1. Setting the scene

Water is essential for our communities, the economy and the environment.

Securing Sydney's water needs over the next 25 years means:

- ensuring that we have sufficient water available over time to meet the needs of a growing city and to protect river health, and
- ensuring that we have the ability to withstand current and future droughts.

These objectives must be achieved while minimising economic and environmental costs.

This *2006 Metropolitan Water Plan* sets out how the NSW Government will achieve these objectives – providing a secure supply of water that can meet the long term needs of Sydney, ensuring that water supplies are adequate during drought, and minimising costs to the community and the environment.

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1.1 Sydney's water supply system

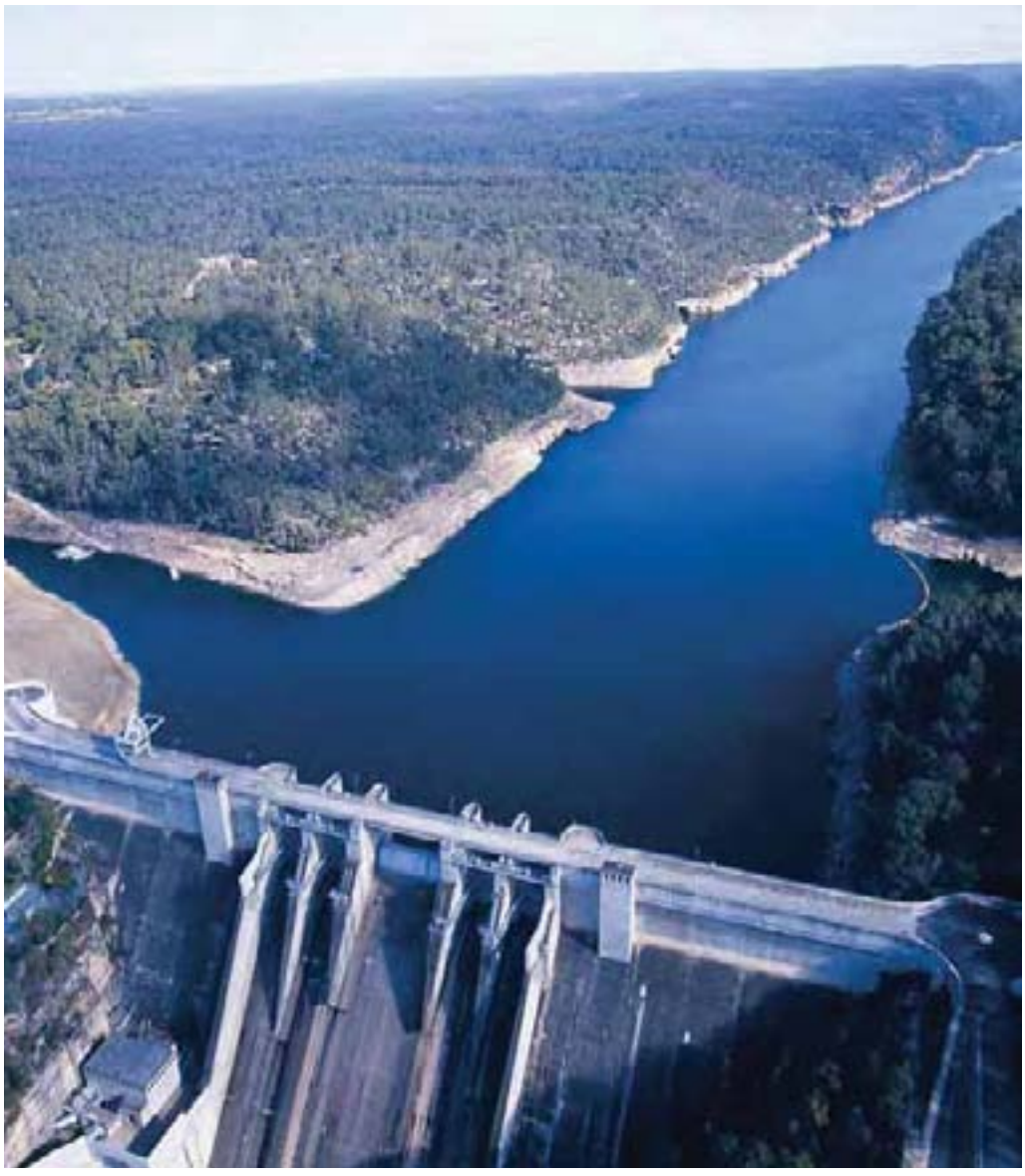
Historically, Sydney has relied principally on capturing rain and storing it in dams to meet its water needs. Drinking water is sourced from many streams, each fed by rainfall runoff. The rainfall is highly variable, and the runoff that it produces is even more so, resulting in high variability of streamflows and low flows for several years at a time.

To deal with variable runoff patterns, the extended operating storage capacity of the Sydney system of dams is around 2,600 billion litres - very large relative to the population it serves. The system includes 11 major dams in five drinking water catchments to the south and west of the city. The largest is Warragamba Dam, completed in 1960.

Warragamba Dam has a very large storage capacity, and can withstand long periods of low rainfall.

The smaller metropolitan dams of the catchments of the Upper Nepean, Woronora, Blue Mountains, and Shoalhaven have higher runoff rates and are less susceptible to droughts.

Sydney stores more water per head of population than many other cities in the world. These other cities often draw heavily on other sources of supply not available to Sydney, notably more reliable rainfall, groundwater and snow-melt water. Sydney's current storage system could provide Sydney with four years of supply under zero inflow conditions. Compare this with Tokyo, which has six weeks of zero inflow supply, or London with 10 weeks. Four years of zero inflow, of course, has never occurred. Even in the driest year of the current drought, there was significant flow into the dams.



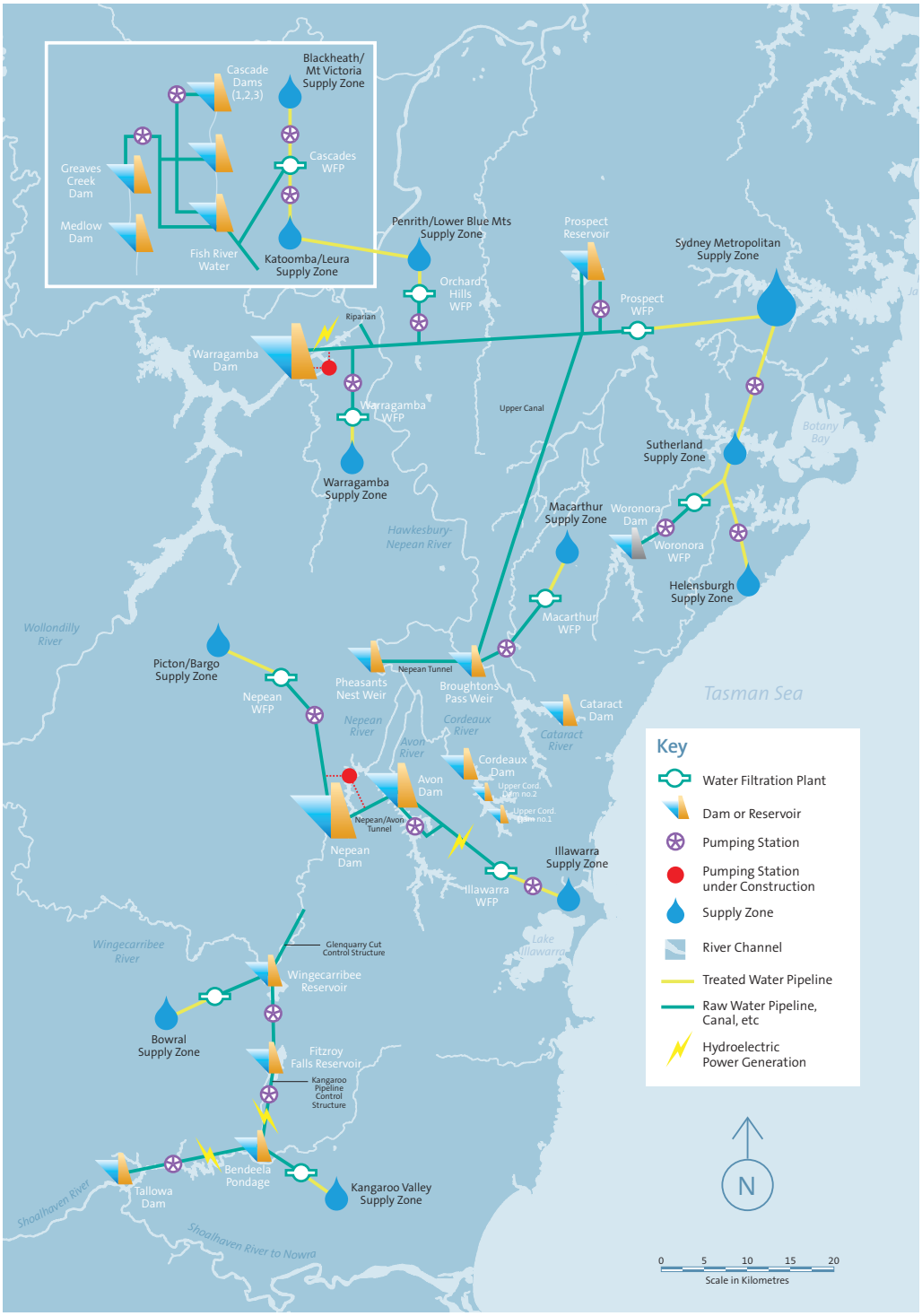
Looking upstream from Warragamba Dam

In fact, well into the second worst drought on record, Sydney has 43.9% of water available in its extended storage (as at 27 April 2006). This is testament to the capacity of the system to deal with periods of low rainfall, and the willingness of the community to do its share.

While the present drought reminds us that we need to manage our water resources carefully, we also need to keep in mind that circumstances can and do change quickly – as occurred in 1998, when the previous drought broke and heavy rains saw the dams fill to overflowing in a matter of a few weeks.

Just as dam levels rose rapidly in 1998 when the last drought broke, dam levels can also decline relatively quickly in severe drought (see graph of dam levels 1960 to 2006 in section 2.3). Planning for and managing an urban water system for a city the size of Sydney needs to take account of this variability and numerous other factors.

Sydney's water supply system



1.2 Sydney's water demand

The key factors influencing water demand over time are population growth and demand trends such as the effects of urban consolidation, demographic and housing mix changes, improving appliance efficiencies, and new technologies.

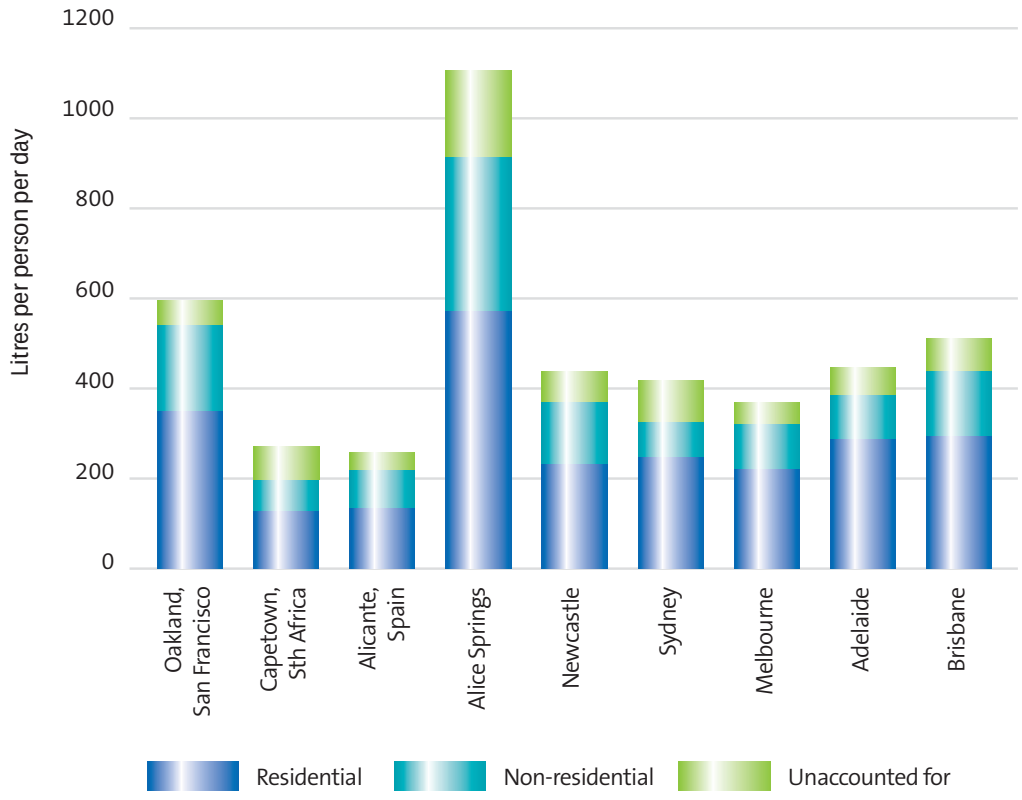
While two thirds of our population growth is from natural increase, Sydney's economic strength and quality of life mean more people are attracted to live here. Sydney's net growth averages 40,000 people per year, or 780 per week. The best available forecasts indicate that this trend will continue, so Sydney's population is expected to reach 5.3 million by 2031.

There is a cliché that Australia has very high water usage rates, despite being the driest inhabited continent. While this is true for the country as a whole, due mainly to its extensive irrigated agriculture industry, Sydney residents' demand for water is comparable to other cities' around the world. However, there remains good potential to further reduce per capita demand through improved efficiency.

Looking back, we can see that Sydney's per capita water consumption has dropped significantly over the last 20 years (from 506 litres per person per day to 403 not including the impact of current restrictions). This is due in large part to pricing reforms, improved appliance efficiency (eg dual flush toilets) and water conservation programs. This has enabled Sydney to accommodate a growing population without building new dams.

Looking forward, water planners need to make predictions about whether this trend will continue, and what other factors might shape water demand. For example, urban consolidation may mean less outdoor water use for free standing homes. On the other hand, a shift to lower household occupancy rates may push up per capita demand, thus offsetting some of the gains delivered by urban consolidation. Other factors, such as improving technologies and appliance efficiencies, will also affect demand. In the mid to longer term, technologies may emerge that are not yet under consideration.

Per capita demand comparison chart showing indicative underlying demand in non-drought times



1.3 Balancing supply and demand

As outlined earlier, Sydney currently relies almost entirely on rain-fed surface water supplies to meet its needs. However, recycled water is playing an increasingly important role in the water balance, as are emerging options like groundwater and desalination, which are becoming more viable, both economically and environmentally.

Ensuring an optimal mix of measures means considering:

- the impact of climate patterns (including drought, climate variability and potential long-term climate change) on the availability of surface water and water demand
- uncertainty about demand projections
- balancing water needs with the ecological and social impacts of various supply options
- the water needs of our rivers
- the dynamic relationship between supply-side options and their combined effect on water availability
- the need to minimise system-wide costs while also having the capacity to ensure supplies in severe drought
- the different lead times associated with introducing different options, and their relative capacity to contribute to meeting drought needs, and
- providing scope for innovation in water supply options (for example taking advantage of emerging recycling technologies).

Assumptions about some of these demand and supply factors can be made with a high level of certainty, while for other factors there is a significant degree of uncertainty, particularly about future rainfall and climatic conditions.

This unpredictability represents a major challenge for governments and the water sector.

1.4 The 2004 Metropolitan Water Plan

To address these issues, a range of demand and supply measures were announced in the *2004 Metropolitan Water Plan*. The *Plan* examined the water available in storages, projected urban water and river health needs, and estimated that if no actions were taken, Sydney would face a large deficit between its demand and its supplies over the next 30 years. This estimate was based on a series of assumptions about the factors described above.

The *2004 Plan* identified the actions that were already under way and new actions that would be taken to reduce demand and increase supplies. It deliberately adopted an adaptive approach to the task of balancing supply and demand.

The principles behind the development of the actions outlined in the *2004 Plan* remain compelling. It makes sense and is best international practice in urban water planning to ensure that the actions:

- are able to respond to changing circumstances,
- are regularly updated to take account of new data and, very importantly,
- utilise diverse strategies to reduce demand and increase supply.

The principles underpinning the *2004 Metropolitan Water Plan* remain appropriate and provide the underpinnings for this *2006 Plan*

- Minimise the risks of water shortages by diversifying sources of supply
- Ensure secure water supplies
- Protect and restore river health
- Adopt a partnership approach with the community
- Provide good quality, cost-effective water supply services
- Foster innovation
- Increase the efficient use of water
- Match the grade of water to its end use
- Optimise the use of existing infrastructure
- Appropriately target future investment
- Make decisions adaptively
- Ensure actions are acceptable to the public, affordable, feasible and sustainable.

Diversification is an important way to minimise both risk and cost: in short, it means that 'not all of our eggs are in one basket'. The measures outlined in the *2004 Plan* addressed both growth and security needs. Implementation of these measures is well under way, together with a number of new programs announced since the release of the *2004 Plan*.

On the demand side, a broad range of programs is now in place to deliver savings across all sectors. Such programs can deliver large savings at low cost. On the supply side, deep water in storages will soon be available, measures to increase recycling are now in place or under development, and options for transferring more water from the Shoalhaven are being examined.

Some of the *2004 Metropolitan Water Plan* achievements

Commitment	Achievement
• Will increase volume of recycled water to 60 billion litres by 2020.	✓ Actions are now under way to increase this to over 70 billion litres by 2015 ✓ Regulations streamlined to promote recycling More detail in Chapter 5 & Chapter 9
• Will undertake detailed planning for a Western Sydney Recycled Water Initiative.	✓ The WSRWI will shortly be taken to a call for expressions of interest from suppliers More detail in Chapter 5, section 5.1.4
• Will investigate other recycling projects	✓ More recycling schemes are now under way or being developed More detail in Chapter 5, sections 5.2, 5.3, 5.4
• Will be water smart in business, government and at home	✓ Established the $130 million Water Savings Fund ✓ New programs introduced, eg washing machine rebate More detail in Chapter 6
• Will access deep water at bottom of dams	✓ Works under way are boosting supply and will come on line in August 2006 More detail in Chapter 7, section 7.3
• Will investigate feasibility of desalination	✓ Investigations have shown that this is a feasible option ✓ Decision made to be ready to construct if needed in an extreme drought ✓ Preparations advanced, reducing lead time More detail in Chapter 7, section 7.6
• Will investigate feasibility of groundwater	✓ Investigations have shown that there is a good resource at Kangaloon ✓ Investigations still under way at Leonay More detail in Chapter 7, section 7.5
• Will investigate increasing Shoalhaven transfers	✓ Government has announced not raising Tallowa Dam wall More detail in Chapter 7, section 7.4
• Will investigate new environmental releases from Tallowa Dam.	✓ Investigations are continuing, for report to Government in 2006. More detail in Chapter 8, section 8.3.3

1.5 Managing adaptively – to reflect new developments

Under an adaptive management approach, plans are regularly reviewed to take account of new data and emerging technologies. Investments are made on the basis of the best available knowledge but without locking out future innovation. The mix of demand and supply measures is adjusted over time to provide the optimum balance, thus meeting growth and drought needs at the least cost to the community.

Better information is being actively sought to guide future decisions. The NSW Government now has new information available to it, from the findings of its detailed investigations in 2005 into recycling, demand management, desalination and groundwater availability. The findings from this substantial body of work have resulted in the *2004 Plan* being adapted to incorporate a more diverse suite of options than previously. These actions will meet Sydney's water needs in a least cost, more sustainable way.

A prime example of the need for continuously updated information is the amount of water that can safely be drawn from our storages, on average, each year. Information emerging in 2005 and early 2006 has meant that the amount cited in the *2004 Plan* has been refined.

Adaptive management is also needed to respond to changing climatic conditions. Since the release of the *2004 Plan*, the drought has continued, with storages reaching their lowest level of 37.9% in mid 2005.

The *2004 Plan* identified that it would be subject to regular review and further refinement when planned investigations were completed. To assist with this process, the Government engaged independent experts to provide advice on an optimal mix of supply and demand measures. This work is documented in Chapter 2.

The *2006 Metropolitan Water* Plan builds on the progress made to date, but reflects the significant developments that have occurred since the *2004 Plan* was released, including:

- further strategies to deal with the current drought
- better information about water availability and new water supply options, and
- decisions made on regulatory issues such as pricing and creating a dynamic water industry in which the private sector is actively involved.

Based on the findings of the independent experts, the *2006 Plan* strengthens the Government's focus on adaptive management as the best way to secure water supplies in the face of uncertainty.

The Government will continue to manage adaptively - the Premier has recently established a new Metropolitan Water Independent Review Panel which will provide a significant input to the four-yearly reviews of the *Metropolitan Water Plan* and the development of subsequent versions of the *Plan*.

1.6 Structure of this Plan

Managing drought - Chapter 3

Periodic droughts are a feature of the long term climate in the Sydney supply region. Over the last 120 years, Sydney has experienced three severe droughts — in the 1890s, the 1940s and currently. Droughts have helped to shape the current water supply system.

Sydney's current reliance on rain-fed supplies makes it vulnerable to deep drought, as well as to the uncertainties of climate variability and the potential impacts of climate change. While the measures now in place will make a significant contribution to a sustainable, long term water supply for Sydney, they are not sufficient on their own to guarantee supply in the face of deep and prolonged drought.

Groundwater and desalination have important roles to play. As the Government announced in its *February 2006 Progress Report*, these options will be deployed in the event that storages fall to critical levels, but the works do not need to be constructed in advance in order to deliver security of supply. The Government's new approach to drought management is outlined in Chapter 3.

Understanding climate change - Chapter 4

Climate change adds another dimension to uncertainty about rainfall patterns. What climate change may mean for Sydney's water system is not yet known. Climate change could mean longer and more intense droughts, but it could also mean more intense rainfall events in the catchments.

A major project is now under way which will shed light on these questions. A collaboration between the NSW Government, the CSIRO, and the Australian Greenhouse Office, the study will examine how climate change may impact on water availability (due to changing rainfall, temperature and evaporation). It will also examine what climate change might mean for water demand, and thus for our supply and demand balance over time.

The results from this study will be available in three years' time and the findings of the study will inform further development and implementation of the *Metropolitan Water Plan*. More details are in Chapter 4.

Increasing recycling – Chapter 5

Recycled water can deliver multiple benefits and has an important role to play in the *2006 Metropolitan Water Plan*. When fit-for-purpose recycled water is used instead of tap water, it reduces the demand on the drinking water system, thus boosting total water availability. As well, recycling can deliver substantial river health benefits by reducing the level of nutrients discharged by wastewater plants. Finally, because it is a non-rainfall-dependent supply option, recycled water can reduce the impact of future droughts by reducing pressure on rain-fed storages.

In the last ten years, the amount of water recycled in Sydney has more than doubled. The recycling measures included in this *Metropolitan Water Plan* will together increase the current level of recycling more than fourfold, from 15 billion litres per year to over 70 billion litres per year. The details are provided in Chapter 5.

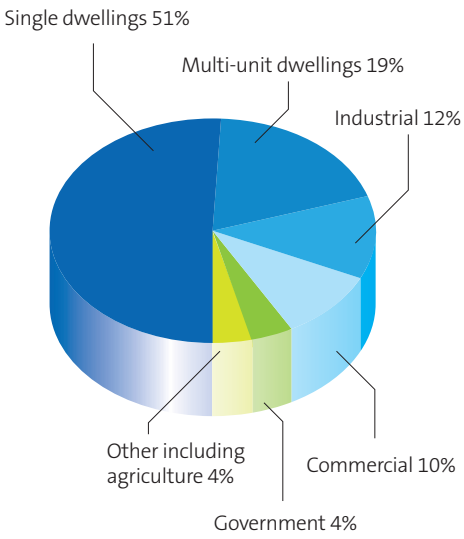
Reducing Sydney's demand for water – Chapter 6

The residential sector accounts for the bulk of the drinking water consumed in Sydney (70%). By contrast, the industrial sector uses 12%, the commercial sector 10% and Government 4%. Agricultural use of drinking water is low at about 2%. Other uses comprise 2%.

There has been a significant downward trend in per capita water demand in Sydney, from 506 litres per day in 1991 to 403 litres per day now (not including the impact of current restrictions).

Investment in programs to reduce demand has been increasing in Sydney since 1995, and particularly since 1998. Sydney's demand management program is now the largest in Australia and one of the largest in the world. It targets residential, industrial, commercial, agricultural and government water users.

Drinking water consumption by sector



A range of measures outlined in the *2004 Metropolitan Water Plan* is now in place, and further measures were announced in 2005 and in the *February 2006 Progress Report*.

Recycling and water saving measures outlined in this *2006 Metropolitan Water Plan* are expected to deliver savings of around 180 billion litres of water annually by 2015. This represents the largest and least-cost contribution to balancing supply and demand. Further details are in Chapter 6.

Increasing supply – Chapter 7

Historically, Sydney's response to growing water needs (including during drought periods) has been to construct new storages — such as Warragamba in the 1950s and Tallowa Dam in the 1970s. However, the focus now has shifted from dams to reducing demand on storages (through increased water conservation and recycling), as well as a range of measures to optimise the use of the existing storage system.

In particular, work is well under way on access to the deep water in Warragamba and Nepean dams. This is boosting supplies in the current drought and making a positive contribution to the longer term supply and demand balance. The Government is also examining options for optimising transfers from the Shoalhaven. Finally, the Government has indicated that it will deploy groundwater and desalination if needed in response to severe drought conditions. These measures are outlined in detail in Chapter 7.

Protecting catchment and river health – Chapter 8

The health of the rivers which supply Sydney with drinking water and their surrounding catchments is important to ensure supplies of high quality drinking water, to maintain dependent ecosystems and to support the communities and economies relying on them. A fundamental part of securing the rivers' health is providing water for their ecological needs. This can be achieved by a range of means, including releasing flows from weirs, modifying dams and controlling water extractions. Environmental water should be provided at times and in volumes that mimic natural conditions as closely as possible. The *2004 Plan* included a commitment to improve the regimes of releases of environmental water from the dams in the Upper Nepean Rivers system and on the Shoalhaven River; and this commitment is reaffirmed in this *2006 Plan*.

In addition, a wide range of activities to improve the health of the river catchments is under way including measures to reduce nutrient inputs to the region's rivers. Chapter 8 outlines both the river and catchment health actions.

Creating a dynamic and competitive water industry – Chapter 9

Meeting the challenge of securing Sydney's water supply in the long term and in drought requires the innovation, resources and cooperation of both the Government and the private sector. The participation of the private sector has recently been advanced significantly, through the Government's Water Savings Fund. In addition, several recycling projects are being offered to the private sector (including the large-scale Western Sydney Recycled Water Initiative).

Further, a major report by the Independent Pricing and Regulatory Tribunal on *Private Sector Provision of Water and Wastewater Services* has been completed. The Government is currently implementing the recommended structural reforms which will, over time, fundamentally change the face of the institutional and administrative arrangements for Sydney's water supply. Details are provided in Chapter 9.

Implementing the Plan – Chapter 10

Just as this *2006 Metropolitan Water Plan* is an adaptation of the *2004 Plan*, so this *Plan* will itself be modified to reflect developments emerging from this point on. The Government is committed to conducting annual status reports on the supply and demand balance, to ensure that the major directions remain appropriate, and to undertaking major reviews of the *Metropolitan Water Plan* when conditions fundamentally alter or at least every four years.

A new Metropolitan Water Independent Review Panel will be established to review the reports and oversee the four-yearly reviews. The Panel will also provide advice to the Government on consultation arrangements for the future reviews. These arrangements are discussed in Chapter 10.

2. Securing Sydney's water needs

What this chapter is about

- The findings of independent experts engaged by the NSW Government to review the supply and demand balance and provide advice for this *Plan*
- The substantial benefits of adopting a new approach to securing Sydney's water needs
- The implications of this new approach for managing the supply and demand balance

What has been done already

- An initial report by the independent experts was published in February 2006
- The NSW Government made a number of decisions on the basis of this advice, as outlined in *the February 2006 Progress Report*
- A further report provides more detailed analysis of the supply/demand balance and the optimal mix of measures for securing Sydney's future water needs. This report has informed the approach adopted in this *Metropolitan Water Plan*

What will be done next

- The Government will implement the range of actions identified in this *Plan* to augment supply and reduce demand
- Further analysis will be undertaken over time to ensure that the mix of measures continues to deliver optimal results, including:
  - underlying demand trends,
  - potential climate change impacts on supply and demand, and
  - emerging options that can help balance supply and demand over time.

2.1 Introduction

The Government engaged the Institute for Sustainable Futures at the University of Technology, together with ACIL Tasman and the Snowy Mountains Engineering Corporation, to provide expert advice regarding the optimal mix of measures to secure Sydney's current and future water needs.

The consultants delivered an initial report which informed decisions taken by Government and were announced in the *February 2006 Progress Report*. A further report has been prepared which provides more detailed analysis of the supply and demand balance and the optimal approach to securing Sydney's current and future water needs.

Both reports are available at **www.waterforlife.nsw.gov.au**

This chapter outlines the consultants' findings and explains why the *2006 Metropolitan Water Plan* adopts a new approach to meeting Sydney's growing water needs, and securing our water supplies in the face of drought and potential climate change impacts. The Government endorses the broad findings and recommended directions in the consultants' report and has based this *2006 Plan* on those findings and directions.

The consultants' report also suggests some issues for further investigation. It identifies options which are not currently Government policy, to address any gap in the supply and demand balance that emerges beyond 2015; this is discussed further in this Chapter at section 2.6. It also raises issues relating to institutional arrangements, which are discussed in Chapter 10, section 10.2. The Government will consider these suggestions further in the context of the regular reviews of the *Metropolitan Water Plan*.

2.2 'Growth water' and 'security water'

Drinking water for the Sydney metropolitan and surrounding areas is principally supplied by rainfall over the storage catchments. Sydney's highly variable rainfall, and long periods of low inflows, pose a unique challenge for water planners: how to meet the water needs of a growing city and secure supplies in the face of uncertainty, while minimising economic and environmental costs.

Historically, rainfall dependent supplies have been used to meet all of Sydney's water needs. This necessitated pre-emptive investment in dams to provide a buffer capable of meeting water needs during drought periods. As a result, Sydney has a large storage capacity which can sustain our water needs even in severe drought conditions. The capacity of the system on a per capita basis is one of the highest in the world.

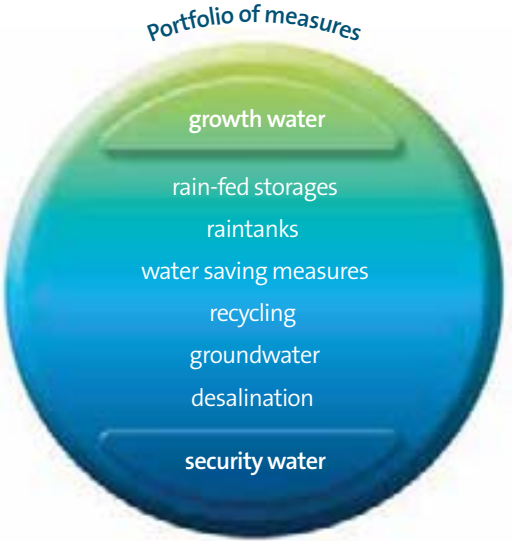
This approach has served us well – even well into the second worst drought on record, the fact that extended storages remain at 43.9% (as at 27 April 2006) is testament to the system's capacity to withstand prolonged periods of low rainfall. Now, however, non-rainfall dependent options are available which can be incorporated into a more diverse supply and demand mix. Options such as groundwater and desalination can be deployed relatively quickly – if and when severe drought conditions emerge. Because such options do not require pre-emptive investment to secure supplies, they open up the possibility of adopting a new approach to meeting our water needs.

In particular, they allow the Government to use different measures to:

- meet Sydney's normal water needs as it grows over time, and
- secure Sydney's water supplies in the face of drought (and, in the longer term, potential climate change impacts).

These related but contrasting needs can be described as 'growth needs' and 'security needs'. In this chapter, reference is also made to 'growth water' and 'security water' – that is, water provided by options that are best suited to meeting these different kinds of needs.

