Figure 7 Average monthly demand (kilolitres), SRDs and MRDs, July 2000 to June 2010

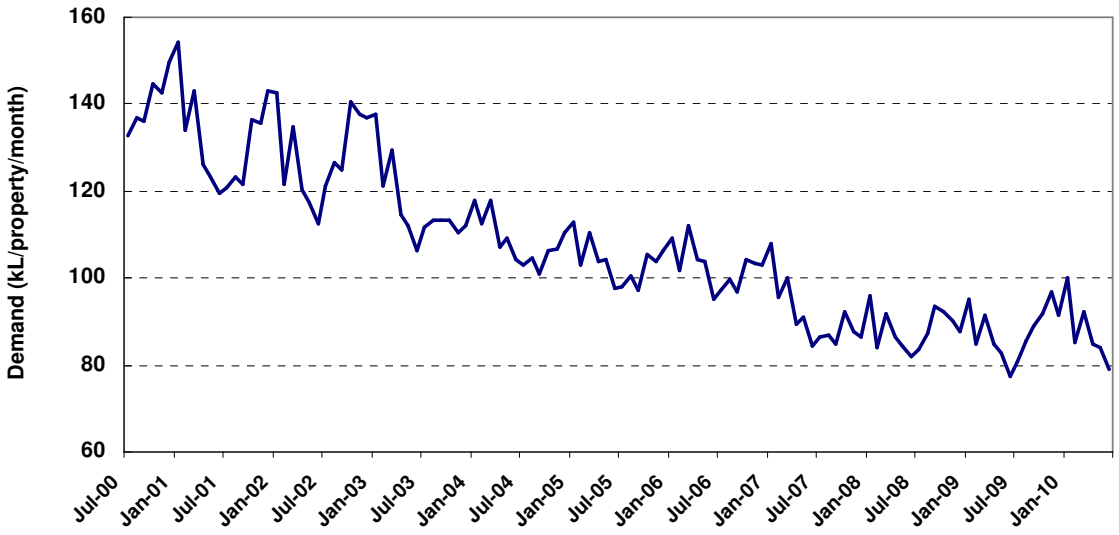


4.1.3 Metered non-residential consumption

The non-residential sector covers a wide variety of properties, including industrial factories and warehouses, retail businesses, schools, hospitals and government buildings. The non-residential sector in Sydney uses about 27% of total water use. The sector is characterised by a few, relatively large water users, such as food production businesses and raw materials manufacturers. The average water use by non-residential properties has fallen by around 35% over the last 10 years (see *Figure 8* below). A significant proportion of this reduction can be attributed to the large scale recycling schemes for industrial use.

The decline in manufacturing in the Sydney basin over a long period, along with increases in the services and transport sectors, have contributed to major reductions in non-residential water use.

Figure 8 Average monthly demand (kilolitres), non-residential properties, July 2000 to June 2010



4.1.4 How has the reduction in demand been achieved?

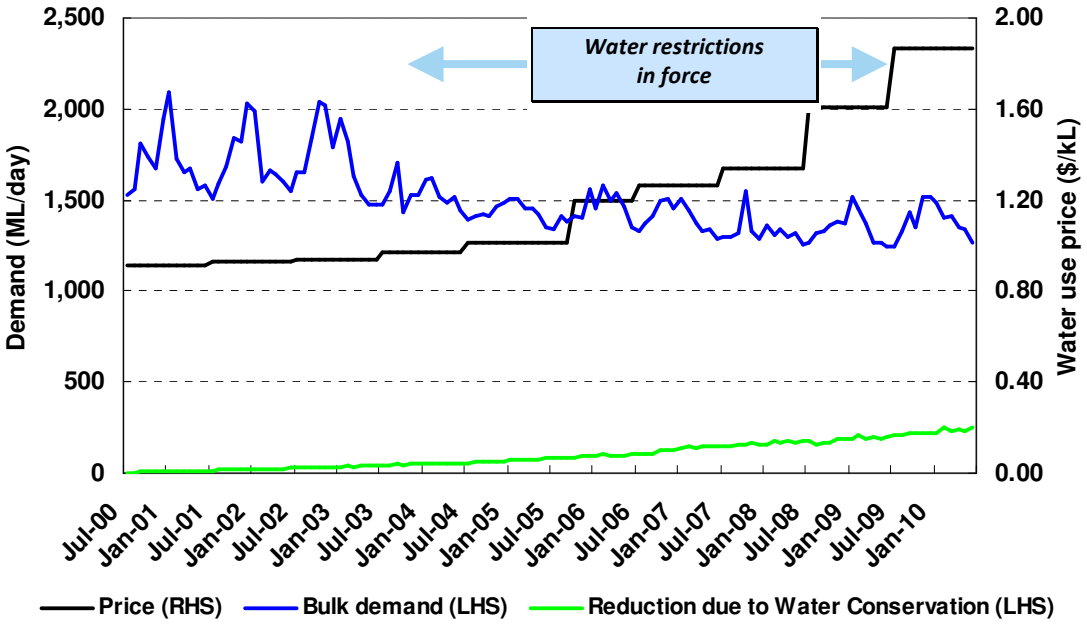
If demand had increased in line with population growth over the last 10 years it would have increased by around 50 GL. This means the total reduction in demand compared to that which could have occurred over the last 10 years is around 180 GL.

The overall reduction in demand can be attributed to four main factors:

1. water conservation activities, involving:
    - demand management programs
    - reducing leaks from the network
    - regulatory measures and planning requirements and promoting water efficient appliances, and
    - recycling.
2. mandatory drought restrictions on outdoor water use
3. peoples' choices about their indoor and outdoor water use, and
4. increases in water prices.

These factors are summarised in *Figure 9* overleaf, and explored in detail, along with some analysis of possible future trends, in *Appendix 1*.

Figure 9 Average monthly demand (kilolitres), non-residential properties, July 2000 to June 2010



Sydney Water estimates that around one half of the reduction (90 GL) can be attributed to water conservation activities. One quarter can be attributed to restrictions on outdoor water use. The other quarter is attributable to peoples' choices about their water use during severe and sustained drought. Preliminary results suggest that price increases implemented by IPART have, to-date, had little effect on demand.

4.1.5 Demand management programs

Demand management programs have demonstrated their ability to gradually improve the water efficiency of households and businesses over a sustained period. As such, they are more suited as an activity that would be undertaken independent of dam storage levels rather than after a severe and sustained drought had emerged.

The key requirement for any program is that it is subject to robust assessment of its effectiveness on a periodic basis. This requires both an accurate estimate of the reduction in water use per 'device' with realistic estimates of the additional activity due to the program. There is a danger that large scale demand management programs – especially those based around rebates for common indoor water appliances and rainwater tanks – become an exercise in wealth transfers rather than promoting the more efficient use of water.

4.1.6 Drought restrictions and overall demand

It is usually accepted that when drought restrictions are imposed in response to declining dam storage levels, the estimated reduction in demand represents curtailed outdoor water use. The main criticism levelled against drought restrictions is that they deny people the opportunity to choose how they reduce their water use.

It is clear that the community's response to severe and sustained drought was far more diverse than simply reducing outdoor water use. Indeed, it is likely that around half the estimated reduction in demand occurred indoors.

This outcome does not mean that drought restrictions did not impose considerable costs on those that valued highly their outdoor water use. However, it does mean that rather than assuming the total reduction in demand was outdoor, it is necessary to consider the costs and benefits of encouraging less water use indoors and drought restrictions separately.