The challenge of meeting Sydney's growth and security needs at least economic and environmental cost is central to the advice provided by the consultants. They have examined the options currently available and conclude that a 'one size fits all' approach (for example, relying solely on rain-fed supply sources to meet needs, is not optimal). Instead, targeted investment in a range of diverse measures can meet Sydney's growth and security needs at substantially lower economic and environmental cost than was possible in the past.



Achieving an optimal supply and demand mix requires careful consideration of how all these options interact as part of a portfolio of measures. Importantly, this requires considering the cost of the whole portfolio of measures, not just the cost of each option in isolation. Some options (for example desalination) have a higher unit cost than others, however they can play an important role in achieving a cost effective portfolio of measures and thus represent good value for money. This is because, as described further below, options that can produce water in times of scarcity have greater value than those which do not.

2.3 Maximising the value of our water investments

The amount of water that can be drawn from Sydney's supply system each year is estimated by the Sydney Catchment Authority using a hydrological computer model known as 'WATHNET'. Annual water availability – generally referred to as system 'yield' - is estimated by reference to (among other things):

- the system's total storage capacity
- inflows to the system that have been observed over the last 96 years which are amended as additional data becomes available and includes several drought periods
- savings expected to be achieved by imposing water restrictions during drought, and
- the releases from the dams needed for river health.

Using this data, WATHNET estimates the amount of water than can be drawn from the system each year without needing to impose drought restrictions too frequently or for too long, and without creating a risk that the system will approach emptiness during deep and prolonged drought.

The result is that, while the system's extended usable capacity is 2,600 billion litres when full (including deep storages at Warragamba and Nepean Dams), the amount that can safely be drawn from the system each year is set at less than one quarter of this. This approach ensures that the system can meet Sydney's water needs even in severe droughts.

While rain-fed storages will continue to supply the bulk of Sydney's water needs by volume, non-rainfall dependent options such as groundwater and desalination have an important role to play because they can produce guaranteed water when storages are low. By providing assurance that Sydney's water needs in deep drought can be met, they increase the amount of water that can safely be drawn from the storages on an annual basis. This is because they free up water which historically has been held in reserve in order to deal with the risk of deep and prolonged drought.

As such, groundwater and desalination 'punch above their weight class': they produce relatively small volumes of water (or no water if they are yet to be constructed) but the ability to deploy them quickly during a drought improves system security and thus increases the amount of water that can be drawn from the dams each year. For this reason, groundwater and desalination can be very valuable from a portfolio viewpoint, compared to options which are unable to guarantee water production in times of scarcity (eg dams, raintanks, stormwater harvesting).

Another useful feature of groundwater and desalination is that they can be turned on and off in response to low storage levels more easily than other options (such as recycling systems). This minimises operating costs while maximising benefits for system yield.

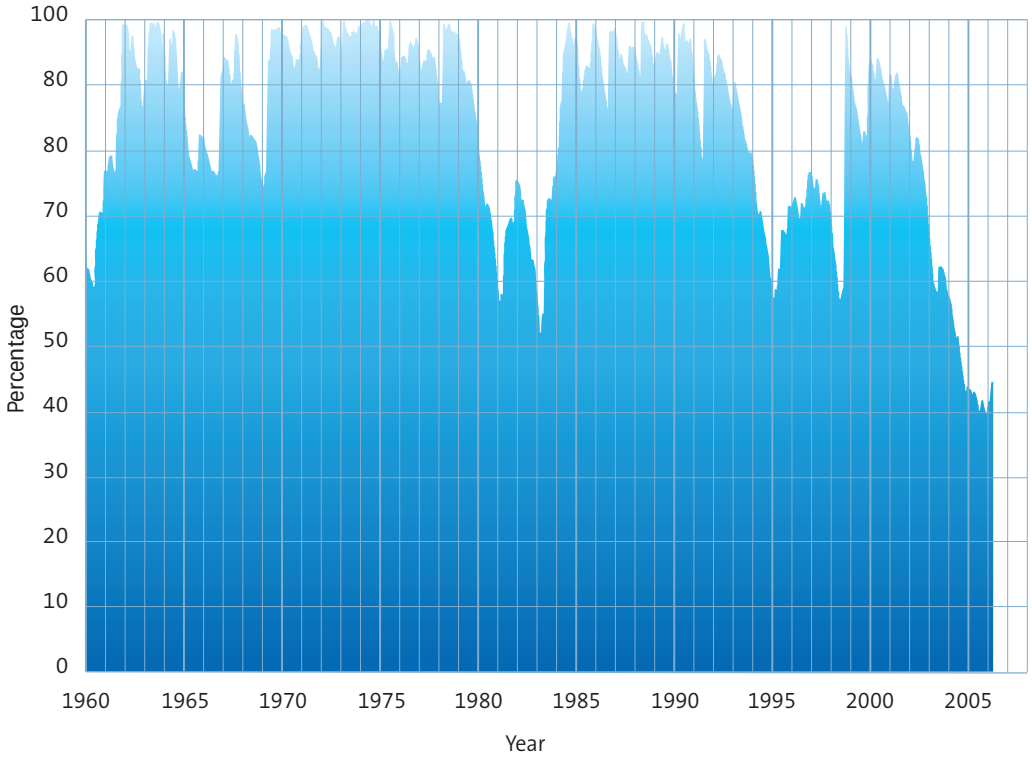
By contrast, options which are designed to operate continuously (eg recycling, water saving measures) will produce more water by volume than groundwater and desalination, but will have a proportionately smaller benefit in terms of system 'yield' or annual water availability. This is because by operating continuously, options like recycling and water saving measures reduce the amount of water extracted from dams each year. This reduces the available 'headroom' and means that the system will spill more frequently – thus reducing the 'system yield' benefit relative to the volume of water substituted or saved downstream of the dams.

By contrast, groundwater and desalination produce water when storage levels are low – meaning that there is less chance of this water being lost due to spills. This is another reason why such options have a big benefit for the system 'yield', even if they produce small volumes of water.

Of course, water saving and recycling measures have many other benefits that need to be taken into account, including:

- the incremental nature of investment in water saving and recycling measures – making them well suited to an adaptive approach, compared with lumpier investments that may become 'stranded' if circumstances change
- the ability to avoid other costs and impacts by reducing the amount of energy required to treat water and wastewater, to transport water and wastewater to and from end users, and to heat water for end-use
- benefits for river health associated with reducing nutrient discharges from wastewater treatment plants
- reducing the rate at which storages deplete during drought, thus reducing the likelihood of needing to invest in groundwater and desalination in response to drought, and
- providing a buffer against the risk of potential climate change impacts.

Sydney's dam levels from 1960 to 2006



An optimal supply and demand mix will take account of all these factors and include an appropriate mix of measures designed to operate continuously, and measures able to guarantee supply when storage levels are low. Too much investment in either type of measure will lead to suboptimal and costly outcomes. For further discussion of this complex issue, refer to section 5 of the consultants' report.

2.4 'Growth water' needs – balancing supply and demand to 2015

The independent consultants have analysed the range of supply and demand side measures that are now in place or agreed. They conclude that, together, these measures are sufficient to meet Sydney's growth needs until 2015. Beyond that time there are a range of options available, discussed at section 2.6.

On the supply side, the following factors (which are already in place or agreed on) contribute to the amount of water now available annually from the storage system:

- the effect of low inflows during the current drought (recent inflow data has been incorporated into WATHNET and has reduced annual water availability by 25 billion litres)
- deep storages at Warragamba and Nepean Dams (is boosting annual water availability by 40 billion litres)
- agreed Upper Nepean environmental flows (which will reduce annual water availability by 25 billion litres)
- the effect of removing Level 4 and 5 restrictions from the suite of possible drought response options
- the Western Sydney Recycled Water Initiative, one component of which will replace the current flow releases from Warragamba Dam
- the effect of being ready to access groundwater in the event that storages fall to around 40% (even if only operated in severe drought, groundwater resources would increase annual water availability by between 5 and 10 billion litres);
- the effect of being ready to build a desalination plant in the event that storages fall to around 30% (even if only operated in extreme drought, desalination would increase annual water availability by between 30 and 70 billion litres), and
- the effect of the current Shoalhaven transfers scheme (that is, without raising Tallowa Dam wall and assuming current operational settings).

The consultants conclude that the net effect of these factors is **an annual supply availability of 575 billion litres.** This is lower than the water availability figure used in the *2004 Metropolitan Water Plan* (605 billion litres). However, the consultants have concluded that the range of measures now in place to reduce water demand means that this level of supply will exceed demand until at least 2015.

Option / Sector	Estimated reduction by 2015 (billion litres per annum)	Description
Non-residential	38	Combination of regulatory (Water Savings Action Plans), funding (Water Savings Fund) and cooperative partnerships (Every Drop Counts Business Program) and other smaller programs to work with organisations to reduce water use.
Recycling*	35	Involves the use of recycled water replacing potable water use in industry (notably BlueScope Steel), at sewage treatment plants. To avoid double counting, drinking water savings that result from dual reticulation in new release areas to support BASIX are included in that estimate below.
Pressure and leakage reduction	33	Includes Active Leak Detection Program, pressure reduction and improved break / leak response time.
BASIX	23	The Building Sustainability Index (BASIX) is an assessment tool that mandates a level of water demand reduction in new and renovated homes and apartments.
Stepped tariff for pricing and outdoor water savings measures	24	Includes the introduction of step pricing as recommended by IPART. The outdoor water saving measures involve the Residential Landscape Assesment and Rainwater Tank Rebate Programs, and the introduction of ongoing low level outdoor water use measures commencing at the end of the current drought and supported by ongoing community education.
Appliance standards and labelling	15	This program involves the introduction of mandatory labelling followed by minimum standards for a range of water-using appliances under the Commonwealth Government's Water Efficiency Labelling Scheme (WELS).
Residential indoor	12	Promotes the use of water efficient appliances in the home through retrofits and rebate programs.
Total	180	

**Note: The total volume of water to be recycled is anticipated to be more than 70 billion litres per year by 2015. In addition to savings identified above, recycled water will be used to substitute for releases from Warragamba Dam, for irrigation and other purposes.*

On the demand side, there is now a wide range of water saving and recycling measures in place or agreed which will reduce pressure on storages and are projected to make a significant contribution to the supply and demand balance. These are outlined in the table above and are described in detail in the chapters on Recycling (Chapter 5) and Reducing Demand (Chapter 6).

The savings expected to result from these measures are a key input to estimating Sydney's future water demand. The way that this is done is to estimate what demand would be in the absence of these water saving and recycling measures (known as 'base case demand'), and then deduct the impact of the measures. To estimate the base case demand in 2015, the projected population of Sydney in 2015 is multiplied by an estimate of water demand per person. The projected impact of the water saving and recycling measures is then netted off the base case demand to work out the projected actual demand for water. By 2015, the measures outlined in the table are expected to reduce the base case demand by 180 billion litres, leading to an actual **annual water demand of 542 billion litres in 2015.**

The estimate is considered conservative because conservative savings estimates were used (and overlaps between related measures were addressed to avoid double counting), and a conservative approach was taken to estimating the base case demand.

The base case incorporates a per capita water

demand figure of 426 litres per capita per day (lcd) - the same figure as was used in the *2004 Metropolitan Water Plan)*. The consultants consider this estimate to be high. Using a less conservative figure of 400 lcd would lower the projected actual demand in 2015 to 502 billion litres – down from the above estimate of 542 billion litres – thus considerably increasing the projected surplus.

The current *Plan* uses the 426 lcd figure in order to be conservative, but the above example illustrates the importance of improving our understanding of underlying demand trends. This will be possible once the current drought has ended and restrictions are lifted. (The factors that influence future water demand are discussed further in Chapter 6 and in section 3 of the consultants' full report.)

The consultants conclude that, in 2015 the combined effect of the water saving and recycling measures listed above on the base case demand is a net annual water demand of 542 billion litres. With estimated water availability of 575 billion litres in 2015, this results in a **surplus of 30 billion litres** in 2015.

It is important to note that these figures will change over time, according to supply-side and demand-side developments. The water availability figure of 575 billion litres may change relatively soon, to reflect the Government's decision on operational changes to the Shoalhaven Transfers Scheme and the new regime of environmental flow releases from Tallowa Dam on the lower Shoalhaven River, about which community consultation is now under way (further discussed in Chapter 7, section 7.4). Over time, the introduction of any new recycling projects or water savings programs would see the demand figure drop, and any new supply sources identified would see the water availability figure rise. The changing nature of these figures is one aspect that will be reviewed by the Independent Review Panel in its review of yearly status reports and four-yearly reviews of the *Metropolitan Water Plan*.

The **balance between supply and demand** – with a surplus as a "safety margin" – ensures that Sydney has sufficient water to meet its needs to at least 2015. This is depicted in the pie chart below, which shows the contribution made by supply side measures and demand side (water saving and recycling) measures. The sum effect of these measures is to deliver water in excess of growth needs to 2015 (that is, including a safety margin or buffer of 30 billion litres). This chart is used throughout this document to indicate how the elements of the *Metropolitan Water Plan* deliver an integrated approach that will meet Sydney's growth and security needs over time.

Throughout this *Plan*, water drops are also used to highlight the contribution of individual measures to the above supply and demand balance.

The numbers in each drop relate to the contribution of each measure to the supply and demand balance in terms of annual water availability, not neccesarily to the amount of water actually produced by each option. These figures are very different. For example, the capacity to deploy groundwater and desalination may involve very little water production (or none, prior to construction of a borefield or desalination plant), but can have a substantial impact on water availability thanks to their benefits for security of supply.

2.5 Factors affecting the supply and demand balance

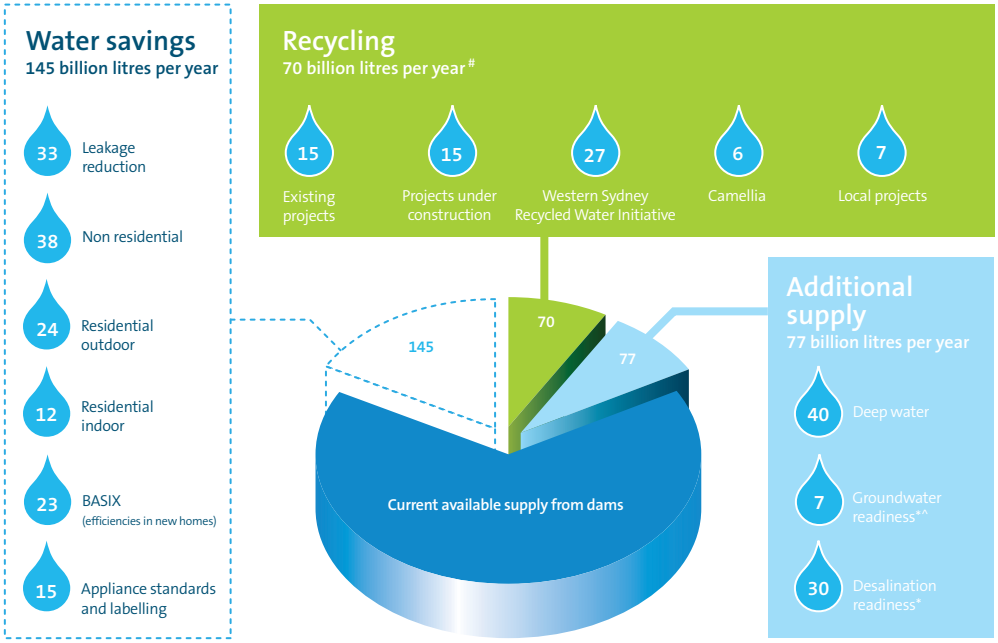
A number of factors influence the supply and demand balance and require careful monitoring. In particular, the consultants note that the above supply availability estimate (575 billion litres per year) is sensitive to the value of many variables and operating parameters. These include, most significantly:

- the reliability criterion, which specifies the maximum percentage of time that customers are subject to restrictions (currently 3%, that is on average 3.6 months every 10 years)
- the various levels at which drought restrictions are triggered and the assumed percentage savings
- the trigger level for water transfers from Tallowa Dam (that is, the storage level for the whole system at which pumping from the Shoalhaven system commences), and
- the trigger levels for water supply from a desalination plant and groundwater (that is, the whole-system storage levels at which work to proceed with construction would commence).

The consultants note that there are still uncertainties in a number of factors which impact on the supply availability, including the yield associated with groundwater resources that have been identified but not 'proved up', and the Shoalhaven environmental flows and operating rules (which are currently the subject of community consultation). These two issues will be resolved in the near term, providing greater clarity about annual water availability for planning purposes.

Climate change is another factor that may impact annual water availability over the longer term. While many assume that climate change will reduce water availability through higher temperatures and longer, more intense droughts, it is also possible that more intense storms over the catchment area will increase the frequency of events which fill the dams. Studies regarding the potential impacts of climate change on supply and demand are under way, as outlined in Chapter 4, and will improve our understanding of these potential impacts. In the interim, however, the suite of measures outlined in this *Plan* provides confidence that the supply and demand balance will continue to be met in the near to mid term, even if climatic conditions worsen.

Meeting Sydney's water needs in 2015



The above mix of supply and demand measures is sufficient to meet Sydney's growth needs to 2015 and to secure drought needs to 2015 and beyond.

#The total volume recycled is anticipated to be more than 70 billion litres every year by 2015. However, the use of recycled water for some purposes does not save drinking water. The total amount of drinking water expected to be saved through recycling is 59 billion litres per year.

**By investing in being ready to access groundwater and desalinated seawater in severe and extreme drought - even if such drought does not occur - more water can now be drawn from the dams without affecting the security of supply; for this reason the calculated water availability figure has increased even without accessing these sources.*

^ In a severe drought, new bore fields would be constructed to enable access to around 30 billion litres of groundwater a year for about three years for drought needs.

The consultants' analysis examined the probability of storages reaching critical levels in future, thus triggering the need to deploy options such as groundwater and desalination in response to severe drought conditions. Based on hydrological modelling using inflow data from the last 96 years, and incorporating simulations of substantially worse drought possibilities, the consultants concluded that the approach adopted in this *Plan* will be sufficient to secure Sydney's water supply needs. In particular, the combined effect of Sydney's large storage capacity, the ongoing programs to increase water conservation and the uptake of recycling, as well as the capacity to deploy groundwater and desalination, mean that Sydney is able to secure its water needs in the face of severe drought. This conclusion holds true even if dam levels decline substantially faster than has been recorded. In other words, Sydney already has some capacity to deal with potential climate change impacts on future water availability.

Given the uncertainties inherent in estimating potential climate change impacts, an adaptive approach is required that can respond to circumstances as they evolve over time. Investing pre-emptively in anticipation of uncertain climate change impacts risks imposing high costs on the community without necessarily enhancing supply security.

The consultants note that there is also uncertainty associated with the estimated projections of demand due to uncertainty in the base case demand and the demand reductions that will be achieved from the range of water saving and water recycling measures that are committed and approved. To reduce uncertainty, it will be important to continually monitor whether the measures outlined above are delivering savings on the scale anticipated, and to improve our understanding of demand trends once the current drought ends.

The consultants have strongly recommended that, given the unavoidable level of uncertainty in key parameters, an adaptive approach is essential, involving regular re-assessments of the demand projections, estimates of supply availability and the other factors in the supply and demand balance. The features of an adaptive management approach are discussed in Chapter 10, section 10.2.

2.6 Measures to balance supply and demand beyond 2015

The above analysis indicates that, with the range of supply and demand side measures currently in place, Sydney has enough water to meet its growth needs until at least 2015. At that time, in line with the adaptive management approach, more will be known about demand trends, population growth and demographic change, the impacts of climate change on water supply and demand, technological developments, and so on.

Importantly, there will also be better information on the effects of increased flows on the Upper Nepean river systems from monitoring of the improved flows due to commence there in 2009. This information will feed into decision-making about a new regime of environmental flow releases from Warragamba Dam, to protect the health of the Hawkesbury Nepean River. This matter is discussed further in Chapter 8, at section 8.3. If it is decided to proceed with increased flow releases, these could reduce annual water availability by some 83 billion litres. In that case, the Western Sydney Recycled Water Initiative (discussed further in Chapter 5, at section 5.5) could provide highly-treated recycled water to substitute for some of the additional flows.

If a supply and demand gap were projected to emerge after 2015, as a consequence of population growth, new environmental flows or other factors, the consultants have identified a number of options which could be deployed:

- revising the reliability criterion: this would involve a marginal increase in the frequency of restrictions and would increase annual water availability
- revising the pump mark for transfers from the Shoalhaven: this would increase annual water availability
- further water savings and recycling measures
- increasing the likelihood of a desalination trigger event (relative to the current, very low probability)
- further augmenting transfers from the Shoalhaven – eg through a tunnel or pipe;
- indirect potable reuse.

None of these options are part of the Government's policy settings for the *Metropolitan Water Plan*, but the Government has noted the consultants' findings on the capacity of such options to address any gap between supply and demand which emerges in the long term. The Government will review demand and supply trends and the full range of options available, as part of its regular reviews of the *Metropolitan Water Plan* (discussed further in Chapter 10).

2.7 'Security water' needs – guaranteeing supplies in the face of deep drought

Section 2.2 discusses how meeting Sydney's future water needs involves having a mix of measures in place that is capable of providing both 'growth water' and 'security water'.

Measures to meet Sydney's 'growth water' needs to about 2015 are outlined in section 2.4. Chapter 3 discusses the consultants' findings about the options available to provide 'security water' – that is, water that is needed for drought times. It also outlines the Government's new approach to drought management, developed in light of the consultants' findings.

In short, the emergence of non-rainfall dependent options such as groundwater and desalination means that it is now possible to adopt a new approach to delivering security of supply in the face of deep drought. The fact that such options can be constructed with short lead times means that it is possible to deploy them once deep drought conditions emerge, rather than pre-emptively as in the past. This can deliver substantial cost savings by deferring investment until required, and can also enable us to make better use of our existing storage system, as discussed in section 2.2.

2.8 Responding to the consultants' findings

As previously stated, the Government endorses the broad findings and recommended directions in the consultants' report and has based this *2006 Plan* on those findings and directions. The consultants have also pointed to areas requiring further work (discussed in more detail in Chapter 10) which the Government will be addressing to feed into subsequent iterations of the Plan.

What will be done next

- The Government will implement the range of actions identified in this Plan to augment supply and reduce demand.
- Further analysis will be undertaken over time to ensure that the mix of measures continues to deliver optimal results, including:
  - underlying demand trends
  - potential climate change impacts on supply and demand, and
  - emerging options that can help balance supply and demand over time.

3. Managing drought – a new approach

What this chapter is about

- Sydney's historical approach to managing drought
- The implications of new, non-rainfall dependent options
- The Government's new approach to managing drought.

What has been done to manage the current drought

- Transfers from the Shoalhaven commenced at around 60% storage levels
- Level 1 to 3 restrictions were applied at approximately 60%, 50% and 40% storage levels
- Construction of deep storage access works at Warragamba and Nepean Dams is well progressed
- Significant investigations and preparatory works have been undertaken to ensure that desalination and groundwater are ready to be deployed in severe drought
- New recycling and water saving measures have been implemented to ease pressure on storages.

What will be done next

- Deep storages at Warragamba and Nepean Dams are being accessed
- Investigations into groundwater resources will be finalised and desalination plant design blueprints will be completed
- Drought restrictions will be reviewed and a new restrictions regime developed once the current drought ends.

3.1 Introduction

Drinking water for the Sydney metropolitan and surrounding areas is sourced principally from many streams and rivers, each fed by rainfall over their catchments. Rainfall in Sydney is highly variable, resulting in highly variable streamflows with low flows occurring for several years at a time. Periodic droughts are a feature of the long-term climate in the Sydney region and have helped to shape the current water supply system.

For the purpose of planning for Sydney's future water needs, drought can be defined as a period of time when the water stored in the reservoirs, plus anticipated or forecast inflows, is considered to be insufficient to meet current or future unrestricted demand (that is, demand that has not been reduced via the imposition of drought restrictions). The intensity of a drought is assessed by calculating the quantity of water available for supply as a percentage of the total water storage capability.

Over the last 120 years, Sydney has experienced three severe droughts – in the 1890s, the 1940s and currently. Of these, the most severe occurred in the period from 1934 to 1942 and initiated the construction of Warragamba Dam. The current drought is second only in severity to the 1940s drought.

In order to meet Sydney's increased demand for water, the NSW Government has built a series of 11 major dams. Total usable capacity was about 2400 billion litres but is now effectively 2600 billion litres, reflecting the deep storages now being accessed. The capacity of the system on a per capita basis is one of the highest in the world. As a result, the Sydney water supply system has good capacity to deal with Sydney's normal water needs – including 'normal' drought conditions. (For a more detailed description of the supply system, see Chapter 7.)

This is illustrated by the fact that the moderate 1992-1998 drought was the first since the construction of Warragamba Dam during which restrictions were imposed. Even well into the current drought (the second worst on record), the fact that extended storage levels are 43.9% (as at 27 April 2006) is testament to the capacity of the system to deal with long periods of low rainfall. Even the conditions seen during the 1940s drought would not have resulted in the extended storage system falling below 30% capacity.

Nonetheless, it is vitally important that the Sydney system has the capacity to provide a secure supply of water in the face of even more extreme drought conditions – particularly given that climate change could lead to longer and more intense droughts in future.

This chapter outlines Sydney's historical approach to drought management, and the implications of this for the overarching water supply system, before outlining the Government's new approach to managing drought.

The *Metropolitan Water Plan* classifies droughts affecting Sydney as follows:

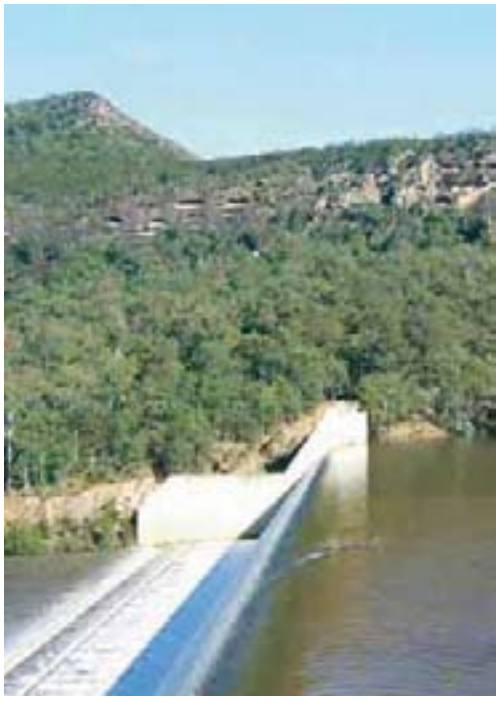
- Normal conditions: where extended storage levels are above 55%
- Moderate drought: which would reduce extended storage levels to 55%
- Severe drought: which would reduce extended storage levels to 40%
- Extreme drought: which would reduce extended storage levels to below 30%

Note that these percentages relate to the extended capacity of the storage system (that is, including deep storages which are currently being accessed).

3.2 Historical approach to managing drought

Historically, the Sydney system has been almost entirely reliant on rainfall to meet its water needs. To deal with rainfall variability and drought, the capacity of the system has been augmented over time so that more rainfall can be captured during wetter periods for use during drought periods. This approach has resulted in a very large storage capacity relative to the population it serves.

The construction of Warragamba Dam in response to the 1940s drought is evidence of this. The construction of Tallowa Dam is another example: it was built in the 1970s to boost supplies during drought and has been used for this purpose on only three occasions since its construction.



Tallowa Dam

Historically, the Sydney storage system has been at or above 90% full for 56% of the time. In other words, the system usually has more than enough water to meet Sydney's needs, and is capable of providing sufficient water in moderate and even severe drought conditions. However, when rainfall is the only supply option, very significant storage capacity is required in order to secure supplies against extreme drought conditions. Even then, risks remain because the community has 'all its eggs in one basket' (in the form of reliance on rainfall).

Extreme drought conditions are highly improbable - even the worst drought on record would not be classed as extreme according to the definition used in this Plan. However, the impact of such conditions on the economy and community would be unacceptable. For this reason, water authorities have historically constructed significant storage capacity and operate the storage system conservatively so as to provide a large buffer in the event that extreme conditions eventuate.

However, technology changes and recent studies suggest that there are now more efficient and more reliable (non-rainfall dependent) ways to manage the risk of rare but high impact drought events. The Government's new approach to managing water supply during drought takes advantage of the new options of groundwater and desalination, as outlined in section 3.4 below.

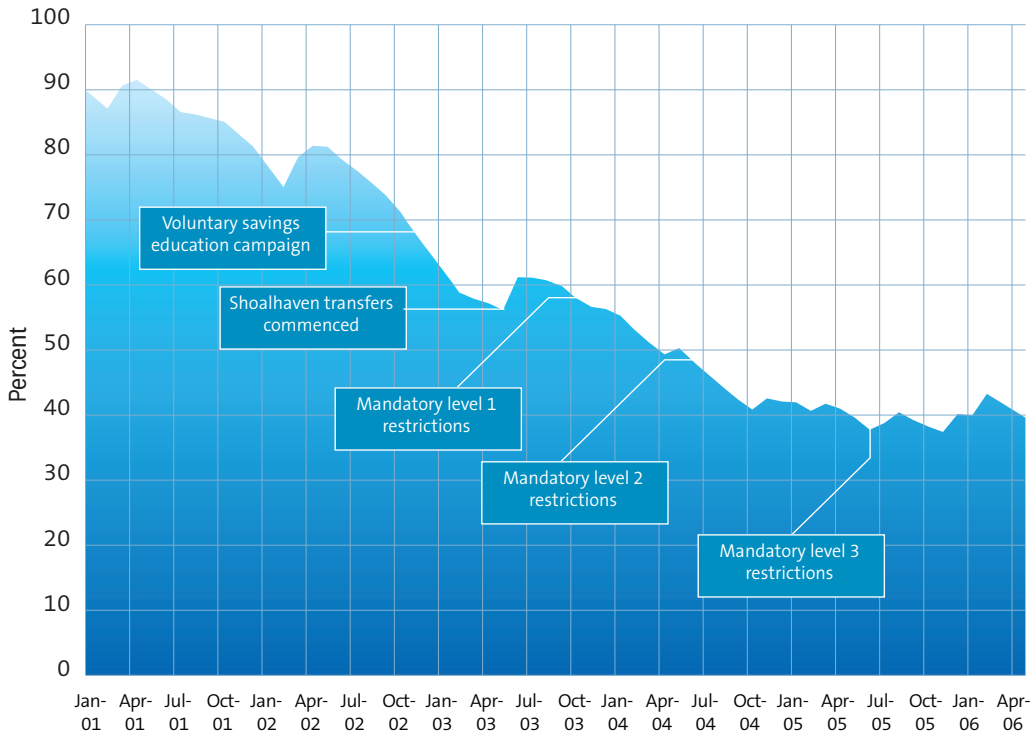
3.3 What has happened in the current drought?

The current drought saw storage levels fall steeply – dropping 11% in 2003 and 14% in 2004. Storages reached their lowest ever level of 37.9% in mid 2005 but have now recovered somewhat. As at 27 April 2006, extended storages were at 43.9%.

The decision as to when restrictions are lifted is a matter for the Minister for Water Utilities. It is not appropriate to indicate in advance the exact point at which restrictions will be lifted, since this decision must take account of the time of year and forecast conditions (for example, lifting restrictions would not be appropriate if forecasts suggested that storage levels were likely to decline in the near future).

As a result of the current drought restrictions and water savings initiatives, Sydney's annual water demand has fallen from 630 billion litres per year before restrictions were imposed to 520 billion litres per year (as at April 2006), a reduction of 17.5%. Such savings represent an important way to reduce demand during drought, thus easing pressure on storages and helping to defer or possibly avoid investment in more costly options.

Dam levels and drought responses



Water restrictions imposed during the current drought

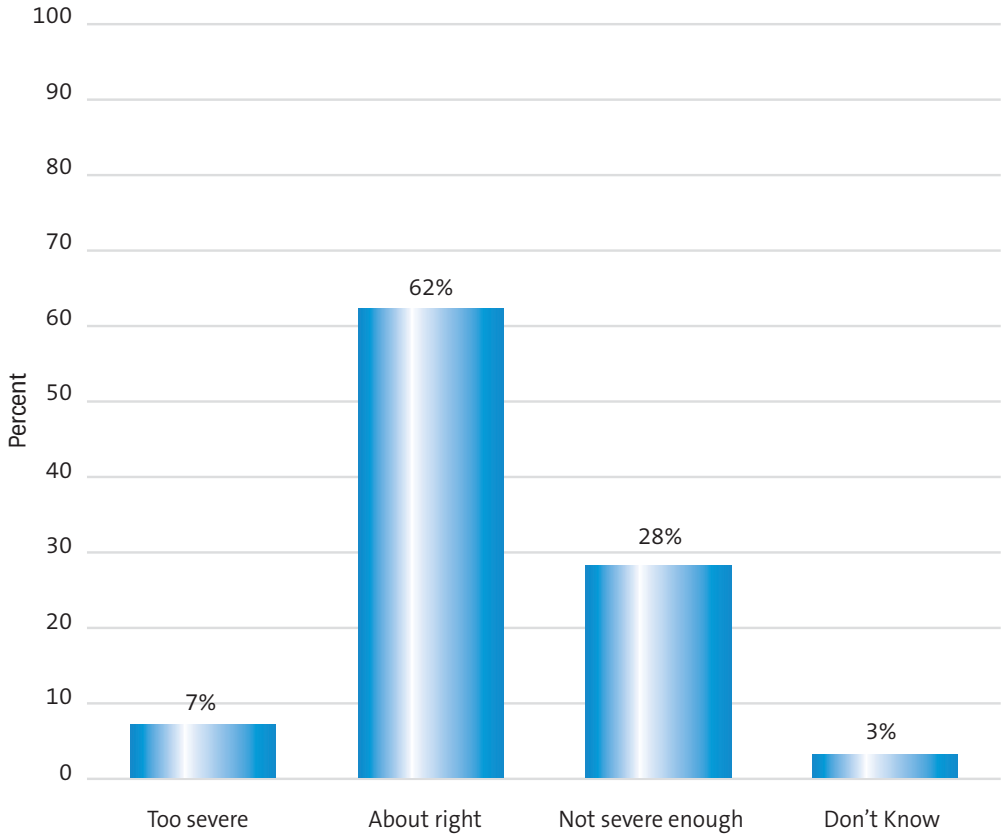
Response	Date commenced*	Measures**
Voluntary Savings Education Campaign	14 November 2002	• Customers encouraged to use sprinklers only after 8pm and before 8am. Drip irrigation and handheld hoses allowed at any time.
Level 1 restrictions	1 October 2003	• No sprinklers allowed at any time; drip irrigation and hand held hoses allowed any time.
Level 2 restrictions	1 June 2004	• No sprinklers allowed at any time; drip irrigation allowed any time; handheld hoses allowed any time 3 days per week.
Level 3 restrictions	1 June 2005	• Hand-held hosing and drip irrigation allowed only on Wednesdays and Sundays before 10am and after 4pm • No sprinklers or other watering systems to be used at any time • A permit from Sydney Water is required to fill new or renovated pools bigger than 10,000 litres • No hosing of hard surfaces including vehicles at any time • No hoses or taps to be left running unattended, except when filling pools or containers • Fire hoses must only be used for fire fighting purposes, not for cleaning.

* Restrictions commenced on these dates but fines for restriction breaches were enforced one month after commencement.
** Measures listed here are those imposed during the current drought, but future drought restrictions may entail a different range of measures, as discussed in section 3.4.

While restrictions do impose some costs on the community (inconvenience, adverse impacts on gardens etc) and on some industries such as turf growers, attitudinal surveys indicate a high level of support for restrictions. Restrictions will remain an important, socially acceptable and relatively low cost tool for responding to future droughts.

The graph below shows strong support for restrictions in Sydney. Residents were surveyed in January 2005 (when Level 2 restrictions had been in place in Sydney for six months).

Attitudes to restrictions among Sydney Water customers



As can be seen from the above graph, more than 60% of people surveyed believed that the restrictions regime was "about right" while 28% believed that the restrictions were "not severe enough". Only 7% considered restrictions to be "too severe".

In addition to restrictions, a number of other actions and investigations have been implemented during the current drought, including:

- commencing transfers from the Shoalhaven when storages reached around 60%
- constructing works to access deep storages in Warragamba and Nepean Dams
- establishing the feasibility of desalination and groundwater
- increasing recycling and water savings measures to slow demand, and
- halving interim environmental flows from dams on the Hawkesbury-Nepean when storages reached 40%.

These are described in more detail below.

Transfers from the Shoalhaven commenced in April 2003 when the total system was at around 57%. Since then, approximately 25% of Sydney's supply has been sourced from the Shoalhaven River (though transfers have not been continuous during this period). See Chapter 7, section 7.4, for more detail on the Shoalhaven scheme.

Access to deep storages is boosting the amount of water available in the current drought, as well as in the longer term. (See Chapter 7, section 7.3, for a detailed description of this project.) The effect of accessing deep water at Warragamba and Nepean Dams is to increase the capacity of the current storage system by around 8%, or the capacity of the extended storage system, including deep storages, by around 4.5% (based on storage levels as at April 2006). This has important implications for the storage levels that have in the past provided guidance on when to transfer water from the Shoalhaven and when to impose restrictions in response to drought. This is a matter which will be further considered in developing optimal responses to future droughts.

Further recycling and water saving measures were announced in February 2006 which will help ease pressure on storages during the current drought and make a positive contribution to the supply and demand balance over time. (See Chapters 5 and 6 respectively for more detail.)

Groundwater resources have been investigated by the Sydney Catchment Authority. A resource has been identified in the Upper Nepean and there are encouraging early results at Leonay near Penrith. These resources will be accessed in severe drought in order to ease pressure on storages. (See Chapter 7, section 7.5, for more detail.)

Desalination planning is well under way. Sydney Water has purchased a site, sought planning approval, will undertake pilot testing, and has called tenders for final design blueprints so that construction of a desalination plant could be initiated in the event that the current drought worsens. (See Chapter 7, section 7.6, for more detail.)

Environmental and riparian flow releases from dams on the Hawkesbury-Nepean River were halved when storages reached 40% to help ease pressure on storages.

As a result of all these actions, Sydney has been able to reduce pressure on storages such that extended storages are 43.9% (as at 27 April 2006), despite being well into the second worst drought on record.

3.4 A new approach to managing drought

The emergence of non-rainfall dependent options such as groundwater and desalination enables us to take a different approach to insuring against the risk of extreme drought conditions in future, and this can deliver substantial benefits. The groundwater and desalination options are discussed further in Chapter 7.

Rather than only investing in additional system capacity pre-emptively so as to secure supplies against future droughts, there is now the option to respond to extreme drought conditions, if they occur, by deploying options such as groundwater and desalination. The key strengths of these measures are their short lead times and the fact that they can be commissioned and operate at full capacity to augment supply *starting* in the depths of a severe drought. In the past, only drought based restrictions had this capability.

This new capacity to use non-rainfall dependent options in deep drought also presents an opportunity to operate the storage system differently – for example, using options like desalination and groundwater as insurance against improbable events, rather than having to maintain a very large buffer of rain-fed supplies in order to provide for prolonged periods of low rainfall.

Groundwater bore drilling

The Government outlined its new approach to managing drought in its February 2006 *Progress Report* which stated that, if severe drought conditions were to return immediately, the Government would:

- proceed to construct the groundwater borefield at around 40% storage levels, and
- initiate construction of the desalination plant at around 30% storage levels.

It is important to note that the above trigger levels of 40% and 30% relate to the extended capacity of the storage system - that is, including the deep water in Warragamba and Nepean Dams which is currently being accessed.

The Government's independent consultants advise that there is only a very small probability that storage levels will decline to 30% (of the extended system capacity – including deep storages) over the next ten years. However, having the ability to deploy such options at short notice provides insurance against the risk of running out of water during extreme drought and avoids the need for costly pre-emptive investment.

The Government has invested approximately $120 million to develop the capacity to deploy desalination and to shorten the lead time required for this option. As a result of the Government's investment in preparatory works, it would now be possible to deploy desalination with a lead time of around 26 months. This means we can defer actual construction of the plant until such time (if ever) as extreme drought conditions emerge, thus delivering financial savings estimated at close to $1 billion (relative to proceeding immediately to build). It will of course be important to maintain our readiness to deploy desalination to ensure that this insurance policy continues to be effective.

Having the capacity to deploy groundwater and desalination also means that it will no longer be necessary to impose restrictions more stringent than those currently in place (Level 1 to 3 restrictions). The Government has determined that Level 4 and 5 restrictions will now be removed from the suite of possible drought response options, on the basis that achieving water savings on the scale required (30% and 50% respectively) would impose significant impacts on the community which can now be avoided through the use of other options.

However, Level 1 to 3 restrictions remain key elements of Sydney's drought response plans because, as noted earlier, such restrictions can deliver large savings without imposing undue impacts on the community. As such, they can effectively and efficiently defer or avoid the need for more costly options.

The Government's independent consultants advise that the current measures included in Level 1 to 3 drought restrictions should be reviewed and refined once the current drought has ended. This will enable experience from the current drought to inform the development of an optimal set of drought restrictions to apply in future.

In addition, it will be important to consider the relationship between future drought restrictions and other possible measures that are still to be decided. This is because the estimate of water availability is very sensitive to changes to assumptions (such as restriction trigger levels) and to the interaction between various supply and water savings measures.

Similarly, while the Shoalhaven scheme plays an important role in responding to drought, its future role is currently subject to community consultation and is yet to be determined. A discussion paper will be released in mid 2006 (see further in Chapter 7, section 7.4).

The optimal approach to managing future droughts will be further investigated once the current drought ends, and the Government will subsequently confirm its detailed approach to managing future droughts.

3.5 Conclusion

Sydney has an extensive water storage network with a total usable capacity of 2,600 billion litres making it, on a per capita basis, one of the largest in the world. This represents the results of previous investments in insurance against drought. This level of insurance has proven adequate to deal with even the most severe droughts that Sydney has faced to date.

However, dam storages are reliant on rain and are thus susceptible to the vagaries of nature. No matter how big or how many dams a city has, deep and prolonged drought can put a city's water supply at risk. Until now, the risks to Sydney of extreme drought have been managed through the option to apply tougher drought restrictions which would, if imposed, have significant social and economic impacts.

This *Plan* adopts a new approach. While a severe or extreme drought is not considered likely to occur, the Government is committed to having the capacity to deploy supply options (groundwater and desalination) at short notice that are not dependent on the weather.

The Government has invested approximately $120 million to develop the capacity to deploy desalination quickly, if and when needed. This capacity provides a new and higher level of drought insurance for Sydney. This new approach has other benefits for the community and economy, in that it enables us to make better use of the storage system, avoids the harsh economic and social impacts of level 4 and 5 restrictions, and avoids the need for costly pre-emptive investment.

What will be done next

- Deep storages at Warragamba and Nepean Dams are currently being accessed
- Investigations into groundwater resources will be finalised and desalination plant design blueprints will be completed
- Drought restrictions will be reviewed and a new restrictions regime will be developed once the current drought ends

4. Understanding climate change

What this chapter is about

- The natural variability in climate thought to affect Sydney's supply and demand balance
- The need to better understand and adapt to human-induced climate change
- New studies to increase understanding of natural variability and the potential impacts of climate change on Sydney's supply and demand balance.

What has been done to understand climate change

- NSW studies have built on international and national studies to increase understanding of the effects of human-induced climate change across a range of sectors and to progress strategies for limiting greenhouse gas emissions
- A study to understand the effect of future greenhouse gas emission scenarios on projected runoff into Sydney's main water storages has commenced.

What will be done next

- Studies to consider climate variability and climate change impacts on Sydney's future rain-fed water supply and Sydney's demand for water will continue and will inform future iterations of the *Metropolitan Water Plan*.

4.1 Introduction

As outlined in the previous chapter, securing Sydney's water needs in drought has been a principal driver shaping the configuration of the rain-fed water supply system, including decisions to implement water restrictions. The current estimate of water available from the system is influenced by the observed pattern of runoff into Sydney Catchment Authority's storages over the last 96 years, a relatively short period in climatic terms. As well as affecting the amount of water in storages, climate also affects the rate at which the water is consumed.

Both natural and human-induced phenomena affect regional and local climate. Major international, national and NSW studies have been undertaken, and some studies specific to the Sydney region have commenced. To manage Sydney's water supply and demand balance over the long term requires improved understanding of climatic cycles and trends, as described below.

4.2 Climate variability in the Sydney region

Sydney's climate is thought to vary naturally over a number of time scales. At times, single rain events deliver large proportions of the annual rainfall. The ENSO (El Niño-Southern Oscillation) phenomenon, characterised by alternating drought and wet periods at opposite sides of the Pacific Ocean, can also impact Sydney rainfall patterns over a timescale of a few years up to a decade. Many El Niño years (such as 1965, 1982, 1994 and 2002) were associated with very low rainfall in the Sydney region.

Longer term rainfall variability in the Sydney region is more difficult to quantify because written records of rainfall and river heights in the Sydney region are available only for the relatively short period of time coincident with establishment of farmlands, towns and the like.

In order to improve understanding of longer term rainfall variability, the University of Newcastle is undertaking research for the Sydney Catchment Authority on long term rainfall patterns in the Sydney region over the last 1,000 years. This study will use techniques that look for evidence of wetting and drying cycles in natural archives. For example, stalagmites are highly responsive to climate variability because the composition of the drip waters that feed them changes with shifts in regional temperatures, biological activity and rainfall. The physical characteristics of sediment that builds up on river floodplains, such as changes in particle size, can show the history and magnitude of past floods. Stalagmites from the Wombeyan Caves, west of Mittagong in the Warragamba Dam catchment, and floodplain sediments from sites in the middle and lower Hawkesbury-Nepean will be considered in the University of Newcastle study, the findings of which are expected to be available in 2009.

4.3 Human induced climate change

In addition to this natural climate variability, human induced climate change may also impact Sydney's future supply and demand balance. Human induced climate change refers to the impact of increasing atmospheric concentrations of greenhouse gases such as carbon dioxide and their impact on global climate systems. There is an increasing body of evidence to indicate that increased greenhouse gas concentrations – due largely to the combustion of fossil fuels in the energy and transport sectors, as well as vegetation clearing and agriculture – are already having an impact on climate, and that these impacts will likely become more pronounced over time.

The Intergovernmental Panel on Climate Change, an international organisation of more than 2,500 climate scientists, including several leading Australian scientists, concluded in its 2001 Third Assessment Report that:

- an increasing body of observations gives a collective picture of a warming world and other changes in the climate system

University of Newcastle study of stalagmites

© Sydney Catchment Authority. Photographer: TVU Pty Ltd.

- emissions of greenhouse gases and aerosols due to human activities continue to alter the atmosphere in ways that affect the climate system
- there is new and stronger evidence that most of the global warming observed over the last 50 years is attributable to human activities
- confidence in the ability of models to project future climates has increased
- by the year 2100, global average temperature may rise 1.4 to 5.8°C if there are no explicit policies to limit greenhouse gas emissions
- projected changes in climate extremes could have major consequences, and
- since global warming cannot be avoided completely, adaptation will be necessary to complement efforts to reduce net greenhouse gas emissions.

For more information refer to: **(http://www.ipcc.ch/pub/un/syreng/spm.pdf)**

The timing and scale of climate change impacts will be influenced by a wide range of factors, including the level of atmospheric greenhouse gas concentrations over time. This in turn is affected by parameters such as economic growth, technology change, global efforts to reduce emissions and so on. As such, it is difficult for scientists to predict with certainty what impacts climate change will have globally – and estimating impacts at the regional and local levels is even harder.

To deal with the uncertainty inherent in projecting future climate change, scientists use scenarios to examine what might occur under varying levels of atmospheric greenhouse gas concentrations. Such analyses tend to take a long term view, for example estimating potential impacts in 2030 and 2070. This reflects the time lag that exists between the actual emission of greenhouse gases, the resulting increase in atmospheric concentrations of greenhouse gases, and the impact that this has on global climate systems. Taking a longer term view also allows analysts to isolate the effect of increased atmospheric concentrations from short term natural climate variability.

In 2001, the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) released climate change projections for Australia. Changes in future Australian temperature and rainfall were projected for the years 2030 and 2070 on the basis of simulations by nine different climate models run for scenarios with higher than current greenhouse gas concentrations. Climate change is projected to impact Australia in a variety of ways – including changed rainfall patterns, more hot days, higher evaporation rates, more prolonged and intense droughts and more intense bushfires and storm events.

For more information refer to: **http://www.dar.csiro.au/impacts/future.html**

The CSIRO 2001 climate projections also included projections for major cities across the country, including Sydney, although it was noted that the coarse spatial scale of the climate models available at that time limited their ability to simulate the details of regional climate change, which is influenced by local conditions such as landform, vegetation type and urbanisation.

In 2004, the NSW Greenhouse Office published CSIRO's analysis of potential impacts of climate change across NSW under a range of climate change scenarios. CSIRO examined past climate records and the results of 12 climate models to assess past changes in NSW climate and likely changes over the next 70 years, for both average climate and its extremes. It found that, across NSW, rivers are likely to decline and extreme weather events are likely to become more frequent.

For more information refer to: **http://www.cabinet.nsw.gov.au/greenhouse/linked_files/Climate%20change%20in%20NSW.pdf** and **http://www.cabinet.nsw.gov.au/greenhouse/linked_files/Change.pdf**

CSIRO's 2004 study has informed the development of the NSW Government's *2005 Greenhouse Plan*, which proposes further analysis of climate impacts on particular regions and sectors, and outlines mitigation strategies (to reduce greenhouse gases) and adaptation strategies (to reduce the impacts of climate change).

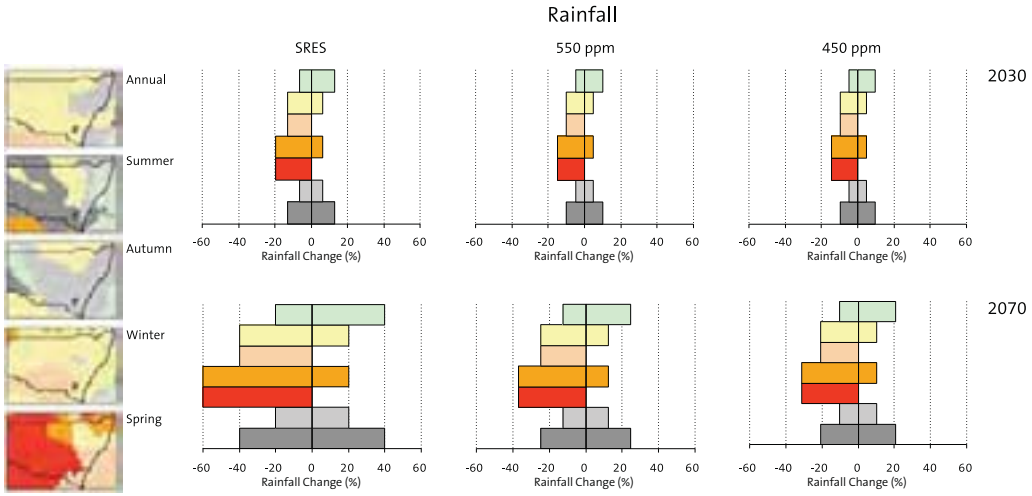
For more information refer to: **http://www.greenhouseinfo.nsw.gov.au/__data/page/927/11-11_FINAL_GHO_Exec_Summary.pdf** and **http://www.greenhouseinfo.nsw.gov.au/__data/page/927/28-11_FINAL_NSW_GH_Plan_web.pdf**

4.4 Potential impacts of climate change on Sydney's water balance

Analysing the potential impact of climate change on the Sydney water supply system involves taking the outputs from global climate models and examining how these results might impact at the regional and local level. Climate change impacts on water availability in Sydney may include:

- higher temperatures
- changed rainfall patterns
- increased evaporation (which will increase evaporative losses from the system and reduce the amount of run-off that flows into the system), and
- longer and more intense droughts.

Rainfall projections for NSW under various greenhouse gas emission scenarios (SRES, 550ppm, 450ppm) in 2030 and 2070, relative to 1990



Together these impacts may reduce the amount of water available on average in the Sydney system. Conversely, however, the frequency and intensity of storm events may increase in future – leading to more storm events that will fill the storages after prolonged periods of low rainfall.

On the demand side, an increase in the number of hot days and prolonged periods of low rainfall may result in greater demand for water as a result of increases in garden watering, use of evaporative cooling, the number of showers people tend to take each day, and so on. Potential changes to rainfall patterns may also impact the potential contribution of rainwater tanks to meeting Sydney's supply and demand balance.

Two studies are already under way in the Sydney region. The Upper Parramatta River Catchment Management Trust has commissioned CSIRO to examine extreme rainfall events across Sydney under future scenarios. The University of New South Wales, in collaboration with the Sydney Catchment Authority, is undertaking a study to downscale the global and regional climate models to the scale of Sydney's water supply catchment. The modelled catchment scale rainfall projections will subsequently be translated into run-off projections and will provide an indication of future changes in catchment yields under different greenhouse gas emission levels.

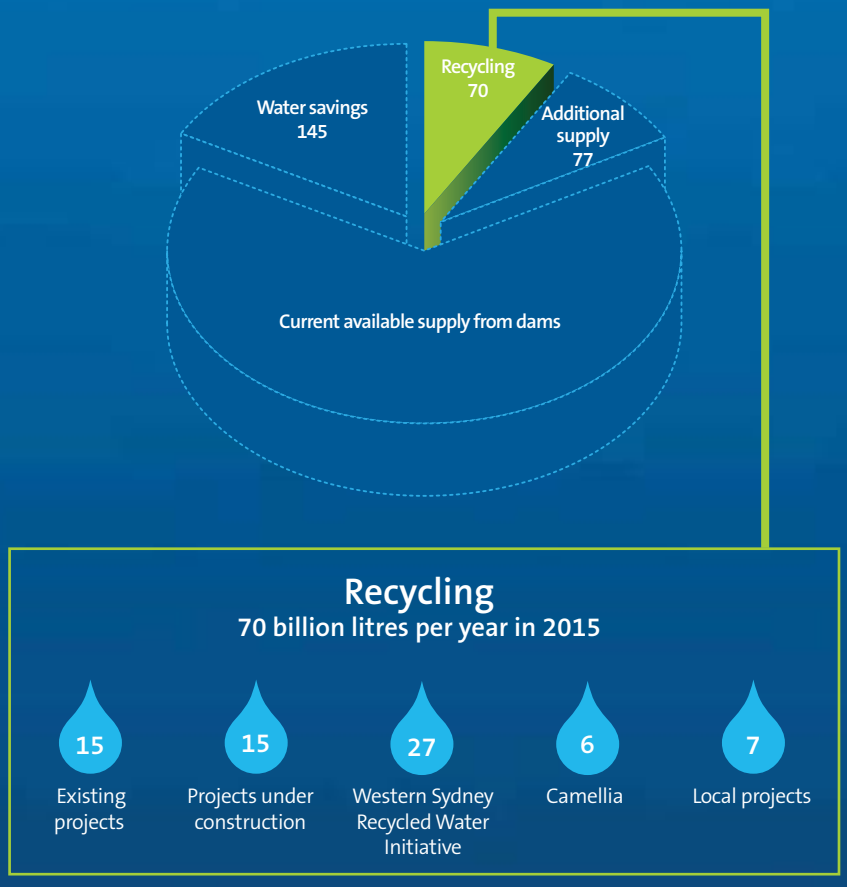
To further improve understanding, the NSW Government has commissioned a study to examine the potential impacts of climate change on both water supply and demand across the whole of Sydney. The study will produce estimates of the potential impacts of climate change on water availability and projected water demand in 2030 and beyond. Contributors to the study include CSIRO, the University of New South Wales, Sydney Catchment Authority, Sydney Water Corporation, the Australian Greenhouse Office and NSW Greenhouse Office. The results from this study will be available in two to three years time and will inform future iterations of the *Metropolitan Water Plan*. In the interim, as discussed in Chapter 2, section 2.5, the independent consultants advise that the suite of measures outlined in this *2006 Plan* provide confidence that Sydney's supply and demand balance will continue to be met in the near- to mid- term, even if climatic conditions worsen.

Given that climate change projections and anticipated impacts are inherently uncertain, it will be important to maintain an adaptive approach to managing Sydney's water needs, including potential climate change impacts. To this end, the Government will continue to monitor trends in water availability and water demand as part of regular reviews of the *Metropolitan Water Plan*. This will enable cost effective and sustainable policy responses (such as additional investment in recycling and water conservation) to be tailored to ensure that Sydney's water supply and demand balance continues to be met over time.

What will be done next

- Studies to consider climate variability and climate change impacts on Sydney's future rain-fed water supply and Sydney's demand for water will continue and will inform future iterations of the *Metropolitan Water Plan*.

5. Using recycled water in greater Sydney



Note: The total volume recycled is anticipated to be more than 70 billion litres every year by 2015. However, the use of recycled water for some purposes does not save drinking water. The total amount of drinking water expected to be saved through recycling is 59 billion litres per year.

What this chapter is about

- How much wastewater is recycled in Sydney
- How Sydney's recycling compares with other major Australian cities
- Role of recycled water in the *2006 Metropolitan Water Plan*
- Western Sydney Recycled Water Initiative
- Recycling water for homes, industry, irrigation, and replacing releases from Warragamba Dam

What has been done to increase recycling

- There are currently 14 recycled water schemes in greater Sydney that recycle approximately 15 billion litres of wastewater per year.
- This recycling volume will almost double with an extra 15 billion litres through new schemes currently under construction and coming on-line in the next few years.
- Round 1 of the NSW Water Savings Fund provided more than $9.2 million towards 27 projects located in Sydney, many of which relate to recycling, that will save more than 21 billion litres of drinking water over the next 10 years.

What will be done next

- The Western Sydney Recycled Water Initiative will recycle water for homes, agriculture and replacing releases from Warragamba Dam, saving up to 27 billion litres of water per year by 2015
- Expressions of Interest will be sought in June 2006 for the provision of recycled water services to new residential development in the North West growth centres and replacing releases from Warragamba Dam
- The Camellia Recycled Water Project will provide recycled water to industrial and open space users at Camellia (near Parramatta), saving up to 6 billion litres of water every year
- Recycled water investigations will be finalised in Botany, Kurnell, Wollongong, and Parramatta, where high water using industry and open space are located
- An $80 million Urban Sustainability Program will provide grants to councils for stormwater harvesting and other measures designed to save water and protect the environment under the City and Country Environment Restoration Program
- Guidelines will be released to provide advice on planning and design aspects of stormwater harvesting projects
- A new Sewer Mining Policy will make future sewer mining agreements between Sydney Water and non - government organisations easier
- A third party access regime will make it easier for the private sector to utilise Sydney Water's existing wastewater network to recycle water
- Regulatory reform, together with training and education programs, will make greywater recycling easier for householders in single dwellings
- On-site industrial and commercial recycling systems will continue to be developed through Sydney Water's Every Drop Counts Business Program
- Further funding rounds under the NSW Water Savings Fund will encourage recycling by businesses and councils.

5.1 Introduction

Demand for high quality drinking water can be significantly reduced by replacing it, where appropriate, with the use of recycled water.

Water is recycled when wastewater (stormwater or sewage) is treated then supplied to farms, parks, golf courses, businesses and homes for their use. It can be used for a large number of purposes, including toilet flushing, irrigation, clothes washing and numerous industrial processes.

As well as reducing demand for high quality drinking water, recycling can reduce stress on urban streams and rivers by capturing some of the water and nutrients that would otherwise be discharged from sewage treatment plants and stormwater drains.

As a non-rainfall dependent supply option, increasing the share of recycled water also reduces the impact of future droughts and potential impacts of climate change.

5.1.1 What's the role of recycled water in the *Metropolitan Water Plan*?

Recycled water is an integral part of ensuring a sustainable water supply for greater Sydney and plays an important role in a diversified portfolio of demand and supply options. Importantly, the use of recycled water is not reliant on a rain-fed system.

The Government already recycles a significant amount of wastewater in a number of residential, industrial and agricultural projects. Sydney already boasts the country's largest residential recycling scheme. By 2015, the volume of recycled water used will quadruple from the current total of 15 billion litres every year, up to around 70 billion litres every year by 2015, thus making Sydney one of the largest users of recycled water in Australia.

The Government is pursuing recycling wherever it is feasible and practical, but recycling is not the whole solution to Sydney's water needs. Many factors must be taken into account before committing to a recycled water scheme. Features of a successful scheme include:

- close proximity of users to the source of the treated wastewater and stormwater to minimise transport costs
- long term, guaranteed customers that are located close to each other to provide investment certainty for the scheme
- appropriate quality of the recycled water required to ensure protection of public health and the environment
- acceptable treatment and transport costs and value for money
- manageable environmental impacts and benefits (eg. energy use and reducing pollutant discharges to rivers)
- community acceptance to ensure support of the scheme.

The Government does not support introducing recycled water into Sydney's drinking water supply at this time for several reasons. The independent expert analysis of the supply and demand balance shows that Sydney's water supplies are more than adequate to meet the demands of a growing population to at least 2015. Beyond that, there is a range of feasible options available to meet future needs.

Before any proposal to introduce recycled water to the drinking water supply can be seriously contemplated, implications for public health of such a scheme would need to be assessed. For example, such an assessment would need to consider the quality of recycled water, dilution levels as the recycled water is mixed into the raw water in storages, retention rates in the storages and the presence of harmful micro-organisms or chemicals.

Further, no such scheme could proceed without community acceptance. Local research shows community reluctance to accept the introduction of recycled water into the drinking water system at present.

Government investigations have concluded that there are viable recycling schemes in Western Sydney, and in some other established parts of Sydney. A detailed study was undertaken to review potential locations and markets for recycled water across Sydney, the Blue Mountains and the Illawarra. This analysis identified that the most significant opportunities for large scale recycling lie in Western Sydney. These are discussed later in this chapter. Based on the findings of the analysis, proposed recycling schemes involving the transportation of wastewater from coastal sewage treatment plants (such as Malabar) to inland Western Sydney areas are not included in this *Metropolitan Water Plan*.

5.1.2 How much wastewater is recycled in Sydney?

Sydney recycles approximately 15 billion litres of wastewater per year. There are 14 large recycled water schemes currently in place in greater Sydney along with a number of smaller schemes.

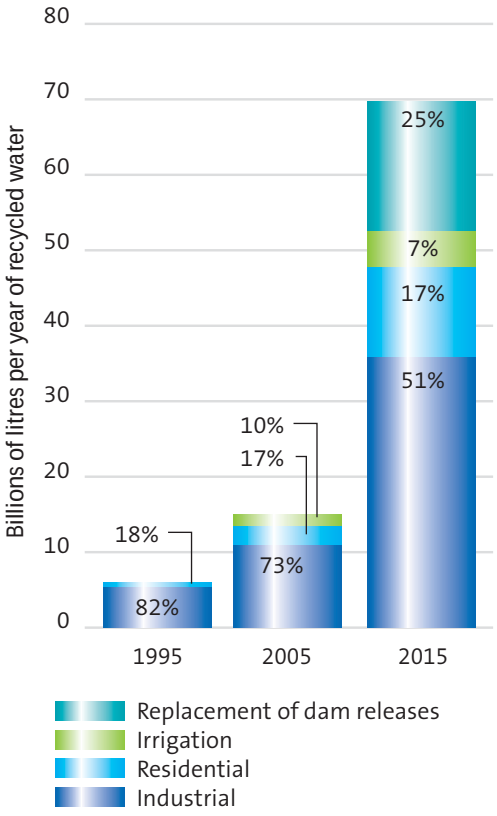
Wastewater recycled in 2004-05 (billion litres/year)	
Rouse Hill, Stages 1 & 2 (residential dual reticulation)	1.40
Richmond Golf Club (irrigation)	0.14
Ashlar Golf Course (irrigation)	0.08
Warwick Farm Race Course (irrigation)	0.16
Castle Hill Golf Course (irrigation)	0.10
Hickeys Lane Reserve (irrigation)	0.01
UWS Hawkesbury (irrigation)	0.42
Kiama Golf Club (irrigation)	0.07
Dunheved Golf Club (irrigation)	0.10
Picton Scheme (agricultural irrigation)	0.36
Aorangi Farm (agricultural irrigation)	0.20
Sydney Water sewage treatment plants (on-site process use)	9.80
WRAMS (Sydney Olympic Park Authority) (sewer mining and stormwater harvesting)	1.30
Liverpool Golf Course (irrigation)	0.03
Other small schemes	0.78
Total	**15**

This current recycling volume per year will increase by an extra 15 billion litres through new schemes currently under construction or due to commence in the next few years.