4.2 Scarcity Pricing

The *Australian Economic Review* article discussed the growing debate about scarcity pricing – linking prices to dam storages to balance supply and demand. In summary it argued that:

- the scarcity pricing debate was essentially a debate about whether prices should be set according to short run marginal cost or long run marginal cost
- the demand for water was very inelastic and the price rises necessary to equate supply and demand could be very large, and
- more research, particularly on the elasticity of demand for water, was necessary before a credible proposal could be put to policy makers.

Since then there have been further calls for the introduction of scarcity pricing, including further work by the Productivity Commission and a paper from Infrastructure Australia. However, the debate has not been significantly advanced.

There is still an absence of detailed design work to demonstrate how scarcity pricing would work in practice. For example, would all households be given an allocation of water for essential purposes? If so, how much? And what would such a mechanism do to the scarcity price for the remaining volume?

Another area that requires close examination is the suggested link between scarcity pricing and efficient investment, particularly by the private sector. The suggestion that temporarily higher prices (of an unknown duration) will create an incentive for entry to the bulk water market needs to be thoroughly tested. While private sector involvement is extensive in the water industry, the private sector has not to date shown an appetite to accept significant demand risk.

Water utilities should not be seen as vested interests in this debate. Scarcity pricing is fully consistent with full cost recovery. Indeed linking prices inversely with storage levels could increase revenue stability for water businesses during drought. Rather, water utilities' reticence about scarcity pricing is that it has been put forward with little understanding of its impact on prices or on the community.

Before recommending scarcity pricing the Commission should undertake research on community attitudes to water. It is important that we understand whether the community regards water as a product like apples (where prices are subject to demand volatility) or as a product like health and education (which should be accessible regardless of ability to pay).

Recent Sydney Water research is summarised in *Box 2* on page 18. This research suggests that Sydney Water customers value stability in water pricing. The research also suggests that, given a choice between higher prices or drought restrictions during a future drought, customers may initially at least, have a preference for restrictions.

4.2.1 The price elasticity of demand for water in Sydney

For its part, Sydney Water is working on better understanding the elasticity of demand for water, and hopes to be able to release further work in the next few months.

IPART implemented the first of a series of increases in water prices on 1 October 2005, along with a second tier of usage prices for residential consumption above 400 kL per year. The only meaningful increases in water prices occurred during Level 3 drought restrictions - by 1 July 2009 the Tier 1 usage charge had increased by around 84% compared to that charged in September 2005.

One difficulty with measuring the impact of these price increases is that the potential role of price is understated because the elasticities were estimated when demand was subject to non-price restrictions.

Sydney Water has sought to estimate the response by residents to the increases in usage prices to better understand the likely price elasticity of demand. The analysis to date has focussed on those properties most likely to respond to an increase in water use prices, namely owner occupied houses with individual meters.[2]

Measuring the price elasticity of demand for water is difficult because of the variety of factors that have affected demand over time. Many current studies are likely to overstate the price elasticity of demand because model misspecification attributes observed reductions in demand to price increases when in fact the decrease was due to other reasons.

The initial analysis suggests that the increases in prices had a modest impact on the demand for water by owner occupied houses and less of an impact on rented houses. Very preliminary modelling suggests the price increases had little or no impact on the demand for water by units and flats. This difference is to be expected as most units and flats are served by common water meters with no individual water use charges levied on individual dwellings.

It should also be remembered that a proportion of total bulk demand (around 10 % for Sydney Water), including leakage and other sources of unmetered water, attracts no charge. Sydney Water will provide further detail on its findings to the Commission once the analysis is further developed.

However, it is important to note that overall demand patterns have changed little since the drought restrictions were lifted in June 2009. What was previously considered to be the 'restricted' level of demand at current prices now, in fact, constitutes the 'unrestricted' level of demand.

This may change in the future if people begin to use water in the way they did before restrictions were imposed but unless or until this occurs, the price elasticities estimated during restrictions continue to be relevant to current levels of demand.

More broadly, the level of water efficiency achieved by the community limits the effectiveness of any measures – price or non-price – to manage demand during drought. Water restrictions would be unlikely to yield the same level of savings as they did during the previous drought. Similarly, prices would need to rise significantly to materially reduce demand. In both cases this is because the level of discretionary water use has been significantly reduced.

Sydney Water conducts regular consumer research about attitudes to water. Historically, the cost of water has not been a major concern for most customers. This is changing with recent increases in water and energy prices. The number of Sydney Water customers seeking financial assistance has grown by more than 20% in the past two years.

There is now increasing interest amongst consumers in alternative pricing options that would allow them to better manage the cost of water by choosing how and when it is used. Despite this interest in individual choice, one of the strongest results from the consumer research is the support for uniform based pricing.

Consumers expressed the view that water is a basic social right and strongly supported postage stamp pricing - even in areas where prices would decrease under area-based differential pricing.

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[2] *Sydney Water is working with Dr Vasilis Sarafidis, Lecturer of Econometrics, Faculty of Economics and Business, University of Sydney to estimate the short and long run residential price elasticity of demand.*

Box 2 Analysis of customer surveys

Sydney Water conducts regular customer sentiment monitoring, in order to determine customer needs, values and expectations. Recent research shows that Sydney Water customers value stability in water pricing. The research suggests that in a future drought, faced with a direct choice between drought restrictions or water price rises, customers may be more likely to opt for restrictions.

Customer relationships with Sydney Water

A 2010 customer relationship survey indicated that 'value for money' is emerging as a key driver of customer perceptions of Sydney Water and its services. The research also indicates that customers are also increasingly focused on the importance of water efficiency – by individuals and by Sydney Water. The cost of water is one of the drivers of this trend.

Importantly, the research demonstrates that the perception customers have regarding the 'value for money' of services, is influential in relation to perceptions of Sydney Water as a whole.

Sydney has only recently emerged from a long period of mandatory water restrictions, from 2003 to 2009. During this time, higher water prices were set by IPART. A significant proportion of those increases were invested in new supply infrastructure – such as the desalination plant and large-scale recycling schemes.

With most of these projects now up and running, and with mandatory restrictions no longer in force, an important question that arises is whether customers are willing to pay more to forgo future water restrictions.

It should be noted that demand for water in Sydney reduced from 534 litres per person, per day, in 2002-03, the last full year before the introduction of mandatory restrictions – down to 309 litres per person per day in 2008-09. This positive response may indicate that Sydney residents are not overly concerned about the potential reintroduction of water restrictions in a future drought.

As demand for water appears to be considerably price-inelastic, and bearing in mind rising community concern about the cost of living in general, some customers may be less concerned about water saving activities than they would be about significant water bill rises.

Potentially, given a choice between water restrictions, or price rises, the water saving efforts of customers during the last drought – which equated to around 30 litres per person, per day – shows that some customer segments may prefer to save water through restrictions rather than pay more for water.

Customer values and sensitivity to the price of water

Research into 'customer values', also conducted in 2010, sheds some light on the services customers expect to receive for the price they pay for water. The research finds that Sydney Water's customer base can be broken down into a number of broad segments, with varying attitudes towards the need for price stability.

The research indicates that around 39% of customers can be categorised as having basic expectations focused on Sydney Water's core services – that is, they would like Sydney Water to provide reliable and well-maintained water and wastewater services.

A further 36% of customers place a high value on water efficiency – either through active water conservation on an individual level, or through the take-up of Sydney Water products such as water efficiency rebates. Cost is one of the key drivers of this interest in saving water.

The two groups mentioned above, with basic expectations and/or with an interest in saving water because of the financial incentives, may prefer drought restrictions rather than price rises.

The research also found that around 25% of customers are less concerned with the cost of water, and would like to see the active promotion of new and expanded sustainability initiatives, water saving offers and community educational programs.