Recycled water projects currently under construction (billion litres/year)	
Rouse Hill Stage 3 (dual reticulation)	2.7
Hoxton Park (dual reticulation)	3.1
BlueScope Steel (industrial)	7.3
West Camden (irrigation)	1.8
Malabar Sewage Treatment Plant (on-site process use)	0.3
North Head Sewage Treatment Plant (on-site process use)	0.3
Total	**15.5**

In addition, the Government has announced plans to significantly increase the amount of recycled water provided through new large scale recycling schemes to new homes, industry, open space and rivers in Western Sydney. These plans, described later in this chapter, will bring the total volume recycled to more than 70 billion litres per year by 2015.

Recycled water use in Sydney



14

Six schemes currently under construction are projected to produce over 15 billion litres of recycled water by 2015, of which 14 billion is expected to replace drinking water.

5.1.3 How does Sydney compare with other major Australian cities?

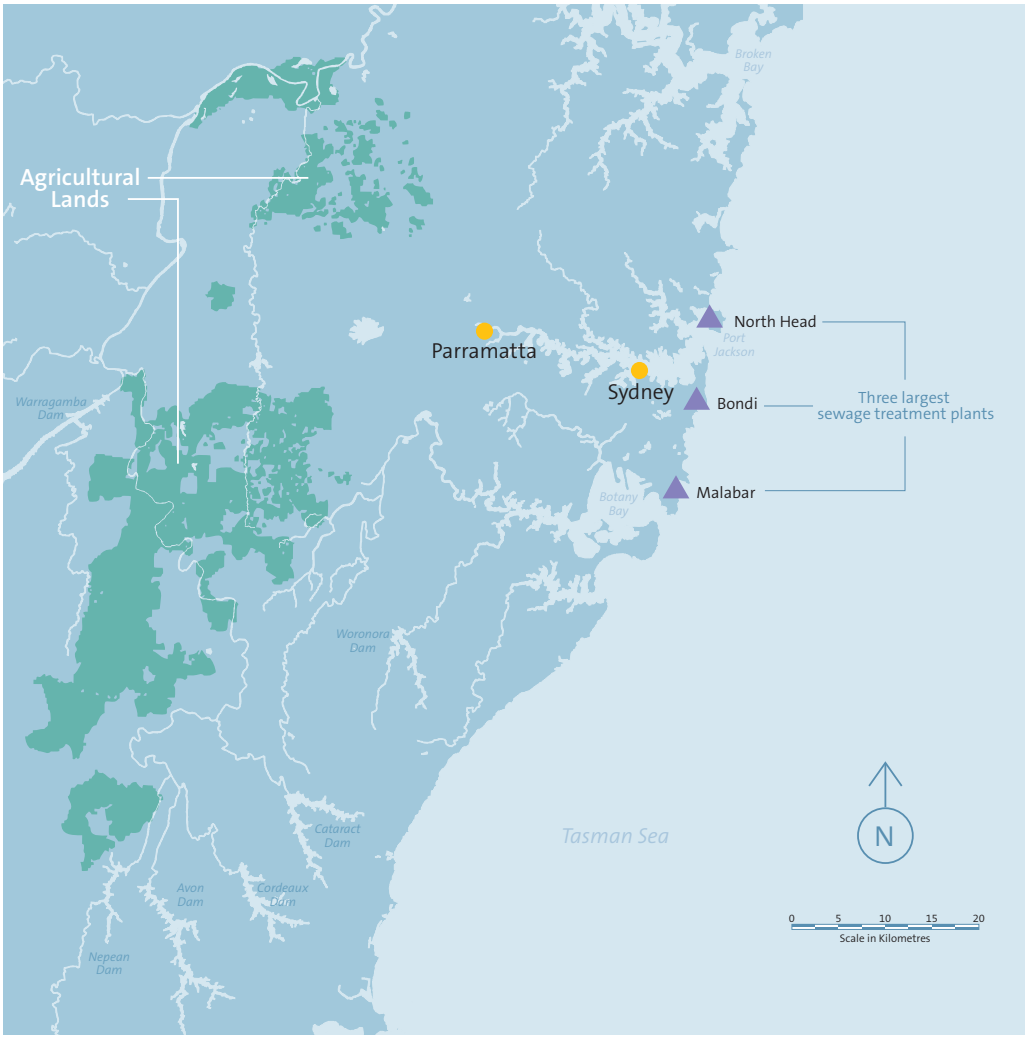
Sydney currently recycles about 3% of all the wastewater that it collects - around 15 billion litres recycled per year from a total of 450 billion litres of collected wastewater. Approximately 41% of that recycled water, or about 6 billion litres, is used to replace drinking water use, reducing pressure on rain-fed drinking water supplies.

Other major cities recycle a greater amount of collected wastewater, but this is primarily only for agricultural irrigation or in operations at sewage treatment plants.

Both Melbourne and Adelaide are able to undertake large scale recycling for irrigation of agriculture because their sewage treatment plants are located close to a small number of high volume agricultural users. For example, the Western Treatment Plant in Melbourne currently irrigates pastures within the boundary of the plant with 20 billion litres of recycled water every year.

In Sydney, such agricultural markets are not close to Sydney's largest sewage treatment plants, which are located in densely urbanised coastal areas. As such, much more diverse recycled water markets are utilised under the Government's Plan in Sydney, including residential, industrial and agricultural markets in Western Sydney. Total recycling in these markets is projected to be more than 70 billion litres per year by 2015, or about 15% of all the wastewater collected.

Location of Sydney's largest sewage treatment plants in highly developed urban areas, remote from large tracts of agricultural land in Western Sydney



5.1.4 Western Sydney Recycled Water Initiative

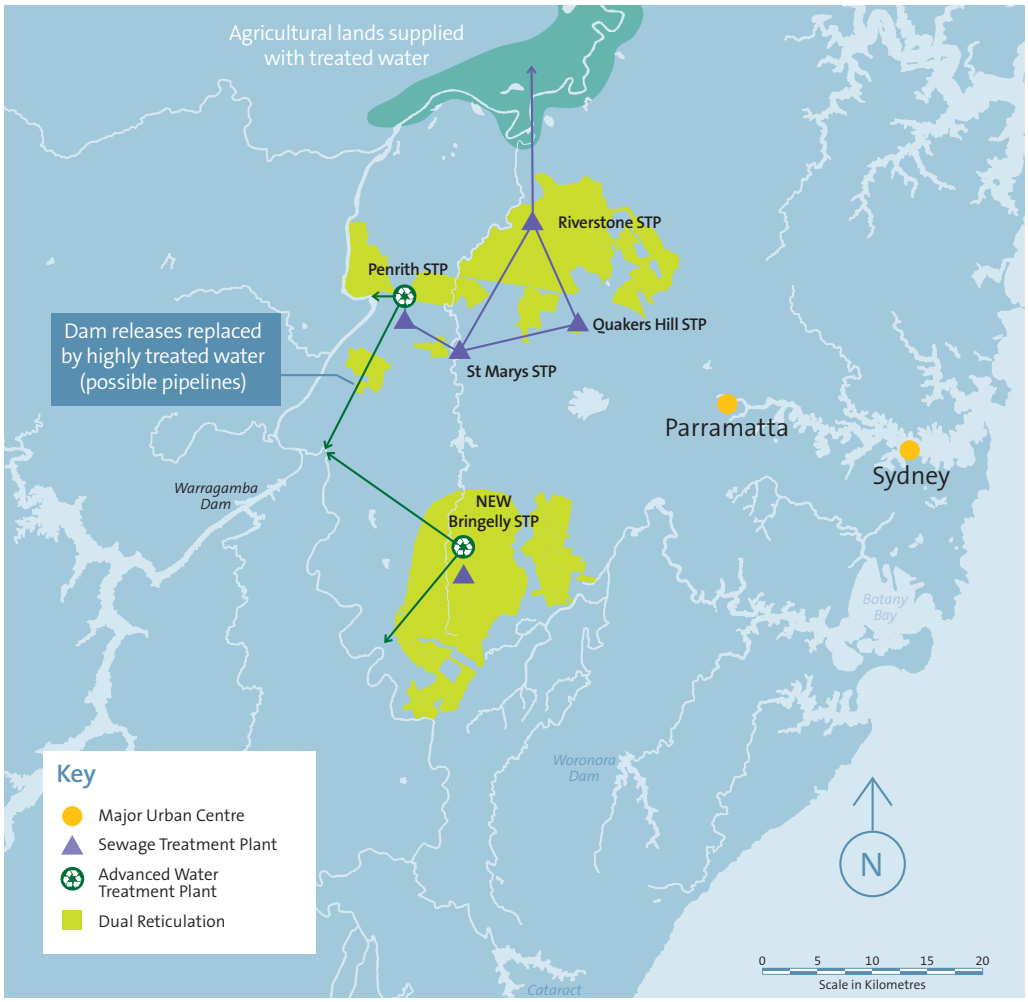
The Government has planned the construction and operation of the Western Sydney Recycled Water Initiative. The objective is to maximise the beneficial use of recycled water for residential, industrial, agricultural and environmental purposes. Large-scale water recycling will result in significant benefits if used in the new, large growth areas of Western Sydney because:

- there are significant markets for recycled water in Western Sydney including:
  - major land releases for residential development
  - agricultural lands for irrigation and
  - substitution of releases of water from Warragamba Dam
- there are several large existing sewage treatment plants that already produce high quality treated wastewater, which requires only low levels of additional treatment before recycling
- transportation costs and disruption are minimised
- wastewater from Western Sydney sewage treatment plants needs to be recycled anyway over the next 25 years in order to reduce the discharges from the plants and to protect the Hawkesbury-Nepean River.

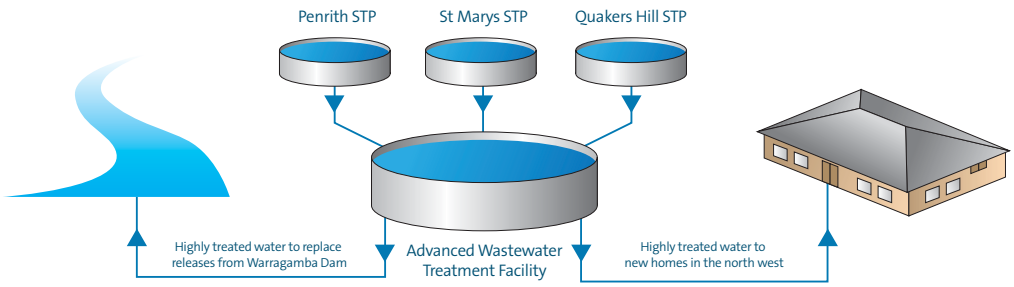
The North West will be the first area to receive recycled water as there are already several high quality sewage treatment plants in the region. Future development plans for the South West are still being finalised and a South West recycling scheme will be implemented as development proceeds.

Under the North West Scheme, three existing sewage treatment plants (Penrith, St Marys and Quakers Hill) will be interconnected to form an integrated source that can service demand for recycled water from the new residential land releases. A new advanced water treatment plant will be built, drawing on the available effluent at the above plants, to replace water currently released from Warragamba Dam for extraction and river health purposes – this is further described later in this chapter. Expressions of Interest will be sought from the private sector in June 2006 for the delivery of the above services.

Western Sydney Recycled Water Initiative



Western Sydney Recycled Water Initiative – North West Scheme



When the North West Scheme is fully implemented, all of the treated effluent currently being discharged by the major Western Sydney sewage treatment plants will be fully allocated to productive uses – none will go to waste. The scheme will produce up to 27 billion litres of recycled water every year by 2015. In addition, by removing large quantities of nutrients currently being discharged by sewage treatment plants that can contribute to algal blooms, the scheme will deliver water quality improvements in the Hawkesbury-Nepean River and its tributaries. It is estimated that approximately 323 tonnes per year of nitrogen and 4.8 tonnes per year of phosphorous will cease being discharged to the river as a result of the Scheme and there will be associated reductions in components such as heavy metals.

The benefits for river health are further discussed in Chapter 8.

Over the next 25 years, the NSW Government is committed to:

- providing recycled water via dual reticulation to all 160,000 new homes to be built in new suburbs in Sydney's North West and South West growth centres
- substituting as much recycled water as feasible for planned releases from Warragamba Dam
- utilising treated wastewater in agriculture as supply becomes available and where it is cost effective to do so.

In addition to the Western Sydney Recycled Water Initiative, the Government will progress a range of practical and sustainable recycled water schemes for homes, industry, open space and rivers in Western Sydney, and in other established parts of Sydney. These are described on the following pages.

5.1.5 Regulatory reform

Businesses and councils can also gain direct access to untreated wastewater in sewer lines and treat it themselves for their own use or for supply to other customers. The Government will shortly release an updated Sewer Mining Policy to make future agreements easier between Sydney Water and non-government organisations. This is described in more detail in Chapter 9.

The Independent Pricing and Regulatory Tribunal is undertaking a review to determine the maximum prices that can be charged by Sydney Water (as well as Hunter Water and Gosford and Wyong Councils) for the provision and supply of recycled water services. The Tribunal will also consider making a determination to cover sewer mining arrangements.

For more information visit:
http://www.ipart.nsw.gov.au

5.2 Recycling water for homes

5.2.1 Wastewater recycled in new suburbs

Water use in the residential sector for toilet flushing, watering gardens and car washing accounts for approximately 40% of current total water demand in this sector. Substituting recycled water for such uses could significantly reduce demand for drinking water. This is a very important role for recycled water, wherever costs, community acceptance and environmental impacts make it feasible and practical.

The best opportunity for large scale residential water recycling is in new suburbs, where recycled water pipelines can be constructed at the same time as drinking water mains. This is often referred to as dual reticulation, meaning two sets of pipes – one for drinking water and one for recycled water.

Already Sydney has Australia's largest residential recycled water scheme at Rouse Hill, where currently 15,500 homes are using 4 million litres of recycled water each day, or 1.5 billion litres per year. This represents a reduction in drinking water consumption of 35% per household. Once Rouse Hill is fully developed, the scheme will service around 36,000 homes and save more than 4 billion litres of potable water per year. Pipelines for the next 10,000 homes will be in place by 2006.

The residential dual reticulation market is a long term, stable market, although there is likely to be some seasonality to the demand where there are significant areas of garden (because people with gardens use more water in the summer than in the winter). Customer research conducted for the Rouse Hill Recycled Water Scheme shows that residents have a very positive view of the scheme. These customers appreciate the environmental and price benefits of the recycled water supply.

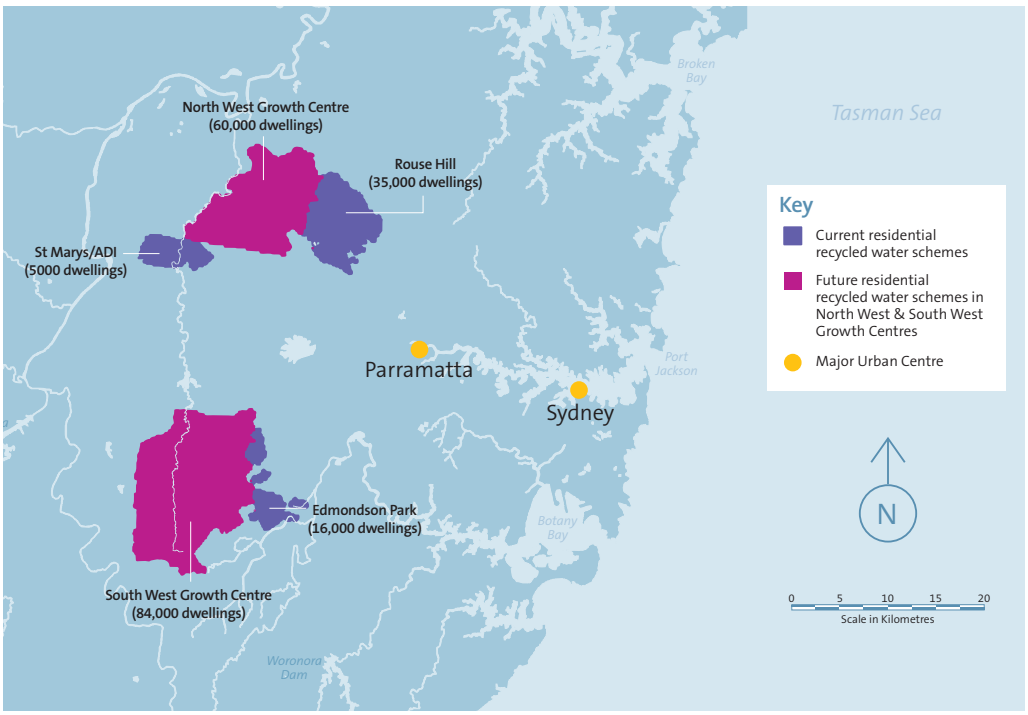
In addition to the Rouse Hill scheme, homes are being serviced by dual reticulation at Homebush Bay, providing drinking water savings of around 0.9 billion litres per year. Two new schemes are also under construction at Hoxton Park and Ropes Crossing at St Marys.

In addition to these schemes, the Government is committed to providing recycled water via dual reticulation to all new homes to be built in new suburbs in Sydney's North West and South West growth centres over the next 25 years. The total number of homes is expected to be 160,000. The first of these homes will be completed in 2007. This scheme will deliver a saving of around of 21 billion litres of drinking water every year by 2030. Expressions of Interest will be sought from the private sector to deliver these schemes. To provide certainty to this process, the Government has incorporated a provision in the draft *State Environmental Planning Policy (Sydney Region Growth Centres) 2006* that requires developers to connect to a recycled water system, if one is available.

Purple recycled water and drinking water mains supply taps that are part of a typical dual reticulation scheme

Providing recycled water to new North West sector residential areas is projected to save up to 4.2 billion litres each year by 2015. Dual reticulation to other residential sectors will bring this total to 11 billion litres a year.

Current and future residential recycled water schemes in Western Sydney



5.2.2 How can wastewater be recycled in older suburbs?

Implementing large scale residential recycling schemes in existing suburbs would involve digging up the streets to lay 21,000 kilometres of recycled water pipelines alongside drinking water mains. This would have major impacts on the community including excavation and restoration of local roads, vegetation clearance and potential compulsory acquisition of community and private land.

It would also require significant and costly investment by Sydneysiders, who in addition to paying for the above works via water charges, would also be responsible for meeting the cost of installing a second set of pipes on their own properties. For these reasons, the installation of dual reticulation in developed areas is generally not economically feasible.

However, recycling can potentially be implemented on a local scale when there is major redevelopment of existing areas. An example of this type of approach is the redevelopment of Kogarah Town Square, which captures and uses stormwater from roofs and paved areas for toilet flushing, car washing, water features and watering landscaped areas.

There are also many ways that homeowners in established parts of Sydney can make a contribution to saving Sydney's drinking water supply. As well as adopting water efficient practices (such as not watering the garden in the heat of the day) and fitting water efficient taps, showerheads and toilets, householders can reduce potable water consumption in their own homes through installing rainwater tanks and reusing household greywater.

Rainwater tanks can play a role in saving Sydney's precious drinking water by capturing stormwater at source and raising awareness of the importance of saving water. Accordingly, the Government will continue to provide financial incentives for installing tanks until June 2008. This is discussed further in Chapter 6.

5.2.3 Reuse of greywater

Greywater is wastewater from a household's shower, basin, bath and washing machine. It can be directly diverted to a garden, using authorised devices and plumbing fittings that can be easily installed by a plumber. More households are seeking to do this in the current drought, as water restrictions limit how gardens can be watered with drinking water.

Currently, such simple diversions of greywater to gardens require the approval of the local council. Councils have usually taken a conservative approach given they have less experience in this activity than others. In addition, the land application guidelines that councils have relied upon were developed more for septic tank management than greywater diversion. There has been significant public interest in reducing the regulatory requirements, and associated costs, for greywater recycling. The community is also interested in gaining access to better information on desirable management practices.

For more information, visit **www.sydneywater.com.au/SavingWater/GreyWater/** and

www.health.nsw.gov.au/public-health/ehb/general/wastewater/wastewater.html

The Government recognises that, if some simple precautions are followed, diverting greywater for single dwelling gardens is a very low risk undertaking in terms of health and environmental impacts.

Therefore, the Government is:

- amending the *Local Government (General) Regulation 2005* so that most direct greywater diversion does not require council approval
- amending the *NSW Plumbing Code of Practice* to permit plumbing changes by licensed plumbers for the purposes of installing or maintaining exempt greywater diversion schemes (where council approval was previously required)
- developing and conducting training and education programs for local government officers to support their ongoing role in greywater management
- developing and releasing user friendly guidelines, fact sheets and a self assessment form to support best practice management.

The exemption from council approval is only for the direct diversion of greywater for garden usage under certain conditions. Treatment and storage of greywater for flushing toilets or other purposes will not be exempt and will continue to require council approval, to reflect the higher environmental and health risks and the need for a detailed site specific assessment.

2

Household use of greywater could save up to 2 billion litres of drinking water each year by 2015.

Greywater is diverted from a shower using a licensed diversion device (1) and distributed directly to citrus and water-loving plants through a slotted pipe (2) under 100mm of mulch. In this unusual installation, a small portion of the flow is diverted through a series of six gravel reedbeds (3) which remove nutrients and pollutants. After five days in the reedbeds, the water enters two water-feature fish ponds (4) with gravel filters to further polish the water.

Guidelines for greywater diversion without an operating approval

- Wastewater is not diverted from kitchen or toilet plumbing.
- The premises are not supplied by recycled water from a dual pipe system.
- An on-site sewage management facility is not in place.
- Greywater is not stored in any way, other than temporarily in a bucket or similar container, or treated other than primary screening or filtration.
- A washing machine standpipe or licensed diversion device delivers the greywater to a sub-soil or sub-surface land application system.
- The standpipe or diversion device has a manual switching or selection facility so that greywater can be easily diverted back to the sewer.
- Any diversion device connected to, or modifying the existing plumbing system is a licensed device, and must be installed by a licensed plumber.
- Any diversion other than by gravity is only via a licensed non-storage surge tank and pump system installed by a licensed plumber.
- Some form of non-storage surge attenuation is installed as part of the diversion device or as a sub-soil trench.
- All drainage lines (including hoses) are located below ground level.
- The local water utility must be notified by the installing plumber that a greywater diversion device is in place.
- The landowner must ensure that the diversion and land application systems are compliant with the performance standards in the Regulation.

5.3 Recycling water for industry

5.3.1 Billions of litres of wastewater recycled for industry use

Recycled water can be substituted for in industrial processes where drinking water is not required, although potential opportunities are limited. Of all the drinking water consumed in Sydney, industry consumes just 12%. Furthermore, many of the largest industry users are food and beverage companies, which are unable to use recycled wastewater for some of their operational needs. Nevertheless, the Government has encouraged investigations and investment to supply recycled water to industry where a ready supply source is located nearby so as to minimise costly transport.

The biggest water recycling scheme in Australia will soon be launched for industrial use by BlueScope Steel in Port Kembla. Twenty million litres of high quality recycled water per day will be delivered to BlueScope Steel from a new recycled water plant at Wollongong Sewage Treatment Plant. This will replace 7.3 billion litres of drinking water per year currently drawn from nearby Avon Dam.

Another significant example is Illawarra Coal's Douglas Park facility, which aims to reuse saline mine water and save up to 2 million litres per day of drinking water (0.73 billion litres per year), while at the same time reducing the amount of salt water discharged into the local creek. The BHP Billiton subsidiary is currently trialling three different types of desalination plants. If successful, the trials could lead to a desalination plant being set up at Douglas Park in 2007 or 2008.

There are also smaller industrial schemes around Sydney such as that being developed at the Dunheved Industrial Estate in East St Marys. Meanwhile, Sydney Water's sewage treatment plants use 10 billion litres of recycled water each year for their own operations. This equates to 85% of the water needed in their processes.

5.3.2 Sydney Water's Every Drop Counts Business Program

Sydney Water offers a formalised water saving process for business customers. A diagnostic process is used to evaluate a business's performance in water resource management, after which a water savings plan is developed.

Recycled water, in addition to other water saving measures, forms a significant component of the savings plans implemented by both private sector and government organisations. The Every Drop Counts (EDC) Business Program is discussed further in Chapter 6, section 6.2.

Wollongong Sewage Treatment Plant containing a recycled water plant.

Since the *2004 Metropolitan Water Plan*, the following recycling projects have been developed through Sydney Water's EDC Business Program participants:

Every Drop Counts Business Program – Commissioned Recycling Projects		
Company	**Project**	**Potable savings (million litres/year)**
Kellogg Australia	Water recycled for use in air pollution control scrubbers	73
GlaxoSmithKline	Increased use of waste water in cooling processes and for amenities	33
Zoological Parks Board of NSW	Increased recycled water use at Taronga Zoo	73
Visy Paper Pty Ltd	Recycling system to filter paper fibre from wastewater to enable reuse in other areas	292
Amcor Paper (Botany Paper Mill)	Utilisation of bore water for production processes	193
Illawarra Linen Service	New technology to enable reuse of laundry wastewater	17
Every Drop Counts Business Program – Planned Recycling Projects		
Sydney Harbour Foreshore Authority	Harvest stormwater at Darling Harbour precinct	4.4
Sydney Harbour Foreshore Authority	Harvest stormwater and recover condensation from air-conditioning for irrigation	22
TAFE NSW – Northern Sydney	Harvest stormwater for irrigation	28
NSW Department of Corrective Services	Recycle wastewater for toilet flushing and irrigation	25
Parramatta Stadium	Harvest stormwater for irrigation of oval	19
Total		**780**

Case study: GlaxoSmithKline

Not long ago pharmaceutical manufacturer GlaxoSmithKline was using more than 200,000 litres of drinking water a day in its production and administrative facilities at Ermington. Since joining the EDC Business Program in 2001, drinking water consumption has halved.

At that time a Sydney Water audit found the company could reduce water use by 40%. However, with recent equipment upgrades and strong staff support, GlaxoSmithKline has reduced its water consumption by more than half and maintained the savings from month to month.

The introduction of a water conservation awareness program for both administrative and manufacturing staff is also paying off. Recycled water continues to be used for toilet flushing in the administration building as well as in the shredder area, resulting in significant savings.

The monitoring of water meters has been critical – by monitoring water use via sub-metering, several leaks at the site were discovered and fixed. Monitoring has also been included in the site's computerised energy monitoring and building management system that tracks water use in real time and alerts the production personnel should the usage pass a predetermined limit.

Older style cooling towers have been replaced and consolidated as air conditioning towers have been removed from service and the heat load transferred to newer and more efficient air conditioning system cooling towers.

GlaxoSmithKline has shown that a 50% saving can be achieved and maintained.

New cooling tower at Glaxo Smith Kline

For more information, visit
http://www.sydneywater.com.au/SavingWater/InYourBusiness/EDCBusinessProgram.cfm

5.3.3 Water Savings Fund

In February 2006, the Government announced the first round of funding under its Water Savings Fund. The first round offers more than $9.2 million towards 27 projects, many of which relate to new practices and the installation of new technologies for water recycling in industry.

Industry recycling under the Water Savings Fund (round 1) 2005

Company	Type of recycling	Volume (million litres/year)
CSR Building Products Limited (fibre cement factory)	Process water recycling	139
DPK Australia Pty Ltd (fabric dyeing and finish plant)	Innovative filter technology	294
R Cordina & Son Pty Ltd (poultry processing)	Reuse of spin chiller overflow water	44
BlueScope Steel Limited (steel manufacturing)	Installation of storage tank to allow wastewater reuse	36
Solvay Interox Pty Ltd (chemicals)	Utilisation of treated groundwater	207
So Natural Foods Australia Limited (food processing)	Capture and reuse of potable water	24
The Austral Brick Co Pty Ltd (brick manufacturing)	Utilisation of alternate water source from quarry sump	23
Nationwide News Pty Ltd (print works)	Dam to harvest rainwater	30
Port Kembla Coal Terminal Limited (minerals)	Use of stormwater for dust suppression	100
Amcor Packaging (Australia) P/L (paper recycling)	Reverse osmosis technology to treat bore water	200
Total		**1,097**

1

Recycling projects under round 1 of the Water Savings Fund are projected to save around 1 billion litres of extra drinking water each year, by 2015.

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Various local projects are projected to save 12 billion litres of drinking water each year, by 2015

Case study: DPK Australia

DPK Australia received $525,000 from the first round of the Water Savings Fund towards a $1.4 million project to install new filtering equipment at its fabric dyeing and finishing plant in Alexandria.

The new equipment introduces innovative technology which, for the first time, is capable of removing fabric dyes from wastewater and clean it to a standard that can be reused in the manufacturing cycle.

DPK reports the new equipment will save and reuse 75% of manufacturing water, approximately 175 million litres a year which is currently going to waste.

DPK was established in 1981 and employs 125 people. The company manufactures and supplies a range of innovative knitted fabrics using Australian Merino wool and other luxury fibres, supplying local and export markets.

Additional funding rounds of the Water Savings Fund will be offered over the three remaining years of the program, providing further opportunities for innovative recycling projects identified by businesses and local councils. Applications for round 2 of the Water Savings Fund are currently being assessed.

For more information, refer to: **http://www.deus.nsw.gov.au/waterandenergysavings/index.htm**

5.3.4 Camellia Recycled Water Project

In addition to the above projects, the Government has identified a number of projects with strong prospects of further increasing the use of recycled water. They involve recycling treated wastewater and stormwater, and also using groundwater for industrial customers and for open space watering.

The first of these projects is an innovative water recycling scheme in the Camellia area near Parramatta, for which the Government released a Registration of Interest (ROI) in December 2005. Under the ROI, Sydney Water sought interest from the private sector for the provision of recycled water to industrial and open space users at Camellia, and the potential to expand the recycled water service to surrounding areas and beyond. This area of Sydney has many large factories and redevelopments where recycled water can be used instead of drinking water.

The Camellia Recycled Water Project will involve the design and construction of a recycled water treatment facility, pipelines, service reservoirs, pumping stations and other ancillary works.

The treated wastewater can be sourced from Liverpool Sewage Treatment Plant, retrieved through sewer mining or provided from an expanded Water Reclamation and Management Scheme located at Sydney Olympic Park, Homebush Bay. It will then be delivered to customers with a large demand, and several other medium sized commercial and industrial customers. The project could recycle up to 6 billion litres every year.

The NSW Government has assessed the ROIs and has received a range of proposals, some even expanding on the proposed scheme.

The short-listed companies are:

- AGL joined by Agility Management and Veolia Water Australia
- Earth Tech Engineering joined by McConnell Dowell
- United Utilities and Transfield Joint Venture joined by Tenix Alliance and Sinclair Knight Merz.

The Government has identified a number of additional projects in urban areas of Sydney with good prospects for further increasing the use of recycled water. Areas currently under investigation where a potential ready supply of recycled water is located near high water using industry include Botany, Kurnell, Wollongong and Quakers Hill. These investigations will be completed during 2006 and implementation will be managed by Sydney Water.

5.4 Recycling water for irrigation

5.4.1 Irrigating with recycled water

In greater Sydney, recycled wastewater is used for irrigating farms, golf courses, sportsgrounds, parks and racecourses.

Wastewater recycled for irrigation in 2004-05

Project	Volume (million litres/year)
Aorangi Farm, Gerroa	149
Carlton Farm, Picton	362
Ashlar Golf Club	76
Castle Hill Golf Club	83
Dunheved Golf Club	92
Kiama Golf Club	65
Liverpool Golf Club	55
Richmond Golf Club	139
Hickeys Lane Reserve sports grounds, Penrith	7
University of Western Sydney agriculture	416
Warwick Farm Racecourse	162
Total	**1,606**

Other schemes are being developed. For example, in the Hoxton Park area, construction is under way to provide recycled water by 2009 for irrigating Ingleburn Industrial Park, Forest Lawn Cemetery and three new golf courses. Recycling for irrigation as part of numerous schemes described in this chapter is projected to save 4 billion litres of drinking water each year by 2015.

Case study: Dunheved Golf Club

Dunheved Golf Club is a privately owned 18-hole golf course located at St Marys in Western Sydney. The course is situated alongside South Creek and previously relied on water extracted from the creek to meet its irrigation needs. Dunheved Golf Club approached Sydney Water and, in September 2000, a constant pressure, supply-on-demand recycled water scheme supplied from the St Marys Sewage Treatment Plant began operating.

The recycled water supply system connects to the club's existing fixed irrigation system. Outlets are also provided to allow connection of soft hose moveable sprinklers. Irrigation is generally carried out at night.

Recycled water usage data for Dunheved shows that average daily usage is around 255,000 litres. The maximum daily usage recorded to date is 1.32 million litres and the highest monthly total consumption was 18.23 million litres recorded in January 2003.

As part of the environmental management of the site, annual soil tests are carried out. The results indicate that the soils have not been degraded through irrigation with recycled water and are suitable for ongoing irrigation with recycled water. Although the results also indicate that groundwater levels have risen since commissioning, further monitoring of groundwater levels is required to determine long term trends.

Under the terms of the original recycled water supply agreement between Sydney Water and Dunheved Golf Club, the capital cost of the scheme was met by Sydney Water, Dunheved Golf Club would progressively repay this over 20 years. The club, however, subsequently elected to fully reimburse Sydney Water for the capital cost of the system in June 2003 and is now liable for only minor usage charges. Sydney Water remains responsible for the operation and maintenance of the recycled water supply system.

5.4.2 Increasing recycling of wastewater on farms

Farmers in the Sydney basin use recycled water to irrigate crops or pasture and reduce extractions from the Hawkesbury-Nepean River and tributaries. Such use will also avoid the discharge of wastewater from sewage treatment plants to the river, thus reducing the impact of nutrients (eg. algal growth). Effluent from Western Sydney sewage treatment plants needs to be recycled anyway over the next 25 years in order to reduce the discharges from the plants and protect the Hawkesbury-Nepean River.

Most of the irrigators in the Sydney basin currently take water directly from the Hawkesbury-Nepean River and its tributaries, rather than using the potable supply. On average, 110 billion litres of river water is extracted every year. Therefore, providing recycled water to these users will not directly reduce demand for drinking water but would contribute to environmental flows.

Irrigation on a farm in Picton using recycled water from Picton Sewage Treatment Plant

A key issue for agricultural reuse schemes is the low cost of river extractions (currently $3 for 1 million litres). Recycled water schemes may therefore not be financially competitive with river extractions. As with irrigation of public parks, golf courses and gardens, the agricultural irrigation market is seasonal and weather dependent, which can lead to increased costs for recycling due to storage requirements.

However, substituting river water with recycled water provides a reliable supply source for irrigators, without limitations on extractions when river flows are low. Further, such agricultural recycling schemes leave water in the river which is beneficial for river health, or may even reduce the amount of water that needs to be released from Warragamba Dam, making more water available for drinking use.

The Government is looking at opportunities where further agricultural recycling in the Sydney basin is practical and affordable. For example, as part of the upgrade of West Camden Sewage Treatment Plant, Sydney Water will supply almost 2 billion litres per year of high quality treated wastewater for irrigating turf, lucerne crops and dairy grazing land. This will improve river health by reducing the amount of water extracted from the river by irrigators and by reducing the discharge of nutrients into the river from the West Camden plant. The upgrade is expected to be complete in early 2007. The Government is currently considering the cost effectiveness of incentives for such agricultural recycling schemes.

The irrigators who currently use drinking water rather than river water consume in total up to 12 billion litres per year. To reduce this, there are Government programs underway such as WaterWise on the Farm, which is discussed in Chapter 6.

5.4.3 Harvesting stormwater for irrigation

Stormwater harvesting and reuse is defined as the collection, treatment, storage and use of stormwater runoff from urban areas. Stormwater is the most variable source of water for reuse and its quality is poorer than that of roofwater as it flows overland.

Stormwater harvesting and reuse is a relatively new form of water reuse compared to the reuse of wastewater from sewage treatment plants. It is, however, increasingly recognised as a potentially viable option to meet the water demands and pollution reduction objectives for many projects and sites. To date, harvested stormwater has commonly been used for non-drinking purposes such as irrigation of public parks and golf courses.

Some of the key characteristics of a successful stormwater harvesting and reuse scheme include:

- replacement of an existing mains water use to reduce stormwater flows and pollution loads – thus meeting multiple objectives
- proximity to where the stormwater is reused (eg. a golf course located adjacent to a creek)
- integration of the storages for holding stormwater before it is reused into the landscape or underground, to minimise their visual impacts.

Household-level stormwater harvesting

Stormwater reuse opportunities tend to be more cost effective on a small scale, where water is retained and reused as close to its source as possible. Rainwater harvested directly from roofs has a relatively high quality, requiring minimal or no treatment, compared to stormwater collected from drains in an urbanised catchment.

For these reasons, priority has been given to rainwater tanks and local opportunities, as these options are the most cost effective, requiring less treatment and distribution.

Local stormwater harvesting

Local councils are responsible for 95% of stormwater drainage in Sydney. It is at this local level that most stormwater harvesting has occurred to date in Sydney.

The Government supports development of local stormwater harvesting projects by councils. Urban sustainability grants totalling $80 million under the City and Country Environment Restoration Program will enable councils to undertake stormwater harvesting and other measures designed to save water and protect the environment. This program will run until 2010.

For more information, refer to:
http://www.environment.nsw.gov.au/education/ccerp.htm

To make stormwater harvesting easier, the Government has also released guidelines titled *Managing Urban Stormwater – Harvesting and Reuse*. The guidelines present an overview of stormwater harvesting and its potential benefits and limitations. They also provide guidance on the planning and design aspects of stormwater harvesting projects, taking into account statutory and regulatory requirements.

For more information, refer to:
http://www.environment.nsw.gov.au/stormwater/

The Government has also amended the *Local Government Act 1993* and the *Local Government Regulation 2005* to enable councils to raise funds for stormwater works outside their rate-pegging limit.

A number of stormwater harvesting and reuse projects, fully or partially funded by the NSW Government, are in operation in Greater Sydney.

Stormwater recycled for irrigation in 2004-05

Project	Volume (million litres/year)
Barnwell Park Golf Course, Five Dock	1.5
Sydney Smith Park, Westmead	7
Bexley Municipal Golf Course, Bexley	12
Black Beach Foreshore Park, Kiama	12.7
Manly Stormwater and Reuse Project	22
Powells Creek Park, North Strathfield	2
Richmond Recycling Project	25
Solander Park, Erskineville	2
Riverside Park, Chipping Norton	10
Hornsby Shire Council Nursery	0.8
Total	**95**

Case study: Bexley Municipal Golf Course, Bexley

This stormwater harvesting project was implemented in two stages. The first stage involved constructing the stormwater collection, storage and treatment system and the second stage involved the irrigation system.

A weir was built on the stormwater channel, and the ground was excavated upstream to give a storage capacity of 7 million litres. A supplementary turkey's nest dam storage holding 1.4 million litres was constructed on the high point on the golf course, to increase the project's storage volumes, as there was insufficient space available along the concrete channel for a larger storage to deliver a reasonable yield. A two way flow pipe connects the two storages, allowing top-up water to be pumped from the weir storage to the turkey's nest dam and for water from the dam to flow back to the weir storage for irrigation.

Stormwater is treated first by a trash rack constructed in the concrete inlet channel upstream of the weir. Further treatment occurs through sedimentation and mechanical aeration in the storage. The storage also reduces bacteria levels, primarily through ultraviolet light. The irrigation system includes self-cleaning irrigation disc filters.

The second phase was the installation of the irrigation system. Treated stormwater is pumped from the weir storage to the dam, and then flows to a spray irrigation system by gravity. The system provides a high level of irrigation to 1.4 hectares of tees and greens and a lower level of coverage to 11 hectares of fairways.

The project had a capital cost of approximately $650,000 and will eliminate reliance on mains water, saving about 12 million litres of drinking water per year. It will also reduce pollutant loads to the Cooks River by 100 tonnes per year.

Stormwater harvesting for irrigation is projected to save more than 0.5 billion litres of extra water each year, by 2015.

In February 2006, as part of the first round of the Water Savings Fund, nine stormwater harvesting projects received funding as described below.

Stormwater harvesting under the Water Savings Fund (Round 1) 2005

Project	Volume (million litres/yr)
Centennial Parklands (Reuse of stormwater fed into local ponds network to flush toilets and water gardens)	10
Hornsby Shire Council (Harvesting stormwater for irrigation of 3 bowling clubs)	13
Ku-ring-gai Council (Harvesting stormwater and sewer mining for irrigation of Gordon and Killara golf courses)	136
Lane Cove Municipal Council (Construction of underground storage tank at Lane Cove golf course for harvested stormwater)	0.5
Mosman Municipal Council (Harvesting stormwater for reuse on Balmoral Oval and Foreshore Reserve)	15
Nationwide News Pty Ltd (Dam package to harvest rainwater in Chullora for operations)	30
North Sydney Council (Construction of a storage and treatment facility to store harvested stormwater for irrigation of Cammeray Golf Course and adjacent playing fields and parks)	90
Port Kembla Coal Terminal (Harvesting stormwater for dust suppression)	100
Warringah Council/Warringah Aquatic Centre (Rainwater harvesting to supply backwash water to clean water filters)	4
Total	**400**

For more information visit:
http://www.deus.nsw.gov.au/waterandenergysavings/index.htm

Case Study: North Sydney Council Water Reuse Project

By capturing stormwater run-off from the Warringah Expressway and the surrounding urban catchment, North Sydney Council and Cammeray Golf Club will harness 90 million litres of stormwater water a year.

The $2.5 million project received $300,000 funding in the first round of the Water Savings Fund.

The project involves building a storage facility at Cammeray Golf Course where the captured stormwater will be treated before being used for irrigation of the golf course and Cammeray Oval soccer field next door. As well as saving water, the project will save North Sydney Council $40,000 a year.

Later stages will see the pipeline extended to pump water to other parks in the North Sydney Council area, including St Leonards Park, Primrose Park, Tunks Park and Forsyth Park.

Regional stormwater harvesting

The Government is also considering various forms of regional stormwater harvesting, particularly in areas where there is existing storage or sufficient space for new storage facilities.

Stormwater harvesting would be particularly useful in areas where there are open space irrigators, since this requires minimal piping and treatment and there would usually be more opportunities to find a suitable storage area.

As its supply is variable and dependent on rainfall, runoff must typically be stored and usually treated for future use. This can require an urban lake, constructed wetland, aquifer storage or storage tank. In Sydney, aquifers are generally not suitable for this purpose, and the space required for lakes and tanks is often unavailable in urban areas, unless a new development is under way.

However, the Government is investigating some potential sites for storage such as disused brickpits and flood mitigation dams around Sydney including Parramatta Lake, Manly Dam, Chipping Norton Lakes and Prospect Reservoir.

5.4.4 Sewer mining

Apart from using wastewater treated at sewage treatment plants and harvesting stormwater, businesses and councils can also gain direct access to untreated wastewater in sewer lines and treat it themselves for their own use or for supply to other customers.

In 1999, the Sydney Olympic Park Authority (then the Olympic Co-ordination Authority) constructed the Water Reclamation and Management Scheme at Homebush Bay. Wastewater for treatment and distribution through the scheme comes from sewer mining and stormwater harvesting. A large disused brick pit stores the stormwater before treatment and distribution to customers. Dual reticulation supplies recycled water for use in toilets, irrigation, car washing and clothes washing in suburbs such as Newington.

In October 2005, the Government entered into its first sewer mining arrangement with a non-State Government body. A water recycling scheme is being trialled at Beverley Park Golf Club which produces irrigation water from wastewater. This will be used on the course's greens and fairways rather than Sydney's drinking water.

The sewer mining plant has been commissioned, and the trial, funded by the NSW Government, Kogarah Council and Copa Water, will recycle up to 300,000 litres of wastewater each day. The Government does not charge the user for the wastewater and is working with council to ensure protection of public health and the environment.

The Government is also currently investigating other potential sewer mining schemes, including at Kurnell and Botany. Chapter 9 describes the sewer mining policy in more detail.

Case Study:
Beverley Park Golf Club

The Beverley Park Golf Club is utilising ReAqua Hyrate, an innovative new water reuse solution from Copa Water. It is a non-membrane plant that has a smaller footprint, cheaper capital cost, and lower operating costs than many alternatives. The technology has been successfully trialled in Melbourne and, if selected for the full scale plant at Beverley Park Golf Club, this will be the first full scale commercial use of this product. Results thus far have been excellent, and Kogarah Council and Sydney Water are both pleased with its success.

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Using recycled water to replace releases from Warragamba Dam is projected to save up to 18 billion litres of drinking water each year, by 2015.

5.5 Recycling water to replace releases from Warragamba Dam

The Government currently releases set volumes of water stored in Warragamba Dam for environmental flows in the Hawkesbury-Nepean River and for riparian purposes (to enable households with river frontages to extract water for stock and domestic uses and some irrigation).

5.5.1 Current releases from Warragamba Dam

In non-drought conditions, the Sydney Catchment Authority's Water Management Licence requires that a constant 33.3 million litres per day be released as an environmental base flow, and 10 million litres per day be released for use by riverside landholders. If required, additional releases must be made to ensure that a minimum flow of 50 million litres per day is maintained over Penrith Weir. On average, this is the equivalent of releasing 18 billion litres of drinking water from Warragamba Dam every year.

5.5.2 Potential to substitute dam releases

There is a ready supply of highly treated wastewater from a number of Western Sydney sewage treatment plants that currently discharge into the Hawkesbury-Nepean River and its tributaries. The Government's Western Sydney Recycled Water Initiative includes a scheme where this discharge will be further treated to a higher level and piped into the river downstream of Warragamba Dam, so that water which is currently released for environmental and riverside landholder uses can be kept in the dam and used for drinking water. An additional benefit will be a significant reduction in the levels of nutrients currently discharged into the river from the sewage treatment plants.

Initially, during the current drought, the proposal will save 9 billion litres per year of drinking water – which is the amount currently being released (half of the usual release, reflecting drought conditions).

When the drought lifts, it may be possible to replace all of the normal releases of 18 billion litres per year with recycled water. Not only would this keep drinking water in the dam, but the recycling is estimated to remove over 100 tonnes of nutrients every year which are currently being discharged into the Hawkesbury-Nepean River and tributaries from sewage treatment plants. These nutrients are a possible factor in the river's algal bloom problems.

The Government's investigations and planning aim to ensure that the substitution of Warragamba Dam releases with recycled water will deliver an equivalent or higher level of environmental benefit to the river as that which would have been delivered by releases from the dam, particularly in relation to water extracted by the North Richmond Water Filtration Plant, by landowners along the Hawkesbury-Nepean River and for aquatic life. The current nutrient discharge from Penrith and St Marys Sewage Treatment Plants will be dramatically reduced. Also, the increased flow releases from dams on the Upper Nepean will further improve water quality and river health (see Chapter 8).

By 2015, the Government will have sufficient information on the outcomes of the Upper Nepean flow regimes and the success of the water supply and savings initiatives in this and subsequent *Metropolitan Water Plans* to decide on new water releases to be provided to the Hawkesbury-Nepean River from Warragamba Dam (see Chapter 8). If the decision at that time is to increase releases from Warragamba Dam, the Government will investigate how the Western Sydney Recycled Water Initiative could increase the volume of waste water recycled, as well as mimic the natural flow pattern of the river. This may result in some of the new 2015 releases being also replaced with recycled water.

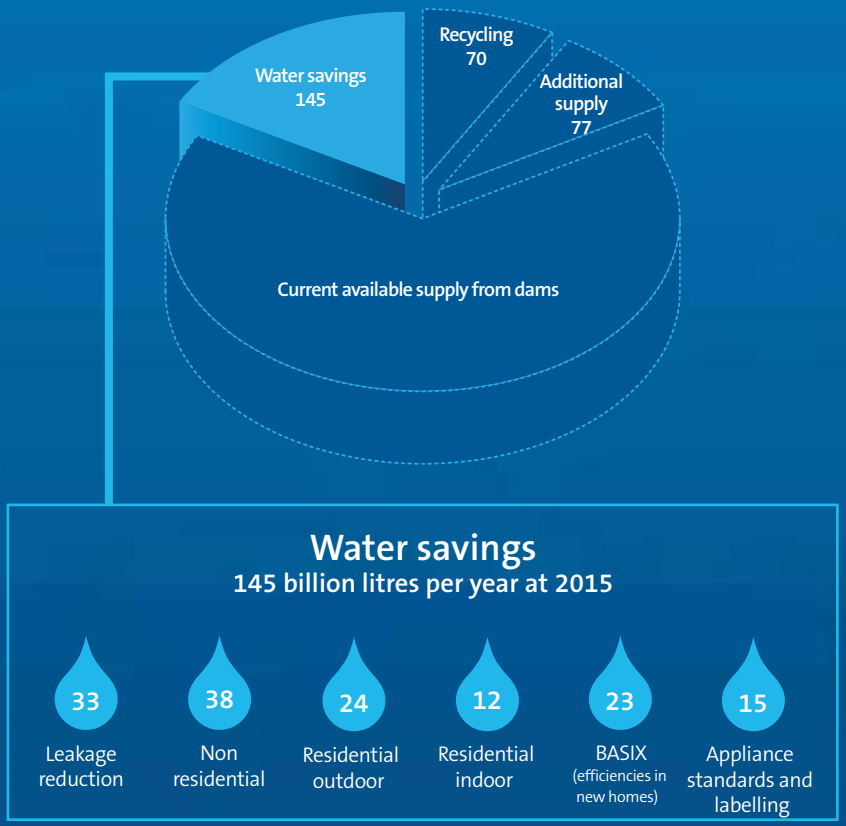
5.5.3 Implementation strategy

The Government will seek Expressions of Interest from the private sector to deliver an advanced water treatment plant and associated network with the objective of incorporating the best in innovation and efficiencies. The EOI will be released in June 2006, following a series of information sessions.

What will be done next

- The Western Sydney Recycled Water Initiative will recycle water for homes, agriculture and replacing releases from Warragamba Dam, saving up to 27 billion litres of water per year by 2015
- Expressions of Interest will be sought in June 2006 for the provision of recycled water services to new residential development in the North West growth centres and for replacing releases from Warragamba Dam
- The Camellia Recycled Water Project will provide recycled water to industrial and open space users at Camellia (near Parramatta), saving up to 6 billion litres of water every year
- Recycled water investigations will be finalised in Botany, Kurnell, Wollongong and Parramatta, where high water using industry and open space are located
- An $80 million Urban Sustainability Program will provide grants to councils for stormwater harvesting and other measures designed to save water and protect the environment under the City and Country Environment Restoration Program
- Guidelines will be released to provide advice on planning and design of stormwater harvesting projects
- A new Sewer Mining Policy will make future sewer mining agreements between Sydney Water and non-government organisations easier
- A third party access regime will make it easier for the private sector to utilise Sydney Water's existing wastewater network to recycle water
- Regulatory reform, together with training and education programs, will make greywater recycling easier for householders in single dwellings
- On-site industrial and commercial recycling systems will continue to be developed through Sydney Water's Every Drop Counts Business Program
- Further funding rounds under the NSW Water Savings Fund will encourage recycling by businesses and councils

6. Reducing demand



What this chapter is about

Reducing demand means any change in behaviour, water using equipment or process that helps to minimise water wastage and improve water use efficiency. Demand reduction or water saving measures range from simple actions such as turning off a tap while brushing your teeth, or installing a 3-star or AAA rated shower head, to better purchasing policies across government agencies and multi million dollar process changes by industry. In some cases, saving water may involve finding a way of achieving the same ends without using any water at all, such as sweeping with a broom instead of using a hose.

This chapter details the range of existing, new and proposed water saving measures and other initiatives aimed at reducing the amount of water used by Sydney's households, businesses and government. By 2015 these measures are expected to save around 145 billion litres of water per year.

What has been done to save water

A broad range of programs, funds and initiatives are in place to help government, businesses and households to save water. These include:

- The four-year $120 million Water Savings Fund
- Development of Water Savings Action Plans by high water using industry, government agencies and local councils
- Sydney Water's Leak Reduction Program
- Water price reforms
- The Building Sustainability Index (BASIX)
- The Water Efficiency Labelling and Standards Scheme (WELS) and Smart Approved Water Mark Scheme
- Rainwater tank rebates
- The WaterFix Program for water efficient fittings, and the Do-It-Yourself Water Saving Kit
- The Every Drop Counts (EDC) Business Program
- A range of education programs providing resources and information for the community and other users
- The NABERS OFFICE Water rating tool

What will be done next

- The Water Savings Fund will continue, with an extra $10 million available in 2006
- Water Savings Action Plans will have been completed by businesses and government by mid 2006 for implementation over the next four years
- A $150 washing machine rebate will be provided to Sydney residents who purchase an efficient washing machine until February 2007
- WELS will become mandatory from July 2006 and NSW will lobby for the national introduction of minimum standards
- BASIX will be rolled out for alterations and additions from 1 July 2006
- The NABERS HOME Water rating tool will be released in mid 2006
- Under a newly expanded WaterFix Program an additional 50,000 Department of Housing dwellings will have water efficient fittings installed, bringing the total number of houses serviced across Sydney to 550,000 by 2008
- A new program for leakage reduction in schools will be piloted
- New reasonable use guidelines for river and groundwater use by households will be released
- Further analysis of demand trends and ongoing monitoring of population growth and demand will be undertaken
- The potential impacts of climate change on water demand will be analysed
- Further measures to improve government water efficiency will be undertaken
- Rainwater tank rebates for households will continue to be offered until July 2008
- The Every Drop Counts Business Program will continue to help business and government to make significant water savings
- Sydney Water's Leak Reduction Program will continue
- An enhanced metropolitan water education program will increase awareness of the need for continued water saving efforts.

6.1 Introduction

On average over the past 10 years around 600 billion litres of drinking water per year has been drawn from Sydney's water storages to supply the community, businesses, farms and industry through the drinking water system. In addition, farmers also sourced an estimated 110 billion litres per year directly from rivers and farm dams.

Significant progress has been made in improving the way in which this water is used, but there are many further opportunities to improve water use efficiency and reduce water wastage.

This chapter provides information on the wide range of programs both in place and planned that help to reduce water use while at the same time maintaining or improving the benefits that water provides. Sydney has a comprehensive and coordinated range of water saving initiatives tailored to all major water users, from households to big industry, agriculture and government. Combined, these make up the largest demand reduction program in Australia and one of the most comprehensive and diverse urban water saving efforts internationally.

Saving water by minimising waste and improving efficiency is an essential component of a balanced and diverse strategy to meet Sydney's water needs, and is more cost effective than most other options to help balance supply and demand for water. Such programs can also play a useful role in mitigating the impacts of drought by reducing reliance on rain-fed storages in times of scarcity, and can deliver positive environmental benefits, such as reducing the amount of energy used for hot water systems and for pumping water through water pipes to deliver it to homes and businesses.

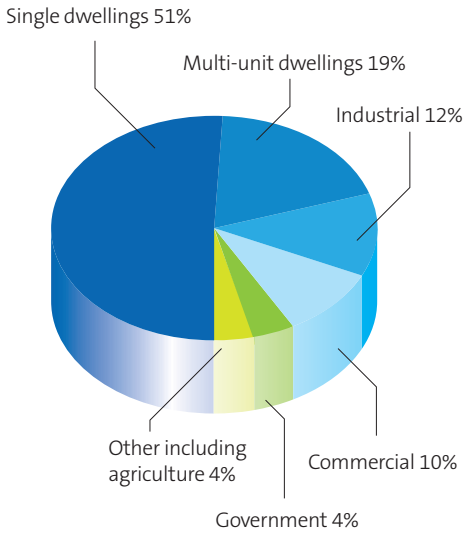
Since 1999, the efforts of all Sydneysiders have saved a total of over 90 billion litres of water, and annualised savings in 2005 are estimated to have been about 41 billion litres. These savings are in addition to those from drought restrictions, and the net effect is that although there are now 950,000 extra people in Sydney, total consumption is the same as 25 years ago.

Several new water saving measures have been developed since the release of the *2004 Metropolitan Water Plan*. In total, the existing and enhanced suite of programs and policies outlined in this *Metropolitan Water Plan* are expected to save around 145 billion litres of water per year by 2015.

The initiatives apply across a number of sectors. The measures in this chapter are presented in the following order:

- cross sectoral
- government
- business
- agriculture
- households.

Drinking water consumption by sector



6.1.1 Understanding the demand for water

Estimating the future demand for water is important for identifying where water saving programs need to be targeted and for planning Sydney's future water systems. The independent expert analysis undertaken for this *Metropolitan Water Plan* has utilised two components to understanding the future demand for water:

1. The 'base case' demand, also called 'reference case' demand. This is the underlying demand for water and includes all water used by households, businesses and government but does not include the impact of water saving measures, recycling schemes and restrictions.

2. The impact of water saving measures and recycling schemes which substitute water from storages with an alternate source of water or with a technology or approach that requires less water.

The projected demand from water storages has been calculated by subtracting the savings which are achieved through demand reduction measures from the base case demand. From a modelling perspective, it is currently easier to model the two components separately, and then to combine them, than to model the net trend directly.

The independent consultants have advised that accurately estimating either of these two individual components is difficult.

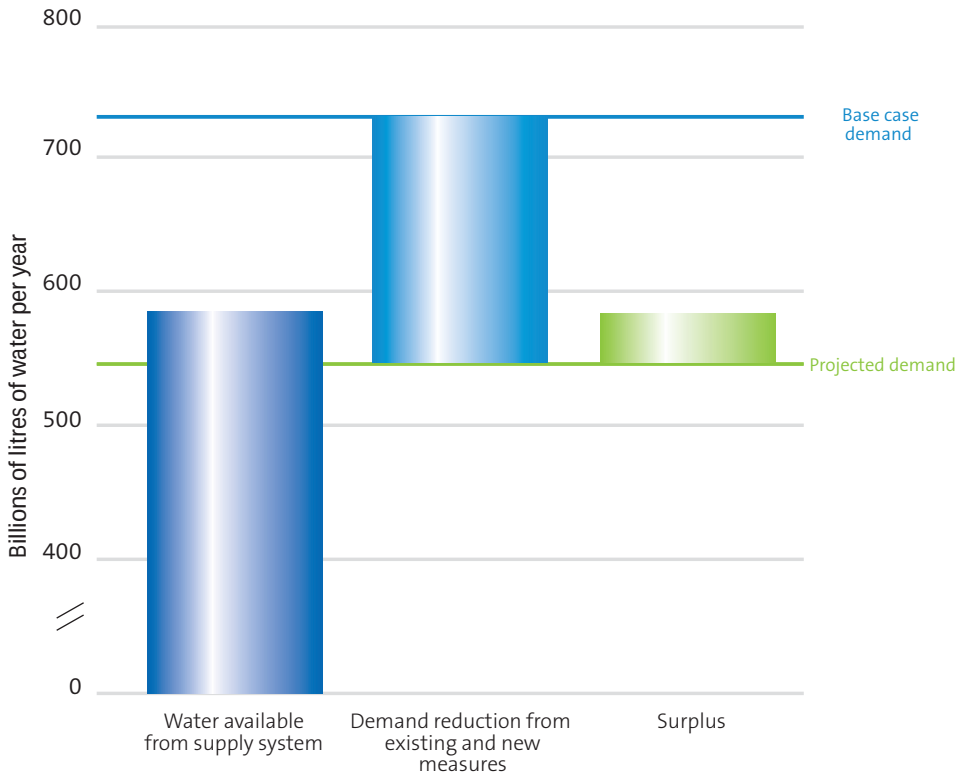
The current approach to calculating the total future demand for water in Sydney is to estimate the water demand per capita per day and multiply this by the projected population to give the total demand. The *2004 Metropolitan Water Plan* used a per capita demand estimate for the base case of 426 litres per day. This estimate is considered conservative (in that it is likely to prove to be too high) and does not rely on analysis of water end-uses and the impact of urban consolidation in the future.

The conservative figure of 426 litres per capita per day has again been used in analysis for this *2006 Plan*.

The net per capita consumption trends that will emerge following the lifting of drought restrictions are likely to be more useful for informing adaptive management decisions than the individual trends of base case demand and water savings. At the same time, improving understanding of trends in demand will prove valuable in refining water saving measures further.

To ensure that the best possible information is being used in future revisions of the *Metropolitan Water Plan*, underlying demand trends will be further analysed and monitoring of population growth and net per capita consumption will continue.

Supply-demand balance for 2015



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The combination of the Water Savings Fund, Water Savings Action Plans and the Every Drop Counts Business Program is projected to save around 36.3 billion litres of drinking water each year, by 2015.

6.2 Cross sectoral water saving initiatives

Many water saving initiatives apply across business, government and households. This section contains information on these initiatives, including the Water Savings Fund and Water Savings Action Plans, the Every Drop Counts Business Program (EDC), Sydney Water's Leak Reduction Program, water pricing reforms and community education programs. Further information on measures specific to government, business, agriculture and householders can be found in Sections 6.3 to 6.6.

6.2.1 Water Savings Fund

The Water Savings Fund was established in 2005 under the *Energy and Utilities Administration Act 1987* to provide $30 million per year over four years to deliver significant water savings across Sydney, the Blue Mountains and Illawarra through water conservation and recycling.

The *2006 Progress Report* announced an additional $10 million for the Fund in 2006, leading to further water savings of around 3.4 billion litres per year by 2015.

The Fund is an overarching support program with several components tailored to areas of need. Funding is directly allocated to several initiatives, including WaterFix for households, a $22 offer to householders to install water saving devices and check for minor leaks, and rainwater tank rebates for households and schools (see later in this chapter). It also has a contestable component where businesses, councils and NSW Government agencies can apply for funding to support water saving initiatives.

Contestable Water Savings Fund

The contestable component of the Water Savings Fund has been developed to:

- stimulate investment in innovative measures to save and recycle water
- save significant volumes of drinking water across Sydney
- increase public and industry awareness of the importance of saving water and the financial and resource savings that can be made.

The Fund aims to support projects which will achieve the greatest possible savings and which would not be likely to proceed without financial support. The first round of the Water Savings Fund opened in late 2005 and attracted more than 70 applications. This is a significant response and shows a high level of commitment and innovation from the business and government sectors, and a strong desire to improve water management.

In February 2006, offers totalling more than $9.2 million were made to 27 projects. Details of the seven water use efficiency projects are provided in section 6.4. See Chapter 5 for information on the recycling projects funded under the program. The second round was opened in March, with grants to be announced in the coming months.

Two to three funding rounds will be held each year, involving a public call for applications.

Further information on the Water Savings Fund is available at: **www.deus.nsw.gov.au/waterandenergysavings**

6.2.2 Water Savings Action Plans

In 2005, a number of changes were made to the *Energy and Utilities Administration Act 1987* to require large water users to prepare Water Savings Action Plans. The aim of these changes is to encourage managers of high water using organisations in business and government to gain better knowledge of how much water is being used in their operations, and the real financial savings that can be made through water savings. This initiative is the first of its kind in Australia.

A total of 237 business and 39 government sites using more than 50 million litres of water per year as well as all 44 councils in Sydney are required to prepare Water Savings Action Plans by the end of March 2006. Owing to the increased complexity in their operations, health authorities must complete their Plans by 30 June 2006.

Water has a low cost relative to other components in the running of an organisation, and is often overlooked as an area where savings can be made. However, once Water Savings Action Plans are developed, it is expected that many businesses will recognise the financial gains that can be made and will voluntarily implement the cost effective measures over the next four years.

Organisations can also apply for assistance under the Water Savings Fund (see section 6.2.1) for any measures identified in Plans which are unlikely to proceed without financial support. The Department of Energy, Utilities and Sustainability will provide oversight and encourage businesses to implement their Plans.

Implementation of the measures identified in the Plans is not presently mandatory, however the Government expects that water users will implement actions in order to realise water and cost savings and contribute to a more sustainable water system. Under the Act, the Minister for Water Utilities has the power to mandate implementation of the Plans if necessary. As part of the ongoing monitoring of the *Metropolitan Water Plan*, consideration may be given in future to using this power to encourage further water savings.

It is expected that implementation of each Water Savings Action Plan will provide up to a 20% saving in the organisation's water use.