Given the sustainability focus of this segment, if faced with a choice between water restrictions or price rises, it is possible that some members of this segment would opt, initially at least, for water restrictions.

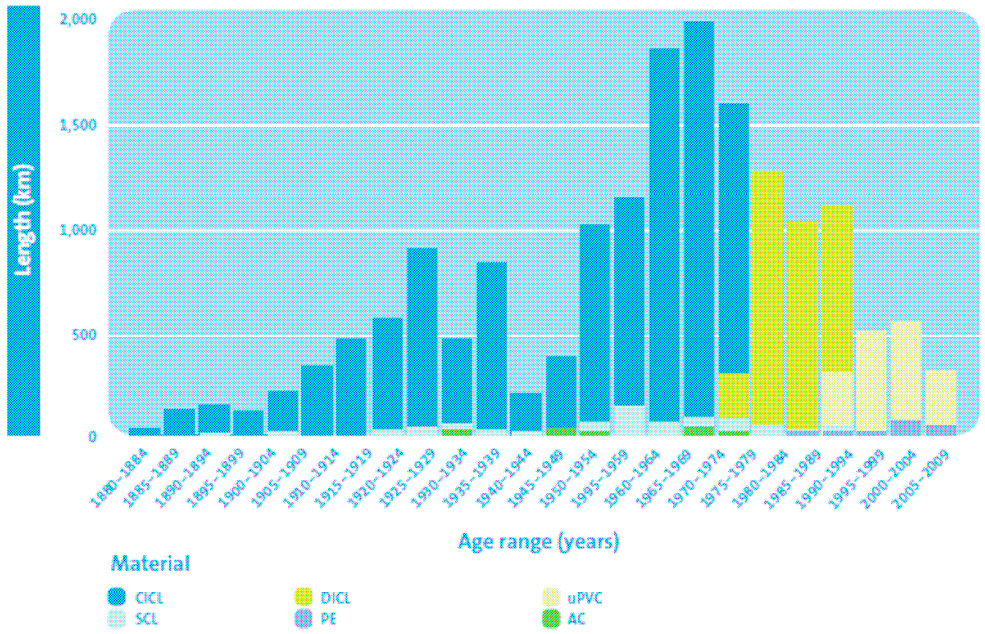
Further research would be necessary to more specifically identify customer preferences among water saving measures and tools in a future drought.

4.3 Intergenerational impacts on prices

Intergenerational issues in the water industry are exerting pressure on prices. The water industry is both capital intensive (see *Section 3* of this report above) and most critical assets are very long-lived. Assets constructed up to 100 years ago are still being used today. Warragamba Dam – which provides the majority of Sydney's water supply – is now 50 years old.

See *Figure 10* below, which provides an overview of the changing age profile of Sydney Water's assets over time.

Figure 10 Age and material profile of water main assets



But funding arrangements in the past were different. Until the 1980s assets were funded from a combination of capital works budgets, Commonwealth grants or through rates from property taxes.

In many cities in Australia this has led to a situation where previous generations paid for many of the assets the current generation uses. The flipside is that the current generation has not been paying a full price for the assets it uses. Regulators set prices based on an asset base that is a small proportion of the replacement cost of the total assets water utilities manage.

This phenomenon finds expression in the regulatory system in regulators drawing 'a line in the sand'. This is the practice of creating an asset base for the water industry not based on the optimised replacement value of assets under management, but on the value that prices can sustain.

In Sydney Water's case the line in the sand occurred in 2000. The value of assets for regulatory purposes (around $13 billion) is well under half the depreciated replacement cost of the assets (over $30 billion).

There are arguments for and against the regulatory approach of drawing this 'line in the sand'. On the one hand, a logical argument that can be made, is that it is not appropriate to charge for assets that have already been paid for by previous generations. This argument, however, raises a number of interesting economic issues that will need to be addressed in the longer term.

First, prices naturally rise over time as the current generation relies less on the efforts of the contributions of past generations. The regulatory mechanism to provide for this is that capital expenditure to renew and replace existing assets is greater than the level of deemed regulatory depreciation. Over time the asset base on which prices are set will grow.

This pressure for price increases will be present no matter what the future structure of the water industry, reflecting the importance of intergenerational effects on the future cost structure and efficiency of the water industry. Policy makers must understand these effects when reviewing the performance of the industry.

Second, what does the line in the sand imply for allocative efficiency? If prices are less than half that implied by the optimised replacement value of assets, what incentives for investment does this create? The line in the sand may constitute a barrier to entry in the urban water industry that will need to be addressed if water or wastewater markets are to develop.

5 Competition and contestability

Many policy makers have called for increased competition in the water industry. The scope for, and approach to implementing, competition will be major subjects in the Commission's inquiry. In the *Australian Economic Review* article we drew attention to features of the water market that made competition more difficult to implement than in industries such as electricity. In summary these are:

- the relatively high transport costs of water compared to electricity and gas
- large cost differentials between different sources of supply, and
- the need to develop a market for water security as well as water supply if private investment is to be attracted and there is to be competition in bulk water supply.

In the United Kingdom, steps are being taken to introduce retail competition. While retail is a contestable part of the supply chain, it is also the smallest. Competition in bulk water is likely to be the focus of analysis in the current inquiries, and in particular what institutional change would be necessary to support competition.

Sydney Water considers that a market for water security will be a necessary element of any bulk water arrangements in addition to the market for the supply of water.

Legislative barriers to competition have been removed across Sydney, the Illawarra, and the Hunter region with the introduction of the *Water Industry Competition Act 2006*. The Act provides an access regime for water and wastewater and a licensing regime for water, wastewater and recycled water. To date no applicants have sought to use the access to provide competitive services.

This is not to say that new players are not entering the market. The majority of licences granted so far have been for small, decentralised schemes, servicing a single building or development.

For example, the high-rise development at 1 Bligh St Sydney will take wastewater from Sydney Water's transport network under a sewer mining agreement, then recycle it for use in toilet flushing and cooling towers within the building. Nearby at Darling Walk, a similar development will also use recycled water for garden irrigation.

This trend towards local schemes and decentralised servicing solutions, facilitated by the WIC Act reforms, is likely to continue, with various licence applications currently being assessed to provide water services in developments on the urban fringes. New BASIX requirements to significantly reduce potable water use in new dwellings are driving an increase in recycled water provision.

The new competition framework has also seen the emergence of an industrial recycling scheme in Sydney's west. The Camellia-Rosehill scheme will provide recycled water to six industrial customers, in competition with Sydney Water's potable water service. The recycled water will be used for industrial processes, wash-down, fire fighting and washing machines as well as cooling towers, toilet flushing and irrigation.

6 Tools and options for achieving reform

The focus of Sydney Water's submission is on providing data that is important to the Productivity Commission's task. However the following comments are offered on the regulatory system and planning.

6.1 Appropriate regulation

The major investments in augmenting the water supply over the last few years clearly demonstrate the need to have economic regulators that are independent of government and political processes.

Increased investment (whether driven by water security requirements or any other pertinent factors) requires prices to rise, and in the past, political considerations have constrained this process. Prices should be set independently of the political process. Independent economic regulation is critical to ensure the 1994 COAG-endorsed principle of full cost recovery is maintained, and to assure the community it is receiving value for money.

The NSW Independent Pricing and Regulatory Tribunal (IPART) has determined Sydney Water's prices since 2000. Other jurisdictions such as South Australia and Western Australia have recently also moved to more independent regulation.

As we noted in 2008, however, full cost recovery was a challenge in some jurisdictions and this remains the case. Irrespective of the structure of prices, recovery of the full costs of infrastructure from the community benefiting from that infrastructure is a threshold test for the efficiency of major investments.