Further information on Water Savings Action Plans is available at:
www.deus.nsw.gov.au/waterandenergysavings

6.2.3 Every Drop Counts Business Program

The Every Drop Counts (EDC) Business Program has been running since 2001 and targets high water users in the manufacturing, commercial, hospitality, education and government sectors. Through this program, individual organisations are assisted and encouraged to systematically manage their water use as part of normal operational activities. The program helps businesses to get the most out of the water they buy and achieve demand reductions that can be sustained over the long term.

The innovative EDC approach aims to integrate water management with existing operational and environmental management systems. The program consists of the following elements:

- co-operative partnerships
- identification of management barriers
- identification of technical projects
- employee awareness
- corporate citizenship
- financial assistance to program participants
- development of Best Practice Guidelines.

By the end of 2005, 304 organisations were EDC partners, and water savings attributable to the Program were estimated to be approximately 7.3 billion litres per year.

Businesses are able to incorporate work they have undertaken in the EDC Program to partially or wholly fulfil their requirements to prepare Water Savings Action Plans (see section 6.2.2). Water saving measures identified by businesses through the EDC program may be eligible for financial support through the Water Savings Fund (see section 6.2.1), if they meet the selection criteria.

Government and business case studies from the Every Drop Counts Program can be found in Sections 6.3 and 6.4 respectively.

Further information is available at:
www.sydneywater.com.au/SavingWater/InYourBusiness/EDCBusinessProgram.cfm

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The Leak Reduction Program is projected to save around 33.5 billion litres of drinking water each year, by 2015.

6.2.4 Sydney Water's Leak Reduction Program

Sydney has nearly 21,000 kilometres of pipes which carry water to households, businesses and government across Sydney, the Illawarra and the Blue Mountains. The 2004-05 estimate of leakage was 10% of the total water supplied. This figure compares favourably to international leakage rates, with only a few countries such as Singapore and Germany achieving lower rates. Sydney Water has the largest and most comprehensive program in Australia to reduce leakage from its system. Even so, detection and repair work is being increased to reduce leakage still further.

Sydney Water's Leak Reduction Program involves five activities:

- Active leakage detection, where the system is acoustically scanned for leaks. Around 18,000 kilometres of mains is being scoured for hidden leaks each year.
- Improving the speed and quality of leak repairs, to reduce the amount of water lost from each leak and ensure that it does not occur again.
- Adjusting system pressures to reduce high pressure areas which can cause leaks and damage household fittings.
- Improved flow metering to better identify where leaks may be occurring.
- Water main renewals to ensure old pipes are replaced before they become a problem. Nearly 100 kilometres of mains will be replaced each year.

Over the next four years, over $400 million will be invested in these activities, including nearly $100 million in 2005-06.

It is estimated that nearly 17 billion litres of water per year is presently saved, and as the program continues, it is estimated that it will save around 33.5 billion litres per year by 2015.

6.2.5 Water pricing reforms

The price of water and the structure of water bills can be used to send clear signals about the importance of using water efficiently. Historically, water charges were based on property values, not on the amount of water actually used. The introduction of 'user pays' pricing in the early 1990s sent signals directly to customers about the cost of consuming water and contributed to a significant reduction in per capita demand. Since then, further reforms have continued to promote more efficient and sustainable water use.

The Independent Pricing and Regulatory Tribunal (IPART) regulates the price that customers pay for water in greater Sydney. In 2004, IPART conducted a comprehensive review of the range of price structures that could reduce demand for water in the Sydney basin. In particular, the Tribunal considered the benefits of a two-tier price structure whereby households that use more than a specified volume are charged at a higher rate for consumption in excess of that volume. A two-tier price structure – also known as an 'inclining block tariff' – encourages water conservation, particularly with respect to 'discretionary' or non-essential water use (such as over-watering gardens).

IPART has set water prices for the period from October 2005 to June 2009. Price structures have also changed in order to encourage water conservation and make a positive contribution to the supply and demand balance over time. Water usage charges are now higher than before and will rise over the next four years, while fixed charges will fall over the same period.

Average annual demand in the residential sector is 250,000 litres per household per year – or around 62,500 litres per quarter.

Water pricing reforms to 2009

Under the new water price structure, residential customers in single dwellings who use less than 100,000 litres of water per quarter (roughly 1,096 litres per day) will pay $1.20 per 1,000 litres, rising to $1.31 (in 2005-06 dollars) per 1,000 litres in 2009. Using more than 100,000 litres per quarter will cost $1.48 for every 1,000 litres used above the threshold, rising to $1.85 (in 2005-06 dollars) per 1,000 litres by 2009.

The new price and tariff structures are expected to reinforce savings achieved through a range of other programs. To reduce the impact of higher prices, households can participate in Sydney Water's low-cost water saving programs. However, it is recognised that for large families, reducing water consumption is more difficult. To address this, most large families will be eligible to receive a free home retrofit of water efficient fittings. In addition, low-income families using more than 400,000 litres per year will be eligible for a $40 annual rebate on their water bill.

Future challenges – sending price signals to all water users

Currently around 40% of households do not pay individual water usage charges – for example, most people living in apartments pay for a share of the building's total water use, rather than paying according to their actual consumption. As a result, there is less incentive for such users to reduce water use. IPART analysis estimates that not receiving a water usage bill increases a household's water use by approximately 19%.

IPART estimates that substantial savings could be achieved – in the order of 18 billion litres per year – if such households were able to reduce their water use in line with the community average.

As the share of medium-density housing in Sydney grows, the percentage of individually metered households will fall relative to total housing stock, unless action is taken. Sending direct price signals to as many customers as possible will help promote more efficient water use and reduce pressure on supplies.

Recognising this, Sydney Water is undertaking a trial to examine the costs and benefits of individual metering in multi-unit apartment blocks, and is looking at several new technologies such as remote metering to make it practical and cost effective. A report on the trial will be complete by early 2007. The outcomes of the trial will be monitored, and where cost effective the uptake of individual metering will be progressed over time.

As with residential customers living in multi-unit apartments, shopping centre tenants generally pay for a share of the total building's water consumption, rather than paying according to actual usage. Metering and charging for individual water usage would overcome this, allowing price signals to be sent direct to water users and thus encouraging efforts to increase water efficiency. See section 6.4.1 for further information.

In December 2005, the Department of Housing (DoH) commenced recoupment of water usage charges from public housing tenants for the first time. From that date all tenants of the Department have paid a percentage of their rent as a water usage contribution. Later in 2006, tenants of separately metered DoH properties will commence to pay for the actual water they use. A key objective of this initiative is to increase awareness of water management among public housing residents.

Future challenges – removing barriers to investment in demand management

Currently the treatment of investments in 'engineering' water supply options (such as dams and pipes) differs from the treatment of investments in measures that save water. Investment in new 'engineering options' is depreciated or amortised over 100 years, while investment in demand management is classed as operating expenditure and passed through to customers via water charges generally in the year in which the cost is incurred (even though the water savings will last well beyond the year in which the expenditure is incurred). This issue will be further examined in the lead up to the next water price determination to ensure that it does not hinder the objective of meeting Sydney's water needs at least cost.

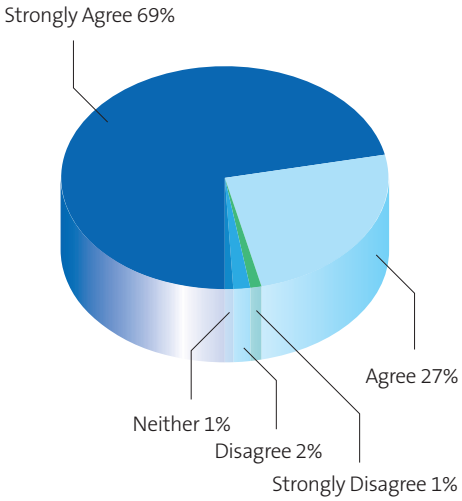
The combination of water pricing reforms, ongoing water saving measures and education campaigns for outdoor water use is projected to save around 19 billion litres of drinking water each year, by 2015.

6.2.6 Partnering with the community

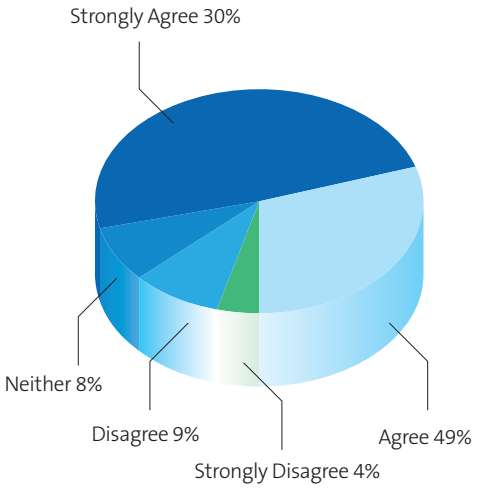
The key to meeting Sydney's water needs in the future is community ownership of the problem and the solution. The responses to a recent survey shown below indicate that there is broad agreement on the fact that long term water management in Sydney requires action by the Government but also by individuals and businesses.

The community is now increasingly aware of the challenge of supplying water in a dry country.

"Do you agree that everyone including households, local councils, business and government is responsible?"



"Do you agree that individual households can really make a difference to the amount of water that is saved?"



For a partnership with the community to work, there must be a free flow of information about what is being done, what should be done, and how to do it. The public is looking to the Government to provide the leadership, information and tools to guide their efforts to save water.

An extensive water education campaign is already in place for Sydney, including campaigns for people from culturally and linguistically diverse backgrounds, featuring the following:

- Water For Life
- Go Slow on the H_2O
- Every Drop Counts
- WaterWise On The Farm.

The benefits of an informed community

Outdoor water conservation

- 93% of Sydney Water customers are aware of the Go Slow on the H_2O campaign
- Water conservation website accessed by 348,000 visitors in 2004-05
- 100 billion litres reduction in use each year under restrictions

Indoor retrofits

- 75% of Sydney Water customers aware of the program
- over 310,000 homes have participated
- 6.5 billion litres saved each year
- $30-$100 in utility bills saved for each participating household

Every Drop Counts Business

- over 7.3 billion litres saved each year
- 304 participating partners

To build on this work, the *Metropolitan Water Education Plan* is being implemented to provide further information to the community about what is being done across the full range of measures and what individuals can do to assist. It includes the following objectives:

- Increase the perceived value of water and the community's understanding of the factors that affect water supply.
- Change water use practices among individuals, households, farmers, industry and business throughout greater Sydney in order to reduce demand for water.
- Respond to needs for communication and education that emerge through the course of implementation of this *2006 Metropolitan Water Plan*.
- Demonstrate the Government's leadership to secure long term water supply for the community.

In addition to education about water savings, many of these education programs also relate to recycling (see Chapter 5).

Further communications campaigns and education programs will focus on reaching two broad groups of target audiences: the greater Sydney community and agents of change in the community. The focus for the first will be communications through electronic and print media. For the second group, partnership programs will focus on skills, knowledge and training.

Water conservation education for non-English speaking people

Research shows that ethnic communities vary greatly in their understanding of environmental issues. Funds will be provided to expand water conservation education to the Ethnic Communities Sustainable Living Project, an established environmental education program conducted in partnership with the NSW Ethnic Communities Council. Twenty bilingual educators from eight ethnic communities will conduct environmental education and training sessions within their own communities.

Professional development and resources for teachers and schools

There is an ongoing need to ensure that young people acquire a basic understanding of water sustainability and its implications for their own lives and the broader community, so as to equip them to play an informed and active role in conserving water for current and future needs.

Funds will be provided to the NSW Science Teachers Association and the NSW Geography Teachers Association to develop teaching and learning materials, to develop a professional development package and to train teachers from the greater Sydney region. Training will be completed by July 2007. Future support will be given via the internet and a network of school environmental educators. This program will ensure that year 5 to 10 Science and Geography teachers have access to high quality teaching and learning resources on water sustainability, and are trained to effectively use them.

Sydney Water also runs several school related programs to educate students about the value of water and to encourage schools to adopt efficient water use as a long term policy. Along with the Every Drop Counts in Schools Program and the

Market gardeners at Rockdale during irrigation efficiency training

Rainwater Tanks in Schools Program (see section 6.3 for further information), Sydney Water is also working closely with the Department of Education and Training to review the overall framework for water education in years K to 12 that will help develop future 'water responsible' citizens. Water education materials are also being developed.

Greenhome workshops

Continued reductions in household water demand require ongoing community-based education. The Australian Conservation Foundation's Greenhome project involves a series of community workshops and events focusing on what people can do in their own lives to help the environment. It is a component of the NSW Government's *Environment – It's A Living Thing* sustainability education partnership program. The program is funded from the Environmental Trust, and has demonstrated successful water savings outcomes. The Government is providing funds to expand the Greenhome project with workshops for householders specifically focused on water conservation throughout the greater metropolitan area.

Water education for the property sector

Commerce and industry use 22% of Sydney's drinking water, and the Government is providing funds to the Property Council to develop a training package, deliver workshops, and disseminate water efficiency information in its newsletters. The Property Council represents developers, managers and owners, and supports its members' interests in BASIX, Energy and Water Savings Action Plans, and sustainability, so this is an efficient education mechanism to enhance the effectiveness of the Every Drop Counts Business Program.

For further information, go to the Water For Life website, which has links to all relevant government information **www.waterforlife.nsw.gov.au** or see the Water Conservation and Recycling Implementation Report prepared by Sydney Water **www.sydneywater.com.au/Publications**

Students from Helensburgh Public School carrying out a water audit under Sydney Water's Every Drop Counts in Schools Program.

6.3 Water Smart government

State and local government together account for around 4% of drinking water use in Sydney. A number of programs have been developed to ensure government water use is as efficient as possible, and that the sector is contributing to a sustainable water supply for Sydney.

Several water saving programs that apply to government are also applicable to the industry and household sectors. These 'cross sectoral' programs can be found in section 6.2, and include the Water Savings Fund, Water Savings Action Plans, water pricing reforms and the Every Drop Counts (EDC) Program. This section contains those measures which apply to government only, as well as government case studies from the EDC Program.

Government case studies from the Every Drop Counts Business Program

Government authorities sector
A water audit of NSW Parliament House was completed in 2004-05. The audit identified opportunities to reduce water consumption by 8 million litres per year. NSW Parliament House implemented the recommendations to retrofit the entire building with AAA shower heads, install flow restrictors in all hand basins, install sensor operated flushing units on urinals, install sub-meters on major water using facilities and to connect these meters to the building's management system.

Local government
Parramatta Council has reduced water use in many of its facilities and public spaces. Council currently reuses groundwater collected from various flooded industrial pits to water its extensive playing fields. An example is the irrigation system at Doyle Ground, North Parramatta which covers the entire sports ground area and, based on seasonal use, will be able to reuse approximately 48 million litres per year for irrigation, saving $14,000 per year on Council's water bill.

Health sector
The public health system accounts for more than 80% of the health sector's water consumption.

Two of the major hospitals, Westmead and Prince of Wales, have participated in water audits that have resulted in significant water savings through reduction of leakage and wastage. Prince of Wales Hospital reduced water use by around 200 million litres per year. With the help of Sydney Water, Westmead Hospital staff have identified and rectified leaks, saving more than 60 million litres per year.

Education sector
TAFE's Sydney Institute was given the opportunity to implement several water conservation projects through the Water Saving Pilot Fund, overseen by Sydney Water. Projects targeted sites with high water use across the institute and involved modifications to amenities at the St George, Gymea and Ultimo Colleges. Approximately 33 million litres per year will be saved as a result of these projects.

6.3.1 Government efficiency

The NSW Government will lead by example through a new policy on Sustainable Water and Energy Use. This initiative is presently being developed and will:

- reduce energy consumption and greenhouse gas emissions
- reduce water consumption
- save on energy and water bills.

All general government sector agencies will be required to improve energy and water efficiency in their buildings and facilities. The Government will demonstrate leadership by rating and improving the water performance of its office buildings and tenancies using the NABERS OFFICE Water rating tool. For sites with high water or energy use, more detailed Savings Action Plans are to be prepared (see section 6.2.2).

The policy will be in place by July 2006 and will replace the current Government Energy Management Policy. The target is to reduce overall drinking water consumption by government agencies by 15% by 2010-11 or around 1 billion litres per year.

To help ensure the 15% target is achieved, the Government is doubling the size of the NSW Treasury Loan Fund which government agencies can access to implement water and energy efficiency improvements. The size of the Fund will now be increased by $20 million to a total of $40 million. Agencies can apply to the Fund for assistance to implement measures identified in their Water Savings Action Plans. Borrowings from the Fund are then repaid from the savings that result from improved efficiency.

Installing water efficient appliances in new buildings, or as old fittings are replaced in existing buildings, is one of the most cost effective ways to save water and contribute in a positive way to reduced water use over the longer term. In order to take advantage of these savings the Government will alter procurement requirements to ensure that agencies preferentially purchase water efficient appliances fittings and other water using equipment.

1

Auditing and metering of Government sites is projected to save up to 1 billion litres of drinking water each year, by 2015.

0.2

The Every Drop Counts in Schools Program is projected to save around 0.2 billion litres of drinking water each year by 2015.

6.3.2 Water Smart schools

Leakage reduction in schools

The *2006 Progress Report* announced a trial of permanent smart monitoring and alarm systems in 20 schools to reduce the frequency and volume of water leaks. If the trial is effective, the program will be rolled out to the other 920 government schools within greater Sydney by 2008. Water savings from the trial are expected to be in the order of 20 million litres per year in 2015.

Rainwater Tanks in Schools Program

To help raise awareness among school students of the value of water and the importance of saving water for the future, the Rainwater Tanks in Schools Rebate program was introduced in April 2004.

The program encourages public and private schools connected to Sydney Water supply mains to install a minimum 10,000 litre rainwater tank and receive a rebate of up to $2,500. Small schools may install smaller rainwater tanks and qualify to receive a rebate if certain other conditions are met.

By the end of February 2006, payments have already been made or are approved to 85 schools, and an increasing number of schools are submitting applications each month. Total savings for the Program are estimated at 20 million litres per year in 2015.

As part of the program, schools also commit to undertake a water audit of the school and develop a water saving plan to reduce water consumption. The program has been extended to 30 June 2006.

More information on rainwater tanks in schools can be found at: **http://www.sydneywater.com.au/SavingWater/RainwaterTanks/RebateSchools.cfm**

Every Drop Counts in Schools Program

Developed in conjunction with the NSW Department of Education and Training, the Every Drop Counts in Schools Program targets reducing water use in primary schools by increasing the awareness of water conservation. This occurs through a series of curriculum-based lessons, involving students in a water audit and development of a water saving plan for the school. This EDC in Schools Program was developed in response to audit findings that on average, schools could reduce water usage by up to 50%. A total of 113 schools have now completed the program since its launch, delivering estimated savings of 181 million litres per year.

6.3.3 Government sites audits and metering

The *2006 Progress Report* announced that the Government sites which are required to complete Water Savings Action Plans (see section 6.2.2) and approximately 23 additional high water using Government sites will be audited for water efficiency and have sub-metering installed to better identify high use areas. These 60 plus sites (mainly hospitals, correctional facilities and TAFEs) are expected to deliver savings within two years in the order of 25 to 30% - that is around 1 billion litres per year.

6.4 Water Smart business

The commercial and industrial sectors account for around 22% of drinking water use in Sydney.

For the majority of businesses, water services represent only a very small component of overall operating costs, and water efficiency programs have to compete for resources against other core business initiatives. To overcome these factors, a range of successful programs has been developed to improve how businesses think about and use water.

Several water saving programs applying to business are also applicable to the government and household sectors. Details of these 'cross sectoral' programs can be found in section 6.2, and they include the Water Savings Fund, Water Savings Action Plans, water pricing reforms and the Every Drop Counts (EDC) Program. This section contains those measures which apply to businesses only, as well as business case studies from the Water Savings Fund and EDC programs.

Successful water efficiency projects - round 1 of the Water Savings Fund

Energy Conservation Systems
Water Savings in City Towers through Integrated Water Management Systems
Funding: $1,000,000
Toilets, showers, taps and leaks in high rise office blocks will be targeted for water efficiency in this water management project developed by Energy Conservation Systems. The company plans to work with the building managers and tenants of high water use office buildings, hotels and apartment blocks to introduce smart metering systems to monitor and gauge use and replace inefficient fixtures with water saving technology. The project aims to save 25% of the water in the office buildings targeted and will include an educational and promotional component. Total estimated savings are 87 million litres per year.

Ethnic Communities Council
Saving Water in Asian Style Restaurants
Funding: $391,000
Restaurant owners will be encouraged to become more water efficient by replacing one of the biggest water-guzzling appliances in the commercial kitchen - the wok stove. The Ethnic Communities Council has developed a multi-lingual education program to promote the economic and environmental benefits of water efficiency in business and encourage restaurateurs to switch to new 'waterless' wok stoves which can save up to 5,500 litres of water per stove per day or 2 million litres per year.

Irrigation Association of Australia
Improving urban irrigation practice in Sydney
Funding: $270,000
Improving knowledge of best-practice water techniques for the home garden and irrigation of public parks is the aim of this new public education program. The project will complement existing community WaterWise education programs with a focus on watering and irrigation. It will involve the development and promotion of training courses for industry, garden professionals and local government staff to increase skills in auditing and best practice irrigation in urban areas. Total estimated savings are 27 million litres per year.

Master Plumbers & Mechanical Services
GreenPlumbers Water & Energy Saving Training & Accreditation
Funding: $263,600
More than 1,000 plumbers will have the chance to become trained and accredited as industry experts in household water and energy efficiency with the expansion of the GreenPlumbers program over the next four years. Developed by the Master Plumbers and Mechanical Services Association of Australia, the GreenPlumbers program will offer plumbers free training to learn about the new rules for water and energy efficient housing in NSW and become accredited under a nationally recognised scheme.

Save-A-Drop Products Australia Pty Limited
Save-A-Drop Water Saving Devices
Funding: $120,000
Save-A-Drop car wash is a self-contained water-pumping system which connects to a 12 volt supply to pump water from a bucket to spray clean your car. It uses 25 litres of water to clean a whole car compared to 99 litres for an average bucket wash or 180 litres using a hose. Products will be developing a marketing plan and beginning a radio, TV and newspaper advertising and promotion campaign to market the product to car owners.

University of Western Sydney
Smart irrigation technologies for saving drinking water on vegetable farms
Funding: $160,164
Vegetable growers in the Hawkesbury district will be reducing their water use with the introduction of innovative irrigation technology on their farms. The project involves the installation of two types of irrigation systems on eight farms. The project will be run by the University of Western Sydney in partnership with the NSW Department of Primary Industries. Total estimated savings are 16 million litres per year.

URS Australia
Reducing drinking water use on golf courses and parks
Funding: $40,670
New studies on water evaporation rates on different landscapes will be used to introduce new watering regimes at golf clubs in the Ku-ring-gai local government area. URS will work with club ground keepers and Ku-ring-gai Council to recommend changes in watering frequencies, irrigation and maintenance based on specific environments. As well as saving water, the project will reduce nutrient runoff and improve overall soil moisture levels. Total estimated savings are 13.7 million litres per year.

Every Drop Counts Business Case Studies

Commercial and financial sector
Lend Lease Retail joined the EDC Business Program in October 2003. A water efficiency audit conducted at Macarthur Shopping Centre resulted in savings of 31 million litres per year and identified further savings opportunities of 18 million litres per year.

Hospitality sector
The hospitality sector accounts for 11% of total business sector usage. For the clubs sector, delivery of the Water Check Program was completed, bringing the total number of clubs that participated in the program to 35. This resulted in the Program achieving water savings of more than 200 million litres per year - an average saving of more than 30% per club – and enabled Sydney Water to develop and launch the Water Conservation Best Practice Guidelines for Clubs.

The Water Check Program for Hotels enables each hotel to be benchmarked against Sydney Water's Water Conservation Best Practice Guidelines for Hotels. Water savings that have been achieved as a result of the Water Check Program for Hotels are nearly 100 million litres per year.

Manufacturing sector
The paper manufacturing industry is a large consumer of water, using over 4 million litres per day or nearly 1.5 billion litres per year. One of Sydney's largest paper mills trialled a drum filter in October 2003. The clarified water from the drum filter was used to replace 250 million litres per year of drinking water use in various applications, such as for chemical dilution. The company had also been benchmarking its water use per tonne of paper manufactured and had reduced water usage by 15% since joining the EDC Business Program in 2002. The paper mill will continue to focus on optimising the drum filter with further drinking water savings of over 200 million litres per year targeted by mid 2006.

6.4.1 Saving water in new commercial and industrial premises

The Government is investigating a range of water saving initiatives for new commercial and industrial premises. Incorporating water saving measures into the design and construction of new buildings and factories is typically much more cost effective than doing it later, and is particularly important given that large water users are now required to prepare Water Savings Action Plans (see section 6.2.2).

To ensure new developments are optimally efficient, the Government will develop guidance on incorporating water saving measures as part of the development assessment process, including water recycling, collection and use of roof water and storm water, and water efficiency.

The Australian Greenhouse Office has commissioned a scoping study to investigate the range of issues which impact on the efficient use of water at the building level. Following the completion of the scoping study, due by the end of 2006, the NSW Government will work with the Australian Building Codes Board to investigate use of the Building Code of Australia and other options to promote improved water efficiency in new buildings.

To ensure new industrial and commercial premises can effectively monitor and audit water use across their facilities, the Government will examine options to require installation of sub-meters in areas of high water use. Industrial and commercial premises can be complex, and have a number of high water using components such as boilers and cooling systems. There is presently only a requirement for these premises to have a water meter for total water use. Installing sub-meters in new developments is an easy and cost effective way to help identify leaks and optimise efficiency, helping to save water over the life of the plant or building and reducing pressure on water supplies.

Many premises such as shopping centres do not have individual metering for each business, so water bills are worked out by the centre manager based on floor area. This means water users do not receive direct price signals about their water consumption. As such there is little or no incentive to reduce water wastage or improve efficiency. The Government will examine options to encourage the uptake of individual metering in new commercial premises.

6.4.2 Saving water in existing commercial and industrial premises

In addition to the cross sectoral programs outlined in section 6.2, there is also a voluntary scheme to encourage sustainable practices in NSW.

The NSW Government launched the National Australian Built Environment Rating System (NABERS) OFFICE Water rating tool in April 2006. NABERS OFFICE Water is a voluntary rating system for the environmental performance of existing buildings, and encourages best practice in the operation and maintenance of commercial and government office buildings to minimise water use.

Four of the largest commercial property owners and managers in Australia – Investa, Colonial First State, Stockland and AMP - have already committed to rating the buildings in their portfolios using NABERS OFFICE Water. NSW Government office buildings and tenancies will be rated under the policy on Sustainable Water and Energy Use, and other building owners will also be encouraged to rate their buildings and to improve their ratings to achieve best practice. It is anticipated that 50% of office space in Sydney will have obtained accredited NABERS OFFICE Water ratings by 2009-10.

Further information on NABERS is available at **http://www.nabers.com.au**

6.4.3 Other programs

EDC Business Program customer retrofits

Sydney Water is currently investigating a proposed program using contracted plumbers to fix leaks and install water efficient devices for business customers. To determine potential savings and project costs, a pilot program will target up to 50 small to medium businesses and some large commercial properties. The pilot program will be aimed at replacing showers, fitting flow controls to taps, adjusting toilet cisterns and optimising flush cycles for urinals. A market survey will be undertaken to research potential uptake from business customers.

EDC Business Program Do-It-Yourself Retrofits

A pilot program will offer 50 business customers a Do-It-Yourself amenity retrofit program for toilets, taps and showers. The customers in the pilot will have their amenities individually metered to quantify water savings. The manufacturing sector is most suited for the pilot because most of these customers have access to plumbers and tradespeople who can conduct the installations.

6.5 Water Smart agriculture

The Sydney basin agricultural sector uses up to 12 billion litres of water per year from the drinking water system, and draws a further 110 billion litres per year directly from rivers and farm dams. The total water use by farmers of around 122 billion litres per year is much less water than the combined household use in Sydney of around 375 billion litres per year. This makes the Sydney basin different to the large inland catchments where much of the water is released from dams specifically for irrigation, and where agriculture accounts for some 70% of total water use.

Nevertheless, agriculture is still a large consumer of drinking and river water in the greater Sydney area. Improving efficiency can reduce overall water usage by up to 25%, and thus improve river health, save money, and help reduce pressure on drinking water supplies.

6.5.1 Water Smart farm extension and education services

The state-wide program of Water Smart Farms, which incorporates the 'WaterWise on the Farm' initiative, is a farm extension and education program that offers education, training and increased community awareness of water use efficiency. The program, which is run by the NSW Department of Primary Industries continues to successfully assist farmers to optimise on farm water use efficiency while maximising yield of irrigated crops and pastures.

The initiative is being delivered in the Sydney region through field days and courses on irrigation management.

A modified version of the irrigation management course for water users with Vietnamese, Chinese, Khmer and Arabic backgrounds is available. Over 400 Sydney basin farmers have completed one of the courses.

Cambodian vegetable farmers discussing new drip irrigation technology

In 2004 an incentive scheme, linked to the courses, equipped 32 farmers in the Sydney basin to prepare Irrigation and Drainage Management Plans, enabling these farmers to receive grants of over $380,000 towards more than $1 million worth of water management technology.

Water use changes included upgrading pumps and irrigation systems, modifying nozzle sizes and sprinkler heads, refining irrigation scheduling, and using recycled water. (More information on recycling in agriculture is presented in Chapter 5.)

Applications can now be made to the Water Savings Fund for financial assistance to improve irrigation efficiency, and one such application has already been successful. See section 6.2.1 and the case study opposite.

Improved agricultural water use efficiency is also being addressed through improved metering and water trading provisions. Metering and water use monitoring are on track to be in place for all irrigators in the Sydney basin by December 2007 to facilitate reporting of water use against entitlements.

Flow meters are required for the top 100 licence holders who hold 36% of the total licensed volume. Lower volume water users are being required to install electricity meters and hours-run meters on their pumps. This group of 900 users command 59% of the total licensed volume. Since the publication of the *2004 Metropolitan Water Plan*, 80% of the first group have installed flow meters and the first annual audit of monitoring requirements has been conducted.

Further information on the program is available at:
www.agric.nsw.gov.au/reader/irrigation

Saving Water on vegetable farms

Vegetable growers in the Hawkesbury district will be saving water on their farms with the introduction of 'smart' irrigation technology.

In a $160,000 project developed by the University of Western Sydney, in partnership with the NSW Department of Primary Industries, the technology will be installed on eight farms, saving 16 million litres of water a year.

The project is one of 27 water saving initiatives receiving a total of more than $9.2 million funding in the first round of the Water Savings Fund.

Following field tests of two types of smart irrigation technology, the equipment will be installed on vegetable farms to save growers water and demonstrate the potential across the industry.

The Irrigation Water Recycling System (IRWS) was developed by the NSW Department of Primary Industries and trials have demonstrated that it can reduce water use by half and protect waterways by reducing runoff.

The second system, the Kapillary Irrigation Sub-Surface System (KISS), saves up to 60% of water by underground irrigation directed at the plants' root system. It also saves water loss through evaporation and runoff.

Rainwater tanks enabled this vegetable grower to totally eliminate the need to use drinking water for his hydroponic production

6.5.2 Management of water accessed under the domestic and stock right

NSW water legislation provides a right for people who live beside rivers or whose land overlies groundwater to take water for use around their house, growing food and watering their animals. This basic landholder water right is known as the domestic and stock right.

Extractions from surface water for the domestic and stock right are estimated to be in the order of 14.6 billion litres per year in the Hawkesbury-Nepean River catchment. The water sharing plans being developed for surface water and groundwater in the greater Sydney region take account of the likely volumes of domestic and stocks rights water with the total plan extraction limits.

Where it does not cause undue extraction pressures on local water sources, exercise of the domestic component of the right by Sydney's householders can be positive, by contributing to the conservation of the drinking water supply for the purposes where highest grade water is needed, such as cooking and bathing. It is recognised however, that in areas with high population density, large increases in the volume of water accessed from adjacent rivers and groundwater could place an additional and unacceptable pressure on local water sources, particularly during drought. For this reason, the Government is in the process of developing guidelines to define what is reasonable for use of water accessed under the domestic and stock right. These Reasonable Use Guidelines will include limits on the total volume of water that can be used for household purposes under the domestic component of the right and on the garden area maintained by use of this water.