Beyond economic regulation, the water industry is also regulated to ensure appropriate health and environmental outcomes for the community. On the one hand, regulation and recognition of environmental factors in the policy mix, is essential to ensure healthy waterways and a healthy river system, and a clean environment for the community to live in.

On the other hand, particularly at a time when utility bills are increasing, it is important to ensure that the regulatory effort is co-ordinated. In particular, there needs to be an economic assessment of environmental standards to ensure the community receives value for money and understands the nature of cost/environmental trade-offs.

Essentially, the costs of environmental initiatives need to be balanced with the cost of the desired environmental outcome. This ensures good environmental policy, managed in an economical way, providing value for money to communities. Environmental cost/benefit frameworks are still developing in most jurisdictions, and it is an area where the Productivity Commission could make an important contribution.

In terms of the broader policy mix, in striking a balance between options to secure the water supply while improving the environment, the Metropolitan Water Plan recognises the need to optimise environmental outcomes. This is discussed further in section 6.2 below.

6.2 Whole-of-government planning

The responsibility for planning augmentation to the water supply lies with the NSW Government and is delivered through the Metropolitan Water Plan. The Plan includes a portfolio of options to secure Sydney's water supply into the future. The portfolio includes the storage dams, desalination, recycling and water efficiency, and the options selected have been tested against a hypothetical future drought more than twice as bad as any recorded drought in Sydney's history.

The portfolio of options included in the mix not only secure the water supply for the Sydney community, they also provide for environmental benefits, such as river health. The Plan has been developed using an adaptive management approach, which allows for the portfolio of options to be reviewed and improved over time, to respond to changing circumstances.

In establishing a portfolio of measures, the Plan has also taken into account the costs and benefits of the options adopted.

The regimes for planning augmentation to the water supply are evolving in response to the emergence of non-rainfall dependent water supplies. Previously, dams needed to be built many years in advance of need. In contrast, desalination plants, water efficiency measures, and recycling schemes, can be developed more quickly. This provides more scope to optimise investments, but also greater complexity.

Water planning should, and is moving into the realm of portfolio choice theory. Each new source of water and each new conservation measure, has different characteristics in terms of volume, price and reliability.

The challenge is to develop the least-cost portfolio to equate demand and supply, at an acceptable degree of water security. Over time new institutions may be necessary to perform this more complex planning function. The Productivity Commission could consider what structures are appropriate.

For example, the Metropolitan Water Plan is updated regularly, incorporates community input and is reviewed by an Independent Expert Panel. Although water utilities have input, the Plan is developed under a whole of government approach.

The adaptive management approach in the Plan is practical, but further consideration of the theoretical basis behind a portfolio approach may provide more definition.

6.3 Planning by agency

While whole-of-government planning is co-ordinated by the NSW Office of Water through the Metropolitan Water Plan, a level of water efficiency planning occurs within Sydney Water, regarding operational matters directly under its control.

Most notably, Sydney Water's discretionary role in investment in water efficiency occurs in the asset management, maintenance and leak reduction areas.

Sydney Water's decisions on investment in system maintenance and water efficiency, are:

- made with reference to the long run marginal cost of individual programs
- in discussion with IPART, when determining expenditure and revenue levels as part of the pricing determination process, and
- balanced by Sydney Water's regulatory water saving targets, in the Operating Licence.

It should be noted that the Operating Licence requires Sydney Water to manage leaks economically.

7 Skills and workforce strategy

Workforce issues are a particular focus for the water industry at the moment. The water industry in Australia currently employs over 80,000 people, but with expansion of the industry and an ageing workforce there will be demand for a further 40,000 new water workers by 2018.

The water industry is facing a skills shortage and Sydney Water is working with the Australian Water Association (AWA), the National Water Commission and other water organisations on the '*H_2Oz Careers In Water*' campaign. The aim of the campaign is to generate awareness of the employment opportunities in the water industry and the many different fields of work involved in the industry.

Sustainability features strongly in the campaign to provide a compelling argument for environmentally conscious people to join the sector. Through the H_2Oz website, potential employees can register for tailored job alerts and industry news, search for current job vacancies or submit a general application and be headhunted, learn about the Australian water industry and the job categories, qualifications and resources required.

Water is also an area being targeted by Government Skills Australia. An online directory of careers in the water industry has been developed in collaboration with the water industry.

Sydney Water has about 3,000 employees. One per cent of staff are eligible for retirement now. This will grow to about 4% a year over the next five years, increasing risks around critical knowledge retention. The retirement risk is greater with senior managers and technical specialists. Retirement is being delayed for now and turnover remains at a very low average level of 3%. Over one in four current staff joined Sydney Water in the last five years.

To manage these issues, Sydney Water has identified 162 opportunities to capture the knowledge of employees or to transfer it to other staff. Nine 'corporate critical' positions have been identified and risk management plans are being implemented to ensure business continuity.

Sydney Water is also building better career paths so staff can gain new skills and move up and across the organisation. About 9% of staff have been identified as potential talent who may be able to step up into a more complex job. Nine interlinked competency programs will cover most staff.

Five year strategic workforce plans have been developed for the different divisions of Sydney Water. These plans are produced by forecasting future trends in recruitment, turnover and retirement, identifying the issues, trends and risks affecting the business and then setting out how to respond to these risks. The plans are reviewed annually and tracked quarterly to ensure they are on track to produce the outcomes we need.

To recruit and retain talented staff at all ages and levels, a tailored program is in place. There is an annual internal talent review as part of the strategic workforce plan previously discussed. Talent is defined as staff having the ability, aspiration and engagement to succeed in a more senior role. Candidates are assessed and their retention risks identified and mitigated.

There is a particular focus on employer branding and innovative methods are used to capture the attention of potential external candidates and retain internal high-performing staff. The branding slogan '*Make a splash*', uses a matrix created from the drivers of attraction and retention identified by the Corporate Leadership Council, and does appear to inspire people.

On the positive side, the number of women working in the water industry has doubled over the past 20 years.

Appendix 1 Water conservation activities

1 Water conservation activities – past achievements and future outlook

Sydney Water has implemented one of the largest water conservation programs in the world at a cost of around $450 million. Over the last 10 years water conservation programs have reduced water use by around 90 GL (see *Table A* below). Sydney Water's activities account for over 80% of this reduction.

Table A Estimated reductions in water use from 1 July 2001, GL/year

	2001-02	2003-04	2005-06	2007-08	2009-10
Residential	1.0	2.6	6.3	13.6	14.5
Non-residential	0.7	4.3	8.1	20.3	24.2
Regulatory	0	0	0.4	4.6	13.8
Leak reduction	3.7	9.7	13.2	18.1	24.1
Recycling	0	2.7	4.1	11.4	12.4
TOTAL	**5.4**	**19.4**	**32.2**	**68.1**	**89.1**

Notes: Represents additional reductions in water use from 1 July 2001. As such, the savings reported in each year are less than those in Sydney Water's 2009-10 Water Conservation and Recycling Implementation report.
Source: Sydney Water estimates.

In 1995 Sydney Water's *Operating Licence* introduced a requirement to reduce total water use to 329 litres per person per day (LPD) by June 2011. The target represented a 35% reduction on daily consumption in 1990-91 of 506 LPD. This per capita use is calculated by dividing total water use each year (including residential, non-residential and leakage) by the current population, then converting it to a daily average.

To achieve this target, Sydney Water developed a Water Conservation Strategy in 1995. Since then, the strategy has been continually reviewed and improved. The strategy includes:

- residential indoor and outdoor programs
- business sector programs
- leak management programs, and
- recycled water projects.

Over time, the range and number of water efficiency programs has broadened across the community and responsibility for water conservation is now shared across agencies. Today, Sydney Water is only one of a number of agencies responsible for implementing water efficiency programs in Sydney Water's area of operations.

The private sector is also playing a greater role in water efficiency, particularly by implementing recycled water projects and providing water efficient fittings and appliances such as showerhead replacements and washing machines.

1.1 Residential demand management programs

Residential indoor demand management programs have included subsidies for the installation of water efficient fittings and appliances including showerheads, tap flow regulators and toilets. WaterFix is Sydney Water's longest running program. It offers residential customers the subsidised supply and installation of a water efficient showerhead and tap flow regulators, a toilet cistern flush arrestor for single flush toilets and the repair of minor leaks. Around 30% of all households in Sydney have participated in WaterFix.

Rebates have also been provided for rainwater tanks and a subsidised garden watering program was provided until 30 June 2009.

After ten years of sustained effort, there is now little scope for these programs to reproduce the large reductions in water use. One reason for this is that most people who are likely to participate in each program do so soon after becoming aware of it. Another reason is that water saving programs that influence the market can lose the ability to generate the same quantity of reductions as time progresses.

For example, as manufacturers and retailers respond to an efficient washing machine rebate by expanding the range of water efficient models, efficient machines come to dominate the market and new water reductions directly attributable to the rebate will be less.

1.2 Non-residential programs

Non-residential demand management programs focus on identifying opportunities for reducing water use through process improvement, leak detection, reuse, water efficient devices and business specific advice. The 'One to One Partnerships' and 'Top 100 Online Monitoring' programs target large water users. Smaller water users are offered programs such as BizFix, with 50-50 co-funding for retrofitting water efficient fittings in bathrooms and kitchenettes.

Like residential programs, the main efficiency gains have been realised. Most future reductions from non-residential water efficiency programs will be found in small to medium water users. These programs are more time and resource intensive, and will result in smaller individual and total savings.

1.3 Future residential and non-residential demand management

Sydney Water's Water Conservation Strategy is based on an adaptive management process. Adaptive management involves an ongoing cycle of review and development. The primary tool used to assess whether a program should be expanded, reduced or withdrawn is its cost effectiveness. Sydney Water uses the estimated levelised cost of a program as the main measure of its cost effectiveness (see *Box A* overleaf).

As the participation in a program decreases levelised costs tend to increase sharply. Given the scope for existing programs to reduce water use is declining, they have rising levelised costs. As such, the role of Sydney Water's demand management programs will be greatly reduced in future years.

Box A Cost effectiveness

The cost effectiveness of programs is measured on the basis of 'levelised cost'. This is calculated by dividing the total cost of implementing the program by the total water saved. The levelised cost of demand management programs can be either 'utility levelised cost' or 'total levelised cost'.

Utility levelised cost is the value of Sydney Water's direct costs, divided by the water savings due directly to the program. *Total levelised cost* is the value of costs to all parties (Sydney Water, suppliers and customers) divided by the water savings due directly to the program. Total levelised cost is usually higher because more costs are included.

All values are calculated using present value. The present value of costs and water use reductions is used to enable a consistent evaluation of programs that usually vary in their cost and water use reduction profile through time. This ensures that the final cost or 'price' per kilolitre accurately represents the resource cost necessary to obtain a given profile of water use reductions. For example, a program that generates water use reductions quickly has a lower resource cost than one where the reductions are not realised for many years.

Certain factors need to be taken into account when calculating the levelised cost of a demand management program. The first the reduction in water use due the installation of the water efficient device. Sydney Water uses 'control group' methods to robustly determine the reduction in water use.

Another consideration is what would have happened if the program had not existed (additionality). For example, it is not reasonable to assume that every rainwater tank rebate paid has led to a new tank purchase. Some customers would have purchased a tank anyway. Measuring the extent to which customers would have done so without the program is difficult but is a critical aspect of a cost effectiveness evaluation.

The levelised cost of a program changes through time. After an initial period of strong performance, the volume of water reduced for the same level of expenditure generally falls. When fixed program costs remain, but fewer customers participate, levelised costs will begin to rise as the overall water reductions decline.

See *Table B* and *Table C* below for a comparison of levelised costs of various initiatives,

Table B Likely future levelised costs, residential programs, $/kL ($2009-10)

Program	Likely levelised cost in 2010-11 ($/kL)
WaterFix	Less than $1.50
DIY Water saving kits	Less than $1.50
Toilet replacement service	Less than $1.50
Love Your Garden	Around $2.00
Washing machine rebates	Greater than $3.20
Rainwater tank rebates	Greater than $3.50

Table C Likely future levelised costs, non-residential programs, $/kL ($2009-10)

Program	Likely levelised cost in 2010-11 ($/kL)
Business	
One to one partnerships	Less than $0.50
Smart rinse	Less than $0.50
BizFix	Less than $0.50
Top 100 online monitoring	Less than $0.60
Community	
Hospital assistance	Less than $0.50
Every drop counts in schools	Less than $0.50
Rainwater tanks in schools	Around $4.00

1.4 Leakage

Leak management undertaken by Sydney Water includes:

- active leak detection and repair
- pressure management
- improved leak/break response time, and
- flow meter replacement.

These programs have reduced leaks from around 69 GL in 2002-03 to around 35 GL in 2009-10. This is less than seven per cent of total water use. This result compares extremely well to other countries and other Australian cities.

In 2010-15, Sydney Water is required by its Operating Licence to maintain leakage at 105 mL/day. However, it supports managing leaks by reference to the cost of alternative water supplies, also known as the 'economic level of leakage'.

The economic level of leakage is the point at which the cost of managing leaks equals the value of the water saved. The Operating Licence provides for ongoing review of the economic level of leakage.

1.5 Recycling

Sydney Water operates 18 recycled water schemes and also provides recycled water for use at wastewater treatment plants. In 2009-10, Sydney Water provided around 34 GL of recycled water. Of this around 12 GL replaced potable water consumption.

The Rouse Hill recycled water scheme is Australia's largest residential water recycling project at around 2.2 GL per year. The Wollongong recycled water scheme is one of the largest operating recycled water projects in Australia. In 2009-10 the scheme supplied around 6.6 GL of recycled water.

2. Drought restrictions and consumers' water use choices

Residents and businesses in Sydney Water's area of operations were subject to mandatory drought restrictions from 1 October 2003 to 21 June 2009. *Table D* below details the voluntary and mandatory drought restrictions implemented in Sydney. In summary, Level 1 restrictions banned watering practices, namely the use of watering systems (excluding drip irrigation), hosing of hard surfaces and washing of vehicles. Level 2 and Level 3 restrictions went further, reducing the number of days of the week, and hours of the day, outdoor watering could occur.

On 22 June 2009, the Minister for Water introduced Water Wise Rules to replace drought restrictions. Water Wise Rules are ongoing outdoor water savings measures that focus on simple, common sense behaviours such as watering the garden in the cool of the day, not hosing hard surfaces and fitting hand-held hoses with trigger nozzles.