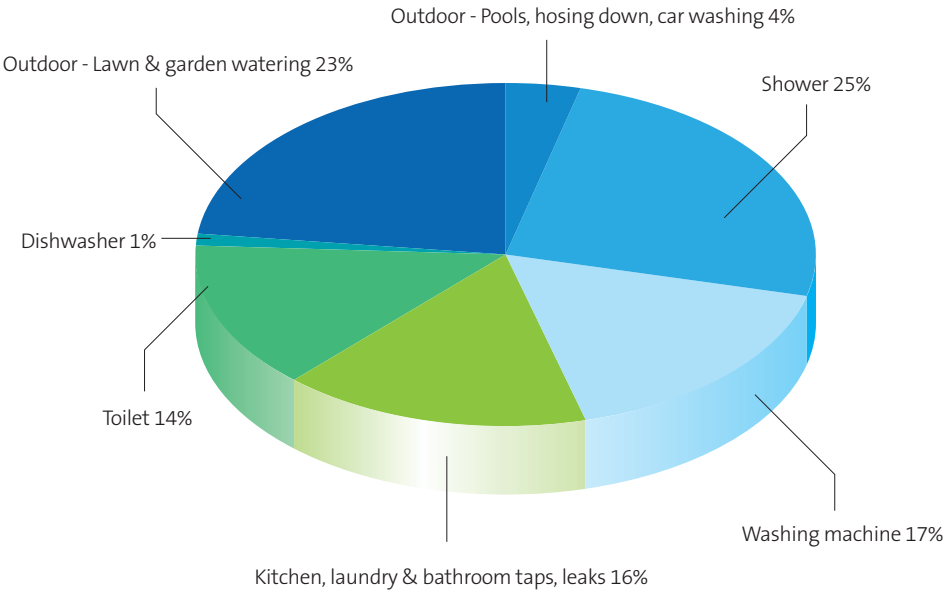
It is expected that these Reasonable Use Guidelines will be placed on exhibition for public comment by the end of 2006.

6.6 Water Smart households

There is a common misconception that the major water users in Sydney are business and industry. In fact, in a typical year without drought restrictions, households in Sydney account for about 70% of total drinking water use. The figure below shows major areas where this water is used around the home and garden. A broad range of water saving programs are in place to reduce water use in each of these areas.

Sydney's householders have made significant efforts in reducing the amount of water they use. A total of more than 30 billion litres has been saved in households since 1999, and by 2015 savings will be around 56 billion litres per year.

Where water is used in and around the home



20

The BASIX system for new homes is projected to save around 20 billion litres of drinking water each year, by 2015.

6.6.1 Building Sustainability Index (BASIX)

BASIX for new homes

Introduced by the NSW Government as a world-first sustainability tool in July 2004, the Building Sustainability Index (BASIX) is a major initiative to reduce the amount of drinking water consumed and greenhouse gas emitted by new homes across NSW. In Sydney, the BASIX policy includes a requirement that new dwellings must be built to use 40% less drinking water than the NSW average. Drinking water use is determined by the number of household occupants, the size of the garden area, the size of the swimming pool (if nominated) and the influence of local climate. Drinking water savings are then calculated by the commitments nominated during the BASIX assessment of the proposed dwelling.

BASIX applies to houses and, since October 2005, to multi-unit dwellings, such as townhouses and low, mid and high rise apartment blocks. In the period July 2004 to December 2005, it is estimated that approximately 30,000 single dwellings in Sydney have been assessed under the BASIX policy.

BASIX offers maximum flexibility by recognising a range of water saving measures to suit individual household budgets, homes and lifestyles, and surrounding environmental conditions.

In addition to saving drinking water, the BASIX Scheme helps to decrease household water and energy bills. It is almost always more cost effective to install water and energy saving measures at the point when a building is being planned, rather than retrofitting those measures subsequently.

In Sydney, the effectiveness of the water-related components of BASIX will be evaluated in a monitoring program in a partnership between the Department of Planning and Sydney Water, when there is an appropriate sample size of occupied BASIX-compliant dwellings.

Saving water under BASIX

The average consumption of drinking water across all NSW households is currently estimated to be 90,337 litres per person per year. (This is the water consumed in residences only and is not the drinking water used in non-residential sectors, such as offices, restaurants, manufacturing and hospitals.) In Sydney and the coast and ranges of NSW, where rainfall is relatively high and the evaporation rate is lower than other parts of the state, the BASIX scheme requires that all dwellings are designed to use 40% less than the average drinking water consumption.

To achieve the BASIX water requirements, households can install combinations of the following:

- water efficient fixtures, such as 3-star showerheads, 3-star tap ware and 3-star toilets
- rainwater tanks for garden watering and toilet flushing, or using alternative water supplies including domestic greywater, groundwater and recycled water supplied via a third pipe system for permitted household uses
- landscaping with low water using plants, including suitable native and exotic species
- approved covers for swimming pools and outdoor spas
- in multi-unit dwellings, centralised greywater treatment systems or water efficient clothes washers and dishwashers, and
- provided certain criteria are met, other water saving technologies as they come to market.

Example BASIX certificate

The building applicant (the architect, builder, or owner-builder) is responsible for completing a BASIX assessment, ensuring the BASIX commitments are clearly marked on the plans, and submitting the BASIX Certificate with the development application

BASIX for alterations and additions

From July 2006, BASIX will also apply to all major alterations and additions to dwellings across NSW. The aim is to ensure that all alterations and additions to NSW dwellings include cost effective and practical measures to reduce greenhouse gas emissions and drinking water consumption, as well as improve thermal performance. The Scheme will affect changes to dwellings such as first floor additions, ground floor extensions, new bathrooms and kitchens, and ancillary developments such as new swimming pools. Water and energy efficiency requirements will need to be met in the altered or added part of the property, and rainwater tanks are generally required where a new swimming pool is proposed.

The independent expert analysis of the supply and demand balance undertaken for this *Metropolitan Water Plan* indicates that, by 2015, the expected water savings in Sydney attributable to the BASIX Scheme for new dwellings and the alterations and additions Scheme is expected to be 23 billion litres per year. This analysis took account of the fact that certain underlying drivers of residential water consumption will change over time. For example, by 2015 it is highly likely that clothes washers, dishwashers and toilets available for purchase in Australia will use less water than the models currently available.

For more information on BASIX, visit the website at **www.basix.nsw.gov.au**

6.6.2 Water efficiency in existing homes

The Government is investigating options to provide information on a dwelling's water efficiency when it is sold, such as the provision of a certificate to inform potential purchasers about whether a WaterFix retrofit has been carried out on the house. Also being investigated are possible water efficiency measures, including installation of efficient fittings or use of a rating scheme like NABERS HOME Water.

The Government will be launching the National Australian Built Environment Rating System (NABERS) HOME Water rating tool in mid 2006. NABERS HOME Water is a voluntary rating system which enables householders to rate their environmental performance compared to the average house in Australia, and provides information on how to reduce water use and improve the rating of a dwelling.

6.6.3 Efficiency labelling and standards

To encourage the purchase and adoption of water efficient devices, the Water Efficiency Labelling and Standards (WELS) Scheme has been developed to provide information to consumers on the performance and water efficiency of water appliances. The Scheme applies mandatory water efficiency labelling to the major household water using products such as washing machines. The Scheme requires water using devices to display labels at the point-of-sale to allow consumers to compare products and make informed purchases.

The water using products covered by the WELS Scheme currently include:

- clothes washing machines
- dishwashers
- toilet equipment
- showers
- tap equipment intended for use over a kitchen sink, bathroom basin, laundry tub or wash trough
- urinal equipment.

Simply by purchasing an efficient version of a product, a household can make significant water savings. The box on page 73 provides further information on water use for different products and star ratings.

Because goods are manufactured and sold across Australia, the Scheme is an initiative of the Commonwealth, States and Territories Governments. It commenced nationally on 1 July 2005, with a voluntary labelling scheme and minimum performance standards for toilets. From 1 July 2006, mandatory registration and labelling will apply to all of the products listed above.

3

The BASIX system for alterations and additions is projected to save around 3 billion litres of drinking water each year, by 2015.

15

Implementation of WELS is projected to save around 15.4 billion litres of drinking water each year, by 2015.

What the star ratings mean for some typical household products[a]

Product	Star Rating[b]					
	6-star	5-star	4-star	3-star	2-star	1-star
Clothes washer (4 kg) Litres of water per wash	20	29	41	59	84	120
Dishwasher (12 place settings) Litres of water per wash	8.3	10.1	12.2	14.8	17.9	21.7
Toilet equipment Litres of water per flush[c]	2.5	3.0	3.5	4.0	4.5	5.5
Shower head Litres of water per 8 minute shower	Not currently available	Not currently available	Not currently available	72	96	128
Taps and flow controllers Litres of water per minute	4.5	6.0	7.5	9.0	12	16

Source: AS/NZS 6400.2005

(a) Indicative figures only – please check labels when purchasing products to confirm water use

(b) Water use must be less than or equal to the volume indicated to qualify for the particular rating

(c) Average of 1 full and 4 reduced flushes

A key part of the WELS Scheme is the introduction of a new water rating label to assist consumers to purchase more water efficient household products. It also provides incentives for manufacturers to improve the water efficiency of these products. The WELS Water Rating label has two main features:

- a star rating that gives a quick comparative assessment of the product's water efficiency,
- a water consumption figure that provides an estimate of the water consumption of the product based on its tested water consumption.

Once a product is registered under the Scheme, compliance with the relevant standard and labelling requirements will be obligatory. Further products are expected to be added to the Scheme over time. Although all products must be labelled, toilet equipment is the only category which has a mandatory minimum water efficiency requirement at this time. Devices that are less efficient will still be available for sale, however the labels will enable consumers to choose more efficient products if desired.

Improved customer recognition and uptake of water efficient products should encourage retailers and distributors to expand the range of these products and encourage manufacturers to design more water efficient products.

Labelling is estimated to reduce domestic water use by 5% or approximately 15.4 billion litres per year in Sydney by 2015. Nearly half of this would come from clothes washers, about 25% from showers and 22% from toilets. More than 86% of the water savings would occur in the residential sector, and the rest in the business and government sectors. With consumers choosing more efficient products, the NSW community is expected to save almost $225 million through reduced water and energy bills by 2021.

The NSW Government has been active in all aspects of WELS Scheme development. NSW is now leading efforts to introduce minimum standards to devices in addition to toilet equipment.

When it becomes mandatory from mid 2006, the WELS Scheme will replace the existing voluntary National Water Conservation Rating and Labelling scheme, which is the 'A' rating scheme familiar to many. Some 'A' rating labels may still be seen alongside the new WELS star rating system until existing stock is cleared.

For more information on the WELS Scheme visit **www.waterrating.gov.au**

6.6.4 Washing machine rebate program

To help speed the transition to efficient washing machines and to encourage industry to develop new products, the *2006 Progress Report* announced that a new Washing Machine Rebate Program would be implemented in March 2006. Under the program, which will run for one year, a $150 rebate will be provided to residents in Sydney Water's area of operations for the purchase of a new 4-star or 5A rated water efficient washing machine.

Washing machines were selected for the rebate scheme as they are a big water user in the average home and water efficient machines are a cost effective way to make real savings. Efficient machines currently make up only a small percentage of sales, and the program is designed to complement the Water Efficiency and Labelling Standards (WELS) Scheme by encouraging NSW residents to install them.

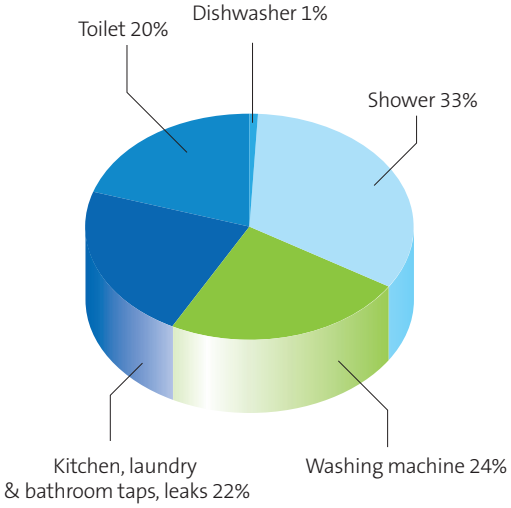
Using a more efficient machine delivers annual savings of around 21,000 litres of water, 125 kilowatt hours of electricity and, as a result, around $45 off utility bills. Within Sydney, the program, combined with the savings from a 2003 pilot program, is expected to save around 0.5 billion litres per year.

See section 6.6.3 for a comparison on water usage for rated washing machines.

6.6.5 WaterFix – improving water efficiency in homes

Indoor water use for showers, toilets and taps accounts for a significant proportion of total household demand. The Every Drop Counts Residential Retrofit Program commenced in 2000 to improve efficiency in existing homes and to help people to reduce their utility bills.

Where water is used inside the home



The program, now known as WaterFix, offers householders the opportunity to have a qualified plumber install water efficient fittings and fixtures in their homes. The retrofit includes the installation of 3-star (or AAA) rated showerheads, tap-flow regulators and toilet cistern flush arrestors, and the repair of any minor leaks. A retrofit reduces household water use by an average of 20,900 litres per year.

The service has a retail value of over $150 but is provided to households for $22. It is offered free of charge to low-income households holding a Pensioner Concession Card, a Health Care Card or a Veteran's Affairs Gold Card.

The WaterFix Program is one of the largest residential water efficiency incentive programs offered anywhere in the world and has received strong support from householders, with approximately one in five Sydney households taking up the offer. In 2004-05, more than 40,300 households received a retrofit. In total, retrofits have been provided to more than 310,000 homes.

The program has also raised community awareness of water saving practices, as shown by the high level of customer interest and the high uptake rate across greater Sydney.

The program is being expanded to achieve a total of 550,000 retrofits by 2008, including Department of Housing retrofits and Do-It-Yourself water saving kits.

The washing machine rebate program is projected to save around 0.5 billion litres of drinking water each year, by 2015.

The WaterFix program is projected to save around 8.2 billion litres of drinking water each year, by 2015.

1.5

The Department of Housing Retrofit Program is projected to save around 1.5 billion litres of drinking water each year, by 2008.

1.6

The Do-It-Yourself Water Saving Kit is projected to save around 1.6 billion litres of drinking water each year, by 2015.

WaterFix Program highlights

Since the program commenced in January 2000, the following has been achieved:

- more than 310,000 households have received the service
- this represents approximately 20% of residential households
- of these, 43% of participants received the service for free
- approximately 20% of participating households have installed more than one showerhead
- in 2004-05 more than 40,000 retrofits were completed, 41% received the service for free and 24% of customers installed a second showerhead
- approximately 367,000 AAA showerheads have been installed
- residential water use has been reduced by 6.5 billion litres per year as a result of the program

Other benefits from the program include:

- increased customer awareness of water conservation
- reduction of flows into the sewer system
- estimated reduction in greenhouse gas emissions of over 1 million tonnes per year due to reduced hot water use and water supply pumping
- $30-$100 per year saving in water and energy charges for a participating household, depending on whether a household has an electric, gas or solar hot water system.

WaterFix remains one of the most cost effective and practical programs to achieve sustained reductions in residential indoor water use.

Department of Housing Retrofit Program

The Department of Housing (DoH) manages approximately 88,000 public housing properties in the Sydney metropolitan area making it a significant property owner. Approximately 6% of residential water use occurs in public housing, accounting for 3.5% of total water demand in Sydney.

The DoH Retrofit Program was launched in November 2004. The service offered under the Program is similar to that provided by Sydney Water's WaterFix Program. The retrofit includes the installation by a qualified plumber of 3-star (or AAA-rated) showerheads, tap-flow regulators and toilet cistern flush arrestors, and the repair of any minor leaks. The full service is offered free to DoH tenants.

In 2004-05 the program was successfully introduced to 17 suburbs around Sydney with an average 21% uptake rate leading to the installation of 7,831 retrofits. It is estimated that during 2004-05 this program saved over 100 million litres of water. In addition to conserving water, DoH tenants will save money on their water and energy bills. It is expected that 25,000 DoH homes will have been retrofitted by mid 2006.

The *2006 Progress Report* announced that an additional 50,000 DoH homes and units will receive a retrofit by 2008, bringing the total number of public housing properties receiving this service to 75,000. Estimated water savings for the Program are 1.5 billion litres per year by 2015.

Do-It-Yourself Water Saving Kit

To complement and build on the savings achieved through WaterFix, Sydney Water is offering every household a free 'Do-It-Yourself' (DIY) Water Saving Kit to enable householders themselves to make taps and showers in their home more water efficient. The DIY kit is quick and easy to install, and enables each household to save approximately 16,000 litres of water each year.

The DIY Water Saving Kit was developed as an alternative to Sydney Water's long-running, full service WaterFix Program. The kits provide householders with the opportunity to upgrade their existing inefficient showerheads and taps so that they provide a similar flow rate to fully accredited 3-star (or AAA) water efficient models, and provides easy access to water efficiency for those households who would prefer not to engage a plumber to do the work.

The Do-It-Yourself Water Saving Kit

The DIY kits are packaged with illustrated instructions and are simple to install, requiring only basic tools and skills. The kit contains two flow regulators (9 litres per minute) for showers, two flow regulating aerators (6 litres per minute) for bathroom basin taps and one flow regulating aerator (9 litres per minute) for kitchen taps.

By February 2006, over 18,000 customers had collected their kits from the authorised outlets. A total of 37,000 kits are projected to be distributed by June 2006. A further 85,000 kits are projected for distribution in 2006–07.

Further information on the DIY Water Saving Kit is available at **www.sydneywater.com.au/SavingWater/WaterRestrictions/DoItYourselfKit.cfm**

6.6.6 Rainwater Tank Rebate Program

Rainwater tanks are an effective way to take the pressure off limited water resources, and at the same time, help manage stormwater runoff. Storing rainwater runoff from roofs can provide water for flushing toilets, washing clothes, watering gardens and washing cars.

The Rainwater Tank Rebate Program is designed to encourage Sydney's existing residential and business customers to install rainwater tanks. The program offers rebates ranging from $150 for a 2,000 litre capacity tank to $500 for tanks with a capacity equal to or greater than 7,000 litres. An additional $150 rebate is available if a licensed plumber connects the tank for indoor use to supply washing machines or toilets. The rebate for installing tanks will be available until July 2008.

Since the Rainwater Tank Rebate Program was launched in 2002, the number of rebates received has steadily increased to an average of 1,050 per month. Around 20,800 rebates have been paid, and the program is estimated to have reduced demand by 760 million litres per year, or an average of 40,000 litres per year for each rebate. The Program has also provided significant education for the community, and assists in further diversifying the water supply.

Rainwater tanks can make a useful contribution to Sydney's water supply, however they are more expensive per litre of drinking water saved than many other measures to reduce demand and increase supply. For example, if one third of Sydney's existing detached dwellings (say 665,000 homes) were provided with a 5,000 litre rainwater tank for use in the laundry, toilet flushing and garden, the savings would be significant at 50 billion litres per year, however the cost would be around $2.3 billion. This is a much more expensive way to save water on a large scale than mass recycling schemes, such as dual reticulation in new suburbs.

Nevertheless, rainwater tanks can play a role in saving Sydney's precious drinking water, can save householders money through lower water bills, capture stormwater at its source and help raise awareness of the importance of water conservation.

More information on rainwater tanks in homes can be found at: **http://www.sydneywater.com.au/SavingWater/RainwaterTanks/Rebates.cfm**

Rainwater tanks can be a useful way to provide water for the garden, clothes washing and flushing the toilet.

2.1

The Rainwater Tank Rebate Program is projected to save around 2.1 billion litres of drinking water each year, by 2008.

2.7

The residential landscape assessment program is projected to save around 2.7 billion litres of drinking water each year, by 2015.

6.6.7 Outdoor water use

In an average year, residential outdoor water use such as garden watering and car washing accounts for about 19% of total demand for drinking water in Sydney, almost as much as that used by commercial and industrial premises combined. Garden water use in the residential sector can vary from about 70,000 litres per year for an average household to as much as 500,000 litres per year for those in the top 20% of residential water users.

As garden water use is such a large component of demand, even relatively minor changes in the way Sydneysiders use water can result in significant water savings. Through the implementation of various initiatives, there are significant opportunities to reduce this usage.

Ongoing outdoor water saving measures

The community has made significant water savings by adopting sensible outdoor water use practices in the current drought. Such practices include watering gardens in the cool of the morning or evening to reduce water loss through evaporation using brooms instead of hoses to clean paved surfaces and washing cars with hoses fitted with trigger nozzles.

If such commonsense and practical behaviours were to continue to be widely practised after the drought has ended, a significant amount of water could be saved each year. Experience in other states suggests that governments can encourage sensible outdoor water use in non-drought periods. At the end of this drought in Sydney, the Government will review the experience of outdoor water savings and consider how to build on it to encourage ongoing water saving behaviours.

Gardening water efficiency guidelines

The *2004 Metropolitan Water Plan* included the development of water efficiency guidelines to help gardeners design, create and maintain gardens with low ongoing watering needs. In October 2005, Sydney Water published these guidelines including 'recipe cards' for popular garden styles. The guidelines, in the form of an easy-to-read booklet, are available for free at most nurseries and are complemented by Sydney Water's web-based plant selector. With 1,000 popular plants, including trees, shrubs and ground cover on the site, Sydneysiders can obtain information about ongoing watering needs to help reduce their outdoor use.

The recipe cards and further information on the plant selector can be found at **http://www.sydneywater.com.au/SavingWater/PlantSelector/**

Residential Landscape Assessment Program

The Residential Landscape Assessment Program aims to reduce residential outdoor water use in targeted high water using properties through behaviour change by providing landscape and irrigation advice and adjustments to irrigation systems.

In 2004-05, over 1,400 residential gardens received comprehensive landscape assessments to determine their specific irrigation needs. This included issuing 'Tap Tags' to remind the gardener of the appropriate irrigation frequency and duration.

The program will be further developed over time with approximately 500 additional assessments being conducted by mid 2006. The aim is to achieve a 15% saving in outdoor use for the participating properties and, subject to analysis confirming achieved outcomes, the program will expand to target 40,000 properties by 2010.

Smart Approved WaterMark

To assist gardeners to make informed decisions about outdoor water using equipment and approaches, the Smart Approved Watermark (SAWM) scheme was established in 2003. The SAWM was developed and funded the Water Services Association of Australia (WSAA), the Irrigation Association of Australia (IAA), the Australian Water Association (AWA) and the Nursery and Garden Industry Association.

The objective of the scheme is to reduce water consumption by recognising products, services and organisations that will contribute to reductions in outdoor water use and to promote the adoption of proven water smart technology. Endorsed products, services and organisations can then use the scheme logo for water saving recognition and marketing purposes. It is a useful outdoor partner to the Water Efficiency Labelling and Standards (WELS) Scheme for indoor fittings and appliances (see section 6.6.3).

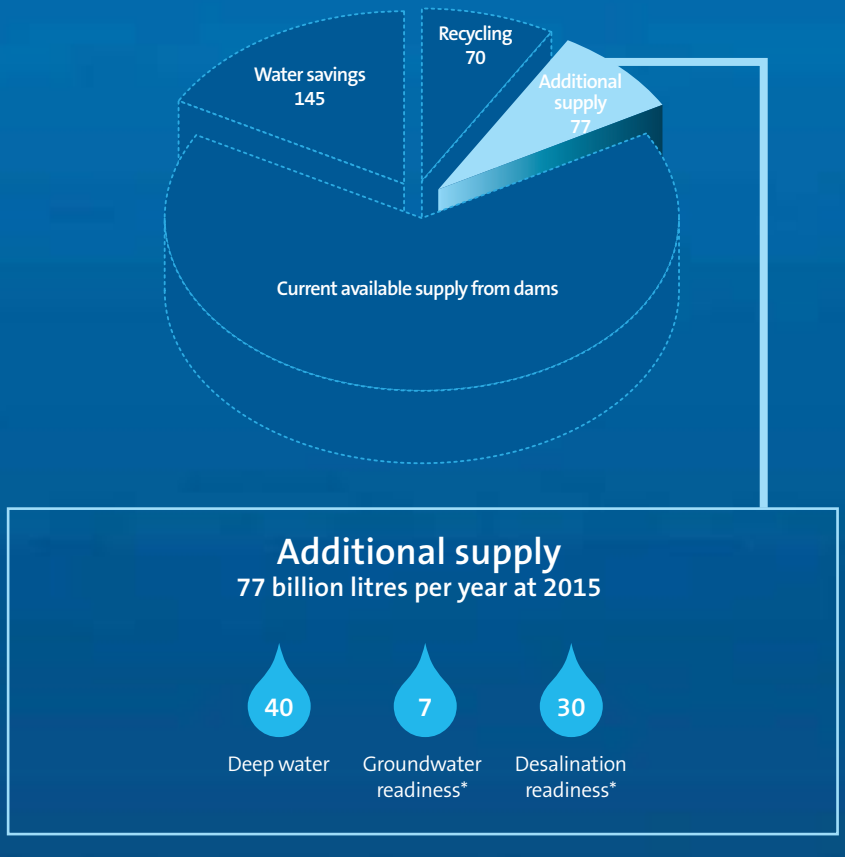
Smart
Approved
WaterMark

Information on the scheme and the latest list of endorsements can be found at **www.wsaa.asn.au/smartwatermark**

What will be done next

- The Water Savings Fund will continue, with an extra $10 million available in 2006
- Water Savings Action Plans will have been completed by businesses and government by mid 2006 for implementation over the next four years
- A $150 washing machine rebate will be provided to Sydney residents who purchase an efficient washing machine until February 2007
- WELS will become mandatory from July 2006 and NSW will lobby for the national introduction of minimum standards
- BASIX will be rolled out for alterations and additions from 1 July 2006
- The NABERS HOME Water rating tool will be released in mid 2006
- Under a newly expanded WaterFix Program an additional 50,000 Department of Housing dwellings will have water efficient fittings installed, bringing the total number of houses serviced across Sydney to 550,000 by 2008
- A new program for leakage reduction in schools will be piloted
- New reasonable use guidelines for river and groundwater use by households will be released
- Further analysis of demand trends and ongoing monitoring of population growth and demand will be undertaken
- The potential impacts of climate change on water demand will be analysed
- Further measures to improve government water efficiency will be undertaken
- Rainwater tank rebates for households will continue to be offered until July 2008
- The Every Drop Counts Business Program will continue to help business and government to make significant water savings
- Sydney Water's Leak Reduction Program will continue
- An enhanced metropolitan water education program will increase awareness of the need for continued water saving efforts.

7. Increasing supply



**By investing in being ready to access groundwater and desalinated seawater in severe and extreme drought - even if such drought does not occur - more water can now be drawn from the dams without affecting the security of supply; for this reason the calculated water availability figure has increased even without accessing these sources.*

What this chapter is about

- Making available the previously inaccessible water at the bottom of dams
- Optimising the contribution of water from the Shoalhaven catchment for Sydney
- Being ready to draw groundwater during severe droughts
- Being ready to build a desalination plant if needed in an extreme and prolonged drought

What has been done to increase supply

- Warragamba and Nepean dams have been re-engineered to allow an extra 40 billion litres of drinking water to be taken each year
- Engineering options for transferring extra volumes of water from the Shoalhaven system have been investigated
- Five of seven groundwater sites have been investigated and at least 15 billion litres of Upper Nepean groundwater has been identified for use each year in severe drought
- Initial drilling and testing has commenced at Leonay, another promising groundwater site
- The critical decisions have been made on a desalination plant, the site has been purchased, and the lead-time to be ready for construction (if an extreme drought requires it) has been reduced

What will be done next

- Complete the accessing of deep water at Warragamba and Nepean Dams
- Complete the groundwater pilot testing program at Leonay
- Complete the groundwater investigations at Illawarra and Warragamba
- Publish reports on the investigations at all seven groundwater locations and consult the community about potential groundwater use and borefield construction
- Complete investigations and consult the community on potential new Shoalhaven operating rules to increase transfers using existing infrastructure
- Purchase the design blueprint for a possible future desalination plant

7.1 Introduction

As discussed in Chapters 1 and 2, Sydney's water supply has historically been dominated by rain-fed water sources. While these surface water resources will continue to be the dominant source of water, the development of new sources of water – such as recycling, groundwater and desalination – will mean that the system is increasingly diverse and becomes better equipped to deal with rainfall variability, including extreme drought conditions.

This greater diversity in the supply mix represents a fundamental shift from the days when rainfall runoff was the only option for meeting Sydney's water needs. By having more options, including options that provide water independent of rainfall, Sydney can make better use of the rain-fed system by operating it differently because it is no longer the sole means of guaranteeing supply – including in the rare event of extreme drought conditions.

This chapter provides information on the additional large scale water sources that are available to Sydney to meet long term growth needs, and drought needs. These include previously inaccessible water at the bottom of existing dams, more water from the Shoalhaven catchment, and groundwater and desalination in the event of severe and extreme drought. Chapters 5 and 6 provide more information about other supply options such as rainwater, stormwater and recycling.

One way to increase the water available to meet Sydney's needs is to make better use of the existing system of dams and water supply transfer infrastructure. Accessing water at the bottom of Warragamba Dam and increasing access to the deep water in Nepean Dam increases the amount of water available in the system by 40 billion litres of water per year. This is boosting supplies in the current drought and also augmenting the capacity of the system to meet Sydney's long term water needs. Transferring more water from the Shoalhaven catchment (but without raising Tallowa Dam) could increase water availability, and work is under way to explore this option further.

On the basis of the independent expert analysis of the supply and demand balance, the Government has decided that groundwater and desalination will be used only in the event that dam levels fall to critical levels. Thus, groundwater will be used to help Sydney through severe droughts, as this maximises the yield benefit of the groundwater resources. It is intended to use groundwater only during drought periods, when dam levels fall below about 40%, and the groundwater aquifer will be allowed to recharge in non-drought periods. The same applies for desalination – the intention is to construct a desalination plant only if required – that is, as a response to extreme drought conditions when dam levels fall below about 30%.

Groundwater from a new source in the Upper Nepean catchment alone may add up to 15 billion litres per year to the amount of water available to Sydney during drought. The current analysis suggests that groundwater would be extracted for two to three years, then the aquifers would be allowed to recharge for five to seven years. At Leonay, in western Sydney, a similar supply may be available but pilot testing is required to confirm the full extent and sustainability of this source.

By using groundwater we can reduce pressure on surface water supplies when the dams fall below 40% capacity. This would slow the rate at which dams would otherwise reach 30% and thus increase the probability that the drought breaks before more expensive action would be required (for example, constructing a desalination plant).

Given its total independence of rainfall, desalination can be used to secure supplies in the event of extreme drought. Following detailed investigations, the NSW Government has identified a preferred technology (reverse osmosis), purchased a site, sought planning approval and undertaken substantial preparatory works so that it can build a desalination plant if required. The probability of dam levels reaching the 30% level is very low, but it is vital to ensure that Sydney's water needs can still be met should this situation occur.

In such a situation, a desalination plant would be constructed with a capacity of 125 million litres per day, but this could be increased to 500 million litres per day if required. Having the capacity to draw on desalination means that the Government will not need to impose drought restrictions on water use that are more stringent than those imposed when dams levels reached 40% in June 2005.

Thanks to the range of measures now in place, the probability of storages falling to these critical levels is now even lower than in the past, but the Government will be ready to respond if that eventuates.

7.2 The current supply system

Sydney's water comes from a complex, integrated system of 11 major dams and associated weirs, reservoirs, pumping stations, canals and pipelines. The system is carefully operated in order to maximise the amount of surface water collected from rainfall runoff in five catchments.

To ensure the highest possible yield, and to maximise the quality of water going to water filtration plants, the Sydney Catchment Authority (SCA) which manages the system, uses a number of processes including:

- selecting water from different reservoirs
- selecting water from different levels in the storages

- balancing capacities and flow requirements of pipes, channels, rivers, canals and tunnels
- controlling activities in the drinking water catchments to protect the quality of water flowing into the storage system
- monitoring and analysing water quality, flows and dam levels.