Table D Drought restrictions in Greater Sydney

Restriction Level	Commenced	Description
Voluntary	November 2002 (dam levels ~70%)	No use of watering systems between 8am and 8pm No hosing of hard surfaces
Level 1	October 2003 (dam levels ~60%)	No use of sprinklers or watering systems (excluding drip irrigation) at any time No hosing of hard surfaces (buildings, windows, driveways, paths, paved areas) and vehicles (cars, trucks, boats) at any time
Level 2	June 2004 (dam levels ~50%)	Level 1 restrictions plus: No hosing of lawns and gardens, except hand-held hosing before 10am and after 4pm on Wednesdays, Fridays and Sundays No filling of new or renovated pools greater than 10,000 litres except with a permit from Sydney Water
Level 3	June 2005 (dam levels ~40%)	Level 2 restrictions plus: No hosing of lawns and gardens, except hand-held hosing before 10am and after 4pm on Wednesdays & Sundays No hoses or taps to be left running whilst unattended, except when filling pools or containers No use of fire hoses except for fire fighting or fire service testing
Level 3 revised	June 2008 August 2008 February 2009	As per Level 3, with exemption allowing car and house washing using a hose fitted with a trigger nozzle Exemption allowing new plants to be watered for 28 days after purchase Exemption allowing children to play under backyard sprinklers on a hot day

2.1 Estimated reductions in water use during drought restrictions

Sydney Water estimates that during Level 1 restrictions demand fell by around 80 GL a year or 50 LPD. During Level 3 restrictions demand fell over 100 GL or 66 LPD (see *Table E* below). These reductions are based on an estimate of baseline and unrestricted demand during the period of restrictions and represent annual savings.

Table E Estimated reduction in demand during drought restrictions

	Level 1[(a)]	Level 2	Level 3
Reduction (GL/year)	78	100	104
Reduction (LPD/year)	51	65	66
Percentage reduction	12%	16%	17%

Notes: (a) Annualised data as the restrictions did not apply for a full year.
Source: Sydney Water estimates.

2.2 Water efficiency campaigns complemented restrictions

At each level of drought restrictions a communications campaign explained the restrictions and encouraged people to reduce demand by being water efficient indoors and outdoors. Simple water-saving behaviours promoted included washing with a full load of clothes, using the half flush button on the toilet and taking shorter showers. The campaigns used television, print, radio, Sydney Water's website and quarterly bills (see *Box B* below).

Box B Encouraging improvements in water use efficiency

2.3 How people reduced their water use during drought restrictions

Analysis by Sydney Water indicates that while drought restrictions only applied to outdoor uses, people in Sydney also reduced their water use indoors to a roughly equal amount during Level 2 and Level 3 drought restrictions.[3] Estimated reductions in outdoor and indoor use for the three levels of drought restrictions are shown in *Table F* below.

Table F Estimated split between indoor and outdoor water use reductions

	Level 1	Level 2	Level 3
Outdoor (LPD)	29 – 37	29 - 39	24 - 43
Indoor (LPD)	14 – 22	26 - 36	23 - 42
Percentage indoor (mid point)	35%	48%	49%

Source: Sydney Water estimates.

[3] *This analysis is currently subject to peer review. A more detailed report will be available once the review is complete.*

As no major water utility in Australia has widespread separate metering of indoor and outdoor water use, this analysis was based on four different sources of information: end use and survey data, dry weather sewer flows, total water use on low demand days and metered consumption data. The variety of data sources used means an estimated range of indoor and outdoor water use reductions were derived.

The analysis indicated that as the level of drought restrictions increased, people saved more water indoors. In moving from Level 1 to Level 2 drought restrictions, it appears that people reduced both their indoor and outdoor water use. This reduction in indoor water use during Level 1 and 2 drought restrictions cannot be explained by water price increases as these did not increase until Level 3 restrictions.

These findings show a more diverse response by the community to concerns over water security than previously assumed. Drought restrictions made it mandatory for people to use less water outdoors, but it appears that a combination of concern over low dam levels and the promotion of simple indoor water saving behaviours achieved a similar, voluntary reduction in people's indoor water use.

2.4 Water use post drought restrictions

Sydney Water will continue to monitor people's water use patterns now drought restrictions have been replaced by Water Wise Rules.

It was initially anticipated that demand would rise by approximately 40 GL under the first year of Water Wise Rules. That is, based on commentary by many that drought restrictions were imposing considerable costs on the community, it was reasonably expected that people would return to pre-restrictions water use in a relatively short time frame.

However, demand remained low in 2009-10, only rising by about 14 GL. This minor increase can largely be attributed to an unusually hot and dry summer.

There has also been no observed 'bounce back' in demand for the first three months of 2010-11, suggesting that residents, businesses and governments have retained the water use patterns established during the drought.

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Policy Forum: Urban Water Pricing and Supply

Urban Water Reform: An Industry Perspective

Kerry Schott, Stuart Wilson and Sally Walkom
Sydney Water Corporation

1. Introduction

Significant reforms have occurred in the urban water industry since the early 1980s. Structural and operational reforms have improved the efficiency of urban water utilities. Pricing reforms, such as the introduction of usage based pricing and moves towards full-cost recovery, have been made to improve the efficiency of water use and to encourage timely and cost-effective investment in water infrastructure. Operational reforms in asset management and procurement, including contracting out, have led to significant cost reductions and better risk management.

Renewed interest in reform is both a result of the evolution of past reforms and a specific response to recent water shortages in most Australian cities. Two particular reform proposals are the introduction of scarcity pricing and an expansion of competition in the urban water industry. This paper discusses scarcity pricing and competition in the context of past reforms in the urban water industry and more recent responses to climate change and drought.

2. Reforms to Date

Publicly owned urban water utilities were part of the commercialisation and corporatisation reforms of the 1980s. Further impetus for change occurred following the Council of Australian Governments' 1994 Communiqué on water reform. Pricing and institutional reforms were key components of that reform (Council of Australian Governments 1994).

2.1 Institutional Reforms

The institutional reform commitments in the 1994 Council of Australian Governments Communiqué sought the introduction of a more commercial focus for major metropolitan utilities, whether through contracting out, corporatisation or privatisation (Council of Australian Governments 1994). In implementing these reforms, different states and cities adopted different structural models. In Western Australia and South Australia, Water Corporation and SA Water, respectively, provide vertically integrated, state wide water and wastewater services. In Melbourne, bulk water provision is separate from water distribution, and three separate utilities operating in different areas are each responsible for water distribution and wastewater treatment. In Sydney and the Illawarra, bulk water is separated from water and wastewater treatment and distribution. In the Hunter Region, water and wastewater services are fully integrated. In Tasmania, three water authorities provide bulk water to councils, which provide water distribution and wastewater treatment. In the ACT, a public–private joint venture, ActewAGL, provides water, wastewater and energy services to capture economies of scale in a relatively small city. In South East Queensland, the industry is currently being separated vertically and a water grid manager created.

There are varying levels of private involvement in each structure. There is significant private involvement in the activities of Sydney Water. Sydney's major water treatment plants are privately owned and operated and one of Sydney's sewage treatment plants is privately operated. All capital projects are contracted out. A significant amount of maintenance is contracted out, as are most service functions such as meter reading and building management. These changes have led to a reduction in staff numbers at Sydney Water from around 19 000 in 1981 to fewer than 3000

today.[1] At the same time, Sydney Water has increased its efficiency.

Regardless of the industry structure, as the Council of Australian Governments recognised, an independent regulator, separate from day to day political processes, is an essential ingredient for good outcomes. The importance of strong, independent regulatory oversight increases as the industry moves to new sources of supply and potentially greater levels of competition. This is still an area for improvement in some jurisdictions. The Independent Pricing and Regulatory Tribunal, which is the regulator of Sydney Water, Hunter Water and the Sydney Catchment Authority, is a good working model of an independent regulator.

The recent drought and an awareness of increased climate variability have renewed interest in the structure of the urban water industry. The vertical separation of the South East Queensland water industry utimately may permit competition in both retail services and bulk water supply. This form of competition could also be possible in NSW, under the *Water Industry Competition Act 2006* (NSW). This legislation enables private sector companies to be licensed to provide water and wastewater services and to access the services provided by monopoly water and wastewater infrastructure, particularly the pipe networks.

The prospect of private involvement in the supply of bulk water is relatively new. In the 1990s there would have been a general consensus that all but the retail function of water and wastewater supply were a natural monopoly. Now, the ability to manufacture water through desalination or the treatment and recycling of effluent raises the issue of whether or not the bulk water supply, as well as retail services, can be subject to competition.

2.2 Pricing Reforms

The pricing reform commitments made by the Council of Australian Governments included the implementation of consumption based pricing, full-cost recovery and the removal of inefficient cross-subsidies (Council of Australian Governments 1994). A key change was the introduction of consumption based pricing to replace property based charges. The significance of this should not be underestimated. Consumption charging relies on the installation of water meters—crucial to ensuring that water users receive a signal about the value of water resources. Meters are also an essential tool in controlling leakage and managing the distribution network efficiently. In contrast to the urban water industry in Australia, in the privatised UK water industry today, more than 70 per cent of residential households do not have water meters.

The principle of full-cost recovery is also significant. Full cost recovery is, of course, a prerequisite for both increased private sector involvement in the industry and the development of water markets. That said, full cost recovery in the urban water industry remains a challenge in some jurisdictions. For ongoing development of the industry, it is important that prices are sufficient to fund the significant investments required in new water sources, including recycled and desalinated water.

The NSW Independent Pricing and Regulatory Tribunal (IPART) recently set prices for Sydney Water that approach a commercial level of cost recovery. The water price in Sydney will rise by almost 50 per cent in real terms (2008–09 prices) from $1.34 per kilolitre in 2007–08 to around $1.93 in 2011–12 (IPART 2008). IPART has estimated that Sydney Water's potable water usage charge in 2011–12 ($1.93 per kilolitre in 2008–09 prices) will equal the long-run marginal cost of augmenting the water supply. IPART argues that prices set at the long-run marginal cost send the right signal to consumers about the value of water and the right signal to potential suppliers considering whether or not to enter the market (IPART 2008).

3. New Reform Proposals

Drought and climate change have prompted a call for renewed efforts on urban water reform. New institutional and pricing reforms have been proposed, both as an evolution of past reform efforts and as a specific response to the recent water supply constraints experienced in most Australian cities. In particular, the

Productivity Commission and the National Water Commission have proposed two changes. First, consideration of water pricing that reflects the scarcity value of water; and second, competition in the supply of bulk water (Productivity Commission 2008; Frontier Economics 2008).

3.1 Scarcity Pricing

In its simplest form, scarcity pricing involves using prices to reduce demand for water in times of scarcity. At present, water scarcity is managed in the short term by water restrictions. With scarcity pricing, prices would increase as dam levels fall. Prices would decrease after rainfall or as other water sources replenish dams. Most discussions about scarcity pricing recognise that efficiently designed urban water systems require water restrictions some of the time. Sydney's water supply system was designed so that restrictions would be required for three out of every 100 years. By using restrictions to manage consumption during drought there are large savings in capital expenditure on additional water supply infrastructure. Scarcity pricing is an alternative to longer periods of restrictions that potentially enables consumers to adjust their water use according to the extent to which they value water. Scarcity pricing is also intended to improve signals about when to invest in new water sources.

Proposals to introduce scarcity pricing form part of a wider debate about the best way to price water. The introduction of consumption based charging was the first step. In this aspect, Australia is 20 years ahead of the United Kingdom and many other countries. Many Australian cities also extended consumption charging to inclining block tariffs where consumers pay higher water prices the more they consume. Some jurisdictions have had up to five tiers of prices based on the volume of water used.

Recently the rationale for inclining block tariffs has been questioned. If water has a uniform marginal cost of production, why should prices depart from this cost? This concept underpins IPART's view that all water should be priced at the long-run marginal cost.

In essence, debate about scarcity pricing is a debate about whether or not water should be priced at the short-run marginal cost of water. The short-run marginal cost is the cost of supplying an incremental unit of water in the short term, when capital is fixed. During drought, the short-run marginal cost exceeds the long-run marginal cost because the marginal cost includes the opportunity value of water use for other uses, including environmental flows. Traditionally, short-run marginal cost pricing has been rejected by water pricing commentators for several reasons. These reasons include that it would create volatility in prices and that it would not send appropriate long-term signals to encourage efficient consumption and investment.[2]

The main gap in the scarcity pricing debate is the absence of solid data on the price elasticity of demand for water. This means that it is quite unclear how high prices need to rise in order to reduce water use. Demand for water is inelastic. That is, price increases will lead to a less than proportional decrease in demand. Most water consumption by households is for essential, indoor purposes (Table 1). Customers have limited ability to curtail their use of water for essential purposes, even if prices rise. Also, both households and businesses have already made significant permanent water savings in response to the recent drought. They have done this by installing water efficient appliances, including low-flow showerheads, aerated taps, dual flush toilets, water efficient washing machines, rainwater tanks, by fixing leaks, and through the use of recycled water in some areas. This means that demand in aggregate is less likely to respond to price because there are few easy gains to be made. Even discretionary uses of water, such as garden watering, may not be very price sensitive. Water is a small component of the monetary and time cost of maintaining a garden. It is also only a small proportion of total household and business budgets. In Sydney, the usage component of the water bill is around 0.5 per cent of gross household expenditure. Most customers are likely to absorb significant price increases before significantly changing their behaviour.

Table 1 Uses of Water in Sydney Residential Properties

Type of water use	*Proportion of water use (%)*
Shower	24.1
Lawn and garden watering	23.6
Washing machine	17.8
Kitchen, laundry, bathroom taps, leaks	15.8
Toilet	13.7
Pools, car washing, hose down	4.4
Dishwasher	0.6

Source: Sydney Water.

The impact of scarcity pricing will vary dramatically depending on the price elasticity of demand for water. Published estimates of elasticity vary significantly. A report prepared for Sydney Water estimated that the price elasticity of demand for urban water was −0.07. The IPART Secretariat (O'Dea and Cooper 2008) cited estimates of between −0.3 and −0.13. At these levels, the Secretariat estimated that prices would need to rise by between 62 and 143 per cent to replicate the reduction in demand from Sydney's level three water restrictions. These level three water restrictions have reduced consumption by about 15 per cent. The increase required if non-discretionary water uses were exempted from the scarcity price was estimated to be up to 1000 per cent. Although other studies have estimated elasticity to be closer to −0.45 to −1.0 (for example, see Hughes et al. 2008) they lack credibility. If these estimates were correct, Sydney Water's 50 per cent price increase over the next four years would at least match the reduction in water use achieved through level three restrictions. In other words, Sydney Water's recent price increases would already amount to scarcity pricing.

If very large increases in price were necessary to reduce the demand for water to the same extent as water restrictions, there would be a very large financial transfer from consumers to the water utility or government. Transfers do not have a place in traditional welfare economics, but when transfers are large they are important to policy-makers. While water makes up only a small part of household income, low-income households and large families need to be considered from an equity perspective. One way of doing this is to exempt a prescribed volume, representing non-discretionary consumption, from the scarcity price. However, this would shift the burden of reducing consumption to the remaining volume of water. Prices would need to rise even higher to have any impact on demand (IPART 2008). Another approach is to provide compensation (for example, as a means tested or per capita payment) to those most affected by price increases. If compensation too closely mirrors the impact of higher prices, the objective of scarcity pricing could be defeated—people would pay a higher water bill in the knowledge that they will get the increase back. In contrast, if payments do not broadly match the impact, some parts of the community would experience a windfall gain, while others would suffer windfall losses. The efficiency losses inherent in any compensation scheme need to be considered when comparing the costs of scarcity pricing with water restrictions.

None of this is to suggest that scarcity pricing should be ruled out, though Sydney Water is sceptical as to its efficacy. To better evaluate the effectiveness of scarcity pricing, further research is needed on the demand curve for water and the elasticity of demand at different prices, including at higher prices than we have so far seen in Australia. A live pilot study in a large but contained urban area would also be appropriate before any general implementation of scarcity pricing occurs. Debate on scarcity pricing may also be informed by the results of Sydney Water's trial of 'smart meters', which allow real time information on water consumption. The Productivity Commission (2008) and the National Water Commission (Frontier Economics 2008) have called for the installation of smart meters and more regular billing to improve price signals.

3.2 Increased Competition

The Productivity Commission (2008) and the National Water Commission (Frontier Economics 2008) have cited a need for increased competition in the urban water industry.

Competition in both retail services and in the provision of bulk water is seen as the next step in institutional reform of the urban water sector. The National Water Commission has commented that 'institutional reform in the water sector has not kept pace with other sectors such as telecommunications, electricity, gas and ports' (Frontier Economics 2008, p. v). In addition, competition in bulk water supply has been made a realistic option since the late 1990s through the diffusion of efficient and cost-effective technology for desalination and water recycling.

Sydney Water welcomes competition and supports the NSW Government's Water Industry Competition Act. Sydney Water also has significant experience with national third party access under Part IIIA of the *Trade Practices Act 1974* (Cwlth), having had the first arbitration on access to infrastructure services in the urban water sector. It is important, however, to note that competition and markets for bulk water have not evolved anywhere in the world. The gas and electricity industries do not necessarily provide a relevant template for the reform of urban water. The characteristics of the urban water industry may have limited the extent of structural change to date.

This is not to say that competition in the water industry cannot occur. Rather, a lot more work needs to be done before there is a clear pathway. The key issue relates to where the line is between the contestable and non-contestable elements of the urban water industry. There is a clear understanding of this line in the gas and electricity industries and, therefore, there is an unassailable logic to the introduction of competition to the contestable areas—principally generation and retail. In the urban water sector, the retail function is certainly contestable. Whether or not the supply of bulk water is contestable depends on some key characteristics of this sector.

Alternative sources of bulk water (like desalination and recycling) tend to be more expensive than water from dams. This is because treatment is more complex (for example, for desalinated and recycled water) and/or because the water has to be transported long distances. Transport costs, in particular, limit the development of a national market for urban water. Transport costs are a high proportion of total water or wastewater costs because of the energy costs for pumping and the significant infrastructure involved. At Sydney Water the cost of energy—largely used to transport water and sewage—is 30 per cent of total operating costs. This figure includes energy savings from numerous renewable energy generation schemes within Sydney Water and optimised and efficient network management schemes.

The cost of transporting electricity is comparatively low. This makes it worthwhile to transport electricity over long distances, which enables the electricity generation market to accommodate many players. Gas is also transported long distances, for example, more than 1000 kilometres from Moomba in South Australia to Sydney. As shown in Table 2, the impact on transport costs, over long distances, is minor. The cost of transporting gas for 1000 kilometres accounts for around $0.80 (or 5 per cent) of the $16 per gigajoule retail price (in NSW). As a result, sources of natural gas that are a long distance from customers can compete with local sources of gas. In comparison, the cost of transporting bulk water over the same distance would be in the order of $8.00 per kilolitre. In 2007–08, the average price per kilolitre for potable water in Sydney was $1.54 per kilolitre. The retail price for potable water would need to be significantly higher for distant water sources to be competitive with local sources.

Another characteristic that would affect the development of an urban bulk water market is that large volumes of water can be stored in dams. Alternative sources of water will not necessarily be required all the time. Volatility in supply and demand occurs over the course of years, rather than hours as in the electricity sector. Short-term supply constraints in the electricity industry arise because electricity cannot be stored in the same way as water (hydroelectric generation aside). This characteristic of the electricity sector creates opportunities for alternative sources of supply even though different types of generation have different costs.

These characteristics mean that, in Sydney at least, dams may have significant natural

Table 2 Indicative Costs of Supplying Gas and Treated Water (2007–08)

		Treated water ($/kL)	
	Gas ($/GJ)	*Local source*	*Distant source*
Wholesale cost	4.00	0.55	0.55
Transport cost (per 1000 km)	0.80[a]	na	8.00[b]
Distribution and retail costs and margin	11.30	0.99	0.99
Retail price	16.00	1.54[c]	9.54[c]
Increase in retail price caused by transport (%)	5	na	519

Notes: (a) $0.80/GJ is the approximate cost of transporting gas for more than 1000 km in the Moomba to Sydney pipeline.
(b) The cost of pipes and pumps to transport a bulk volume of water (say around 500 ML/day) 1000 km would be in the order of $6.00/kL–$10.00/kL.
(c) The retail price for water includes a usage charge and a service charge (averaged per kilolitre).

Source: Based on information from Sydney Water, IPART and the APA Group <http://www.pipelinetrust.com.au>.

monopoly characteristics most of the time. While they have water in them they can supply the market at lower cost than other sources of supply. New dams are generally not an option because of geographical issues, as well as environmental and transport costs. This means that Sydney's desalination plant is critical to the security of the water supply. However, because of the dams, the contract for the plant allows it to be switched off for considerable periods if it is not required. In this situation (with postage stamp pricing) all water users pay for the security provided by the plant. For a bulk water market to work, there would need to be a market for 'security', independent of the supply of water, to provide an incentive to develop infrastructure.

The security provided by alternative sources of bulk water is a type of insurance. Like an insurance policy, the value of the security provided by alternative bulk water sources is related to both the cost of an adverse event and the probability of such an event occurring. The cost of running low on water is high in both social and economic terms. In Sydney, the probability of water scarcity is also very high, relative to other cities, given the high variability in rainfall in Sydney's catchments. Therefore, the security value provided through a diverse range of water supply sources is high.

4. Conclusion

The urban water industry in Australia has changed substantially since the 1970s and 1980s. Institutional and pricing reforms have increased the efficiency of water use, investment in water infrastructure and water utilities themselves. This reform effort continues as institutions adapt to managing new sources of water made necessary by changing rainfall patterns. Further debate and empirical work is required to identify the feasibility of further pricing reforms, such as the introduction of scarcity pricing. Work is also required to identify mechanisms for creating markets for bulk water supply, including markets that specifically recognise the insurance value created by diversity in bulk water sources. There is a role for national involvement in the reform effort. But there is also a role for the continuing diversity of policy approaches that has underpinned improvement in the water industry to date.

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Endnotes

1. In 1999, the Sydney Catchment Authority (SCA) was created as a separate agency. This contributed to the reduction in Sydney Water's staff because the SCA's functions were previously carried out within Sydney Water. Around 200 staff were transferred from Sydney Water to the SCA.

2. The former Industry Commission (1992, pp. 64–5), now the Productivity Commission, outlined a number of issues with setting water prices at the short-run marginal cost of water. These include that:'marginal cost pricing would involve significant price fluctuations. This is because systems are generally expanded through the addition of large blocks of capacity—for example the construction of a new dam—while demand grows more evenly over time. This means that after each new augmentation there is surplus capacity and hence under marginal cost pricing, prices would fall sharply. Thus consumers who did not accurately foresee future price increase, would be encouraged by low prices to develop and maintain gardens, only to have water rationed through price increases when the next capacity constraint

was approached. Following new investment in capacity, water would again return to a low price.'

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