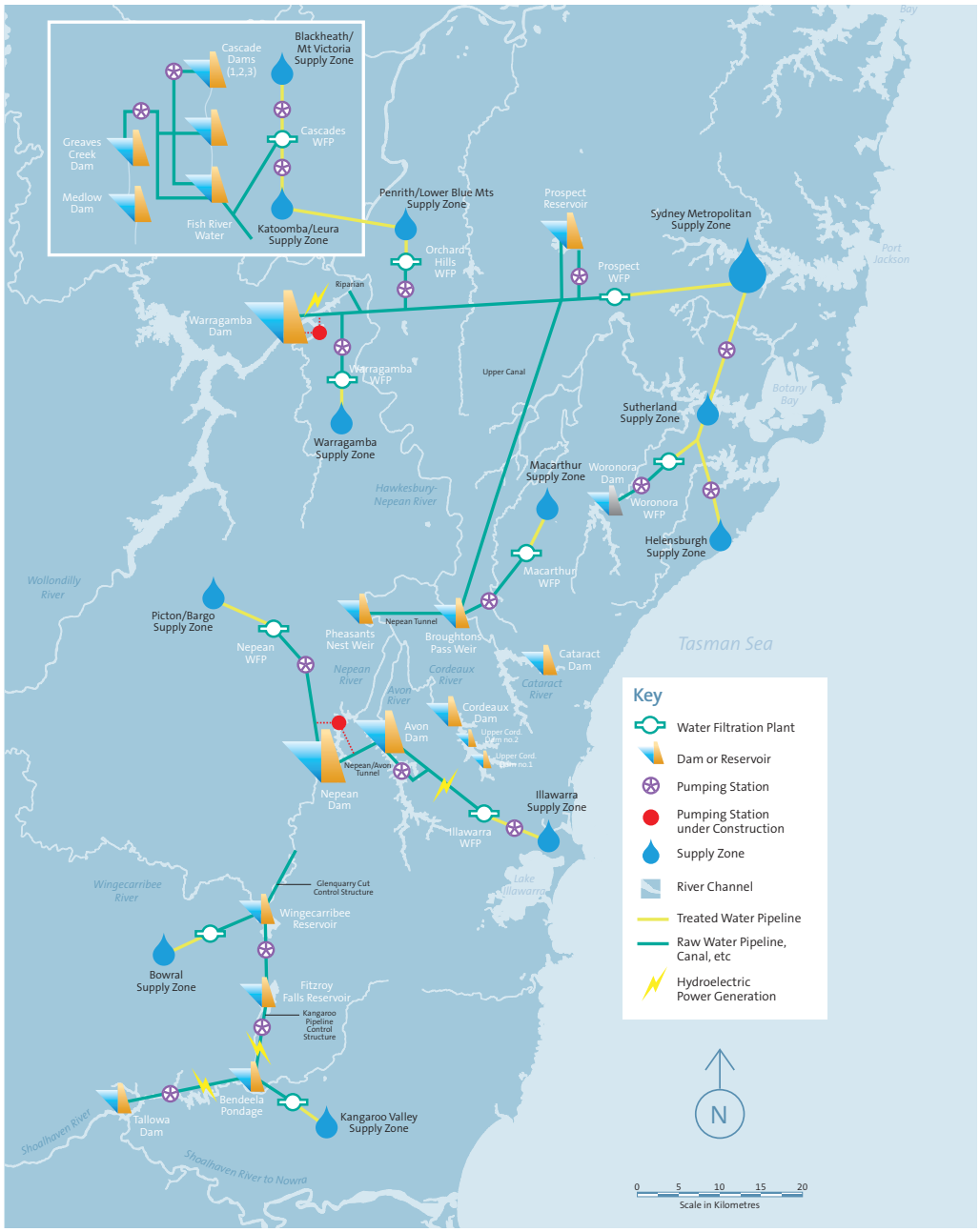
While Sydney receives more rainfall on average than cities like London, its rainfall patterns are highly variable. Thus, the major driver of Sydney's water planning is not the inadequacy of average rainfall, or even frequent droughts, but rather the risk of a rare but prolonged and severe drought across the five catchments.

The Sydney storage system is designed to cope with extended periods of low rainfall and holds more water per person than most other storage systems around the world.

When full, the dams will have an extended available storage of approximately 2,600 billion litres, including the deep water currently being made accessible. This equates to over four years' supply even if there are absolutely no inflows to the storages. Of course, Sydney has never had a year with zero inflows: even during the worst year of the current drought (2004), 370 billion litres of water flowed into the storage system.

The system's capacity to deal with prolonged periods of low rainfall is reflected by the fact that at 27 April 2006 the storages were still 43.9% full, well into the second worst drought on record. While storage levels reached their lowest ever level in mid 2005, it is important to keep in mind that Sydney's water supply has good capacity to deal with normal conditions – including normal drought conditions.

Sydney's water supply system



It is only in the event of severe or extreme drought conditions that further investment is required to ensure security of supply. This new *2006 Metropolitan Water Plan* outlines the Government's strategy to ensure security of supply while avoiding unnecessary costs.

Until recently, the water that could be drawn annually from the storage system was estimated to be 605 billion litres. However, this figure has now been revised down to 575 billion litres. This is due to the net effect of:

- incorporating low inflows to the system during the last six years, which has an impact on the long term system average inflow used to calculate water availability
- more accurate modelling of water released from the system for riparian and other purposes
- environmental flow releases from the Upper Nepean dams (as announced in the *2004 Metropolitan Water Plan*)
- accessing deep water in the Warragamba and Nepean dams
- groundwater and desalination readiness and
- removal of level 4 and 5 drought restrictions.

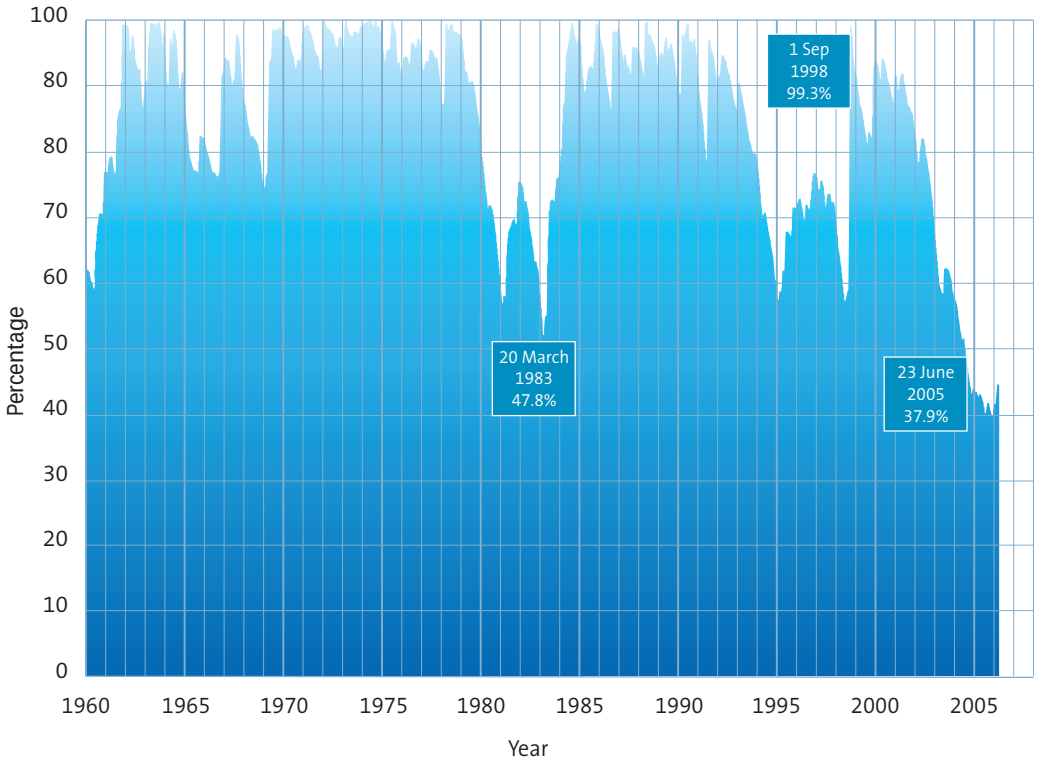
For more information:
http://www.sca.nsw.gov.au/dams/

7.3 Accessing deep water

At the bottom of many dams around the world is a body of water that engineers call 'deep storage' because it is not accessible for water supply using existing pumps and pipes. The Sydney dams, which were designed to release water under gravity pressure only, also had a substantial reserve at the bottom that could not be drawn on. A review of the infrastructure determined that pumping stations and other works could withdraw this deep storage during the current drought to increase the water supply. This enables the Sydney Catchment Authority to tap into previously inaccessible water, providing a cost effective means to augment water supplies.

Accordingly, the *2004 Metropolitan Water Plan* included a commitment to invest about $100 million to access the deep water in Warragamba, Avon and possibly Nepean Dams. At that time, it was estimated that the proposed works would increase the annual availability of water by 30 billion litres per year by the end of 2006. Detailed investigations and planning have now been completed and construction is well under way at Warragamba and Nepean dams. This is boosting water supplies in the current drought as well as increasing the amount of water available from the system in the longer term.

Graph of percentage dam levels from 1960 to 2006 (before deep storages accessed)



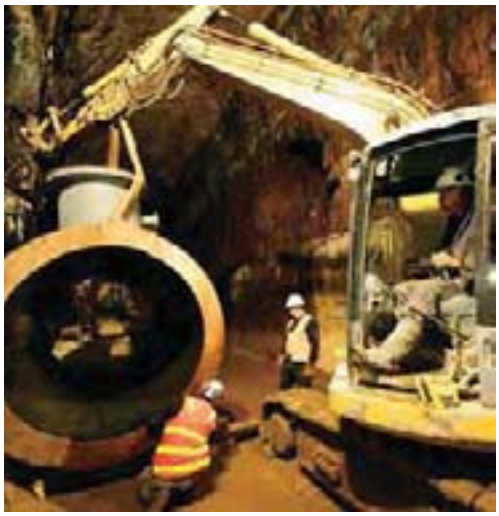
The most recent modelling and engineering works show that the ability to withdraw deep water at Warragamba Dam and Nepean Dam now provides an extra 40 billion litres of water per year at a cost of $119 million. This is an increase of 33% on the initial estimate of 30 billion litres, and the water will be available ahead of schedule by the end of August 2006.

The effect of gaining access to previously inaccessible water in Warragamba and Nepean Dams is to increase the total system storage capacity by 200 billion litres, or around 8%, which will bring total system operating capacity to 2,600 billion litres. This means that the dam levels on 27 April 2006 were at 43.9% of extended storage.

7.3.1 Warragamba Dam

Four outlets were originally constructed in the Warragamba Dam wall. The top three provide a gravity supply to Prospect Reservoir. The fourth outlet is located directly below the third and was used to enable Megarritys Creek pumping station to deliver water to Prospect Reservoir while the dam was filling after construction. This arrangement was no longer required once the water level rose above the high level outlets.

The works at Warragamba Dam have proceeded along the lines of the schematic diagram below. A new opening in the dam wall is being constructed to reach the fourth outlet. Deep storage water will flow through this outlet to the enlarged Megarritys Creek underground pumping station 1.5 kilometres downstream and 40 metres underground. This disused pumping station has been demolished, the original cavern has been enlarged, and new pumping equipment has been installed.

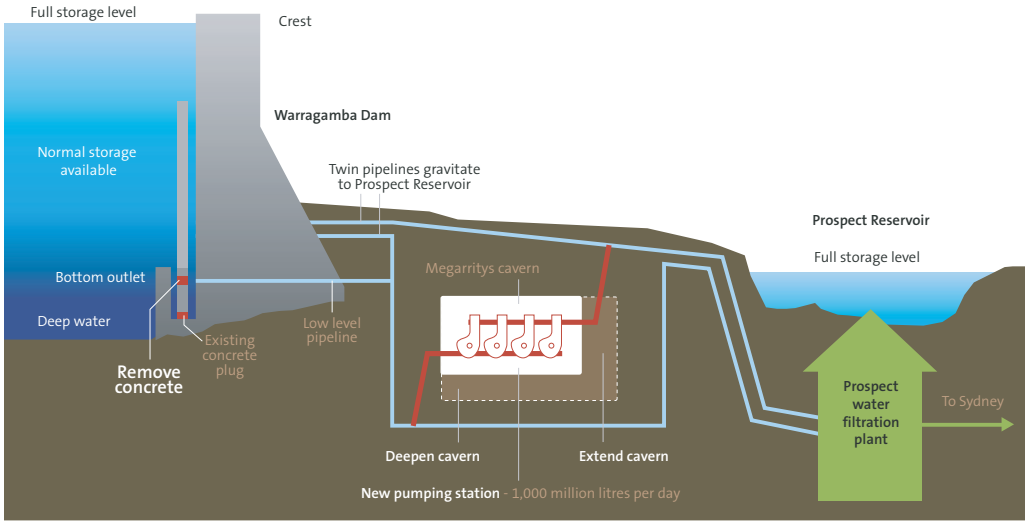


Installing pipes in the enlarged pumping station cavern

40

Accessing deep water will provide an extra 40 billion litres of drinking water each year by 2006.

Accessing deep water from Warragamba Dam



Accessing deep water at Warragamba Dam. Pipes are being installed in a large cavern under the dam to enable water to be pumped into the existing gravity-fed system.

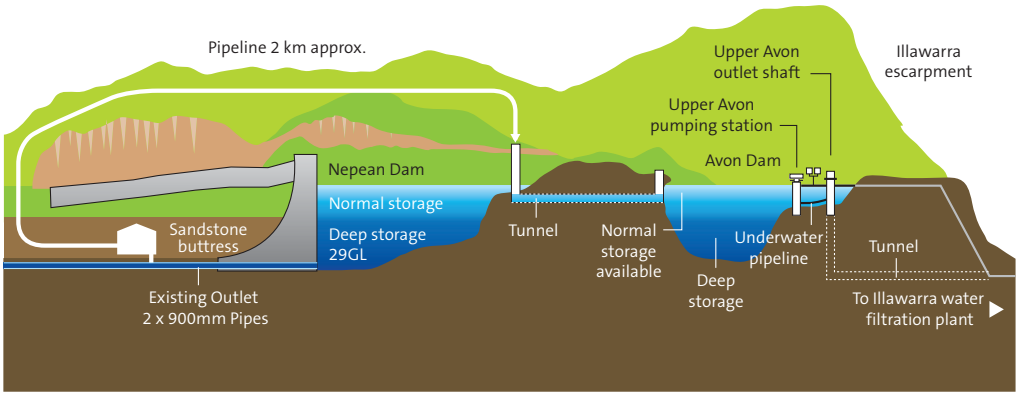
7.3.2 Nepean Dam

The original proposal for works to reach deep storage at Avon Dam and possibly Nepean Dam has now been modified on the basis of engineering and hydraulic investigations. Work is now under way to optimise the use of deep water at Nepean Dam, by constructing new water transfer infrastructure between Nepean and Avon Dams.

Water will be drawn from near the bottom of Nepean Dam through an existing outlet to a new pipe on the outside of the dam. A new pumping station will pump between 125 and 190 million litres per day up through a new 2 kilometre pipeline to an existing tunnel that connects Nepean and Avon Dams.

The project is increasing the total volume of water able to be supplied to the Illawarra, and by doing so, increase the long term water supply by 5 billion litres per year. In a severe drought, this will extend Sydney's water supply by one month.

Nepean Dam Deep Storage Access

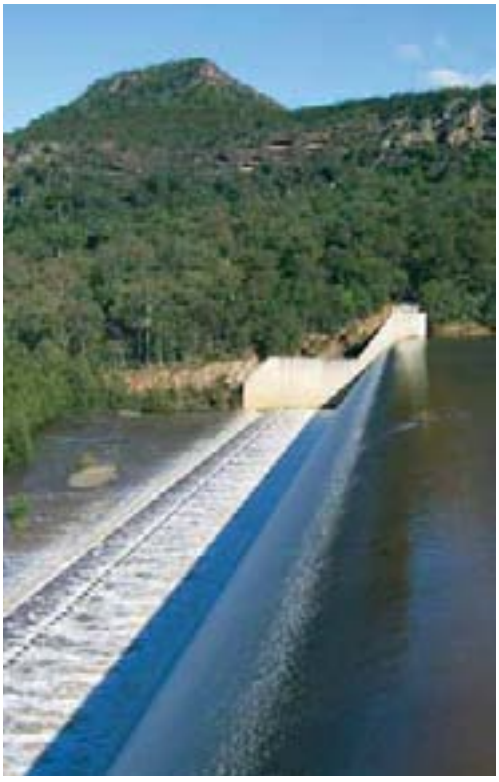


Schematic shows the recovery of the deep water at Nepean Dam and transfer by pumping to Avon Dam.

7.4 Increasing Shoalhaven transfers

The Shoalhaven River originates south-east of Canberra and west of Batemans Bay. Like the Hawkesbury-Nepean, it flows a long way north (for 170 kilometres towards Braidwood) before flowing eastwards towards the coast (at Nowra). The Shoalhaven River catchment has a total area of approximately 5,700 square kilometres, compared to the Warragamba catchment area of 9,000 square kilometres. A key advantage is that the Shoalhaven catchment is well to the south-west of Sydney and, owing to differences in local weather conditions, can provide rainfall runoff at times when the Warragamba catchment does not.

The current Shoalhaven Scheme comprises Tallowa Dam and a system of pumps, pipes and reservoirs which were completed in 1976. The scheme was planned as the first phase of a much larger but now abandoned project (the Welcome Reef Dam) for the specific purpose of capturing water from the headwaters of the Shoalhaven River and transferring it to Sydney to boost supplies when the Sydney storage system fell to low levels. A secondary purpose was water storage for peak-demand hydro-electric power generation.



Tallowa Dam during a spill event

Tallowa Dam forms Lake Yarrunga, which is the major storage at the confluence of the Shoalhaven and Kangaroo Rivers. The Dam is small but collects water from 79% of the total Shoalhaven catchment. Being of a relatively small storage capacity means that Tallowa Dam spills following comparatively small inflows, sending water downstream to the ocean.

The Shoalhaven Scheme has operated only as a drought reserve supply. It is activated only when the total storage level of all the dams in the Sydney system falls below 60%. As part of its normal drought management response, Sydney has transferred significant quantities of water from the Shoalhaven River during three periods since 1977 (1981–83, 1994–95, and 2003–06). The transfers represent just over 3% of the total Shoalhaven River flow for this period.

Since April 2003, the current drought has required pumping from the Shoalhaven River when sufficient inflows occur. This has contributed approximately 25% of Sydney's water supply over this time.

At present, water from the Shoalhaven is transferred from the Wingecarribee Reservoir to Sydney dams by two 'run of river' routes using natural river channels. These follow the Nepean River to Nepean Dam, and the Wingecarribee and Wollondilly Rivers to Warragamba Dam. While the commencement of transfers is dependent on sufficient inflows in the Shoalhaven catchment, the actual transfer rates down these river channels is limited through licence conditions to protect the river ecology and to reduce erosion.

The *2004 Metropolitan Water Plan* announced investigations into increasing the amount of water sourced from the Shoalhaven system. The rationale behind the proposal was to capture a larger percentage of water from the Shoalhaven River during non-drought periods when more water is available in Lake Yarrunga. This was considered preferable to commencing transfers only when the whole system was already experiencing drought. The proposal offered an alternative to the 1960s proposal for the large, expensive and environmentally damaging Welcome Reef Dam near Braidwood.

The Sydney Catchment Authority developed a proposal to increase the yield from the Shoalhaven to Sydney such that transfers would occur more frequently and at times when the Shoalhaven was less stressed. The proposal involved increasing the capacity of Tallowa Dam (through the installation of radial gates) and construction of new transfer conduits. In 2005 a community consultation process was established to provide feedback to the Government on this proposal and on future water sharing for the Shoalhaven River and Lake Yarrunga. The Shoalhaven Community Reference Group, includes representatives of the Southern Rivers Catchment Management Authority, Shoalhaven City Council, local indigenous community, tourism, fishing and environmental organisations.

The independent expert analysis of the overall supply and demand balance showed that Sydney is now in a position to secure its water supplies in the face of severe drought, and has more than enough water to meet its normal growth needs

Some water may be sourced from the Shoalhaven through changed pumping rules

7

Extracting groundwater from Kangaloon will provide 15 billion litres per year during severe drought, boosting average water availability by 7 billion litres per year. Any supplies from the Leonay borefield would be additional to this.

for at least the next 10 years. In light of this analysis, and in acknowledgment of the strong community preference, the Government has decided not to raise Tallow Dam.

However, the independent expert analysis noted that an option to increase the volume of water available to Sydney would be to transfer more water from the Shoalhaven by bringing forward the point (based on storage levels in the Sydney system) at which transfers from the Shoalhaven commence. The economic and environmental impacts of this option will need to be assessed.

This assessment also allows for a range of dam operating levels and environmental flow and transfer options to be considered together in the current NSW Department of Natural Resources review of the environmental flow releases for the Shoalhaven River downstream of Tallowa Dam. After community consultation the Department of Natural Resources will be recommending new environmental flow rules to the Government (see Chapter 8 for more information on environmental flows).

The Sydney Catchment Authority will release a discussion paper for community comment in mid 2006 that will examine options for operational changes to the Shoalhaven Transfers scheme to balance Sydney's water needs, the operational requirements of the water supply system and the health of the lower Shoalhaven River.
The paper will discuss options for:

- the timing of transfers of water from the Shoalhaven to Sydney
- the level below which Lake Yarrunga will not be drawn down
- measures for mitigating the impacts of using rivers as conduits for the transferred water
- environmental flow releases

This examination will not revisit the raising of Tallowa Dam, which has been ruled out by the Government.

The security of the water supply for the lower Shoalhaven communities and the protection of the new environmental flow regime will be achieved through conditions on the Sydney Catchment Authority Water Management Licence (issued under the *Water Act 1912*), and the Shoalhaven City Council water licence.

7.5 Accessing groundwater

Groundwater is all water found below ground level in saturated soil and rocks. The top level of the groundwater is commonly called the water table, and water-bearing zones are called aquifers. Aquifers are capable of providing significant quantities of water for various purposes, including for agriculture and drinking water.

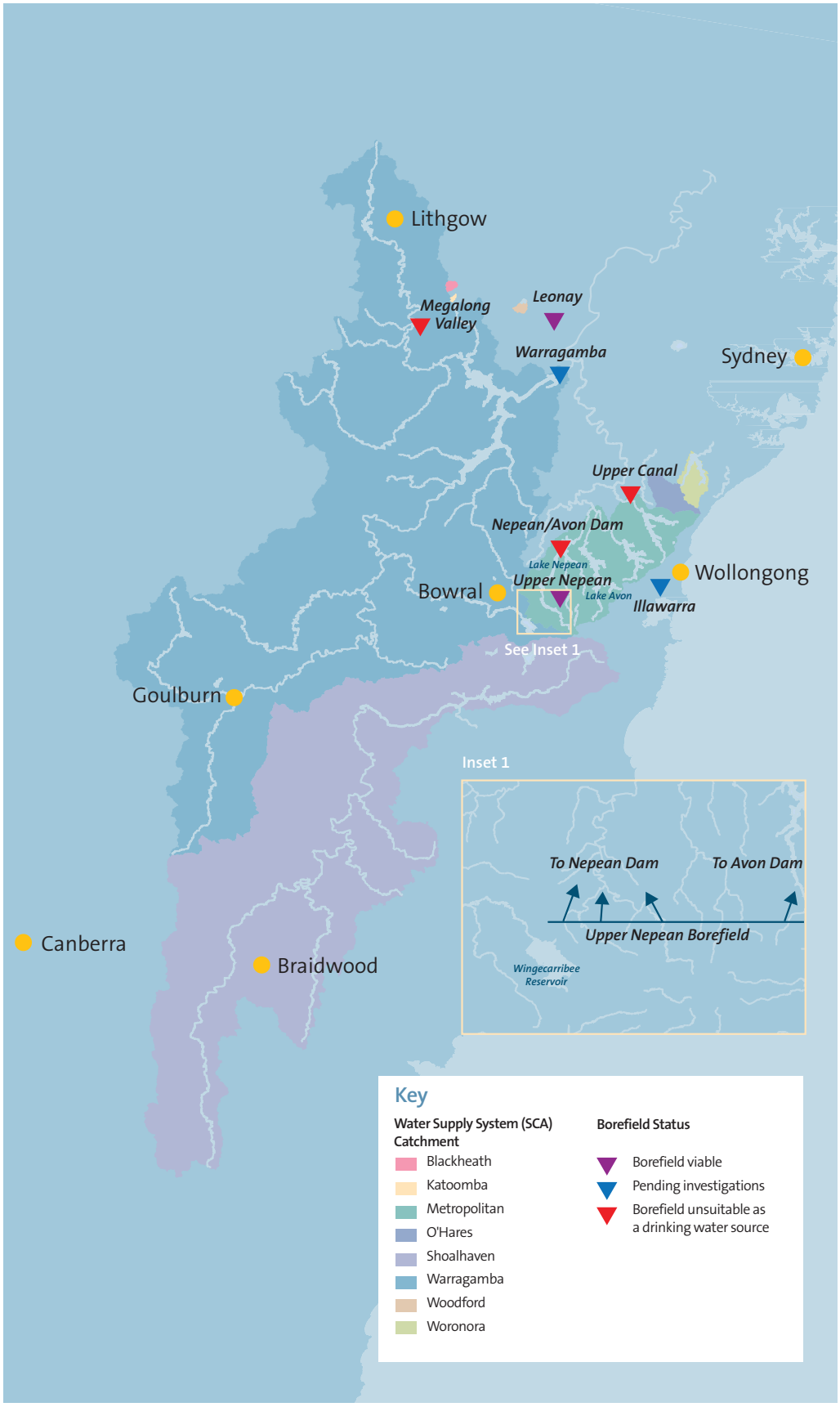
The *2004 Metropolitan Water Plan* included a commitment to investigate the potential of groundwater across the Sydney geological basin to augment Sydney's water supply during severe drought. Preliminary work showed that up to 13 billion litres per year might be able to be extracted from deep aquifers during droughts, to be replenished by rainfall recharge, and natural infiltration in wetter times. The Government allocated $4 million for investigations at priority areas into possible groundwater borefields near existing water storage and supply infrastructure.

Over the past year the Sydney Catchment Authority has investigated potential groundwater resources around the catchments. The study involved deep drilling to levels of more than 300 metres through the Hawkesbury Sandstone at seven priority areas identified in a previous investigation.

Until now, groundwater sources in Sydney's hydrological catchments have not been studied extensively or systematically. While previous investigations identified potential groundwater resources, more recent studies have now examined the extent and viability of these resources as a drinking water supply, including issues such as quality, volume, flow rates and recharge rates. This is a two stage process. The initial work involves drilling and testing to characterise the groundwater of all the priority areas. If results are favourable, then detailed pilot testing and extensive studies will be undertaken to identify the extent and sustainability of the individual sources. Not all potential resources will ultimately prove to be viable, and already three of the seven priority areas have been dismissed owing to poor yields or poor water quality.

The study has already identified one major groundwater resource in the Upper Nepean area near Kangaloon, and there are encouraging early results from a further trial at Leonay in Western Sydney. Three sites have not yielded viable resources. Test drilling will commence soon at the remaining two priority areas, near Warragamba Dam and in the Illawarra, north of Dapto.

Groundwater investigation areas and possible transfer routes to water supply system



The Government is undertaking environmental assessment and community consultation so that it can be ready to draw on groundwater resources if severe drought conditions return in the current drought, or in any future drought. Borefields would be constructed and groundwater would be used only in the event that storages drop below around 40% of the capacity of the extended system, including the deep storages.

The proposed 40% trigger point is conservative and is a robust way to reduce the likelihood and cost of desalination until the resources and access arrangements are much better resolved.

7.5.1 Upper Nepean sites

In the Upper Nepean catchment, investigations have included 21 test bores, 4 production bores and 12 dedicated monitoring bores, plus associated pumping tests, water sampling and water level surveys. These investigations suggest that 15 billion litres per year of good quality water could be drawn from deep sandstone aquifers for two to three years during severe drought. The reserve would then be allowed to recharge for five to seven years.

This borefield, if developed, would cover 50 to 100 square kilometres on lands owned by the Sydney Catchment Authority. It would produce water of extremely high quality from 50 to 60 production bores.

If approved, the borefield would take about two years to fully construct (with bores coming on line progressively from six months into the construction phase).

The proposal is to construct deep bores into sandstone strata that are not tapped by existing users or are remote from current development. The final borefield design and layout would take into account any unacceptable impacts on existing users and the environment. In this area, the shallowest groundwater (from springs in the basalt areas in the upper catchment) is at a high elevation and is disconnected from the sandstone aquifers so it would not be adversely affected by deep pumping. There are relatively few shallow or deep bores in sandstone and there is not considered to be any strong groundwater dependence within the existing ecosystems.

The diagrams on the next page show two scenarios – the current development with springs and a few shallow bores, and the proposed drought development with deep production bores.

The environmental assessment process is comprehensive and covers impacts of drying on forest vegetation, wetlands and streams. Also at some sites during drought, the pumping and distribution rate from the borefield might be higher than the natural river flow, so care will be required to manage ecological impacts from slightly different waters and higher-than-natural drought flows.

These and other issues will be explained and discussed in the community consultation phase, which will follow a full environmental assessment (see section 7.5.3).

7.5.2 Leonay sites

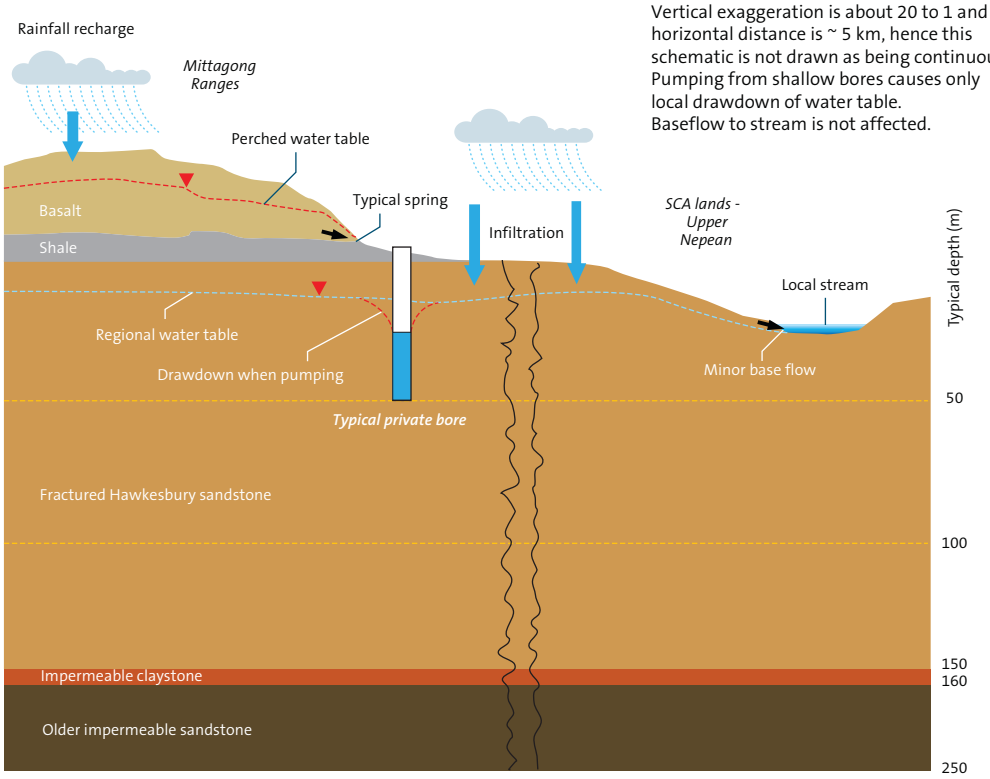
Test drilling at a site at Leonay Oval, west of the Nepean River near Penrith, is now completed to full depth and shows good prospects of providing a high-volume, low-salinity source of groundwater. Detailed investigations and testing are under way to establish the extent and sustainability of this source and whether a borefield for drought supply could be established in this area.

Initial indications are that Leonay could provide a similar quantity of groundwater to that identified in the Upper Nepean. However, an extensive pilot testing program is required to prove the sustainability of this source.

As with Kangaloon, a full environmental assessment and community consultation will occur before any final decisions are made to proceed with borefield development.

Upper Nepean sandstone aquifer comparisons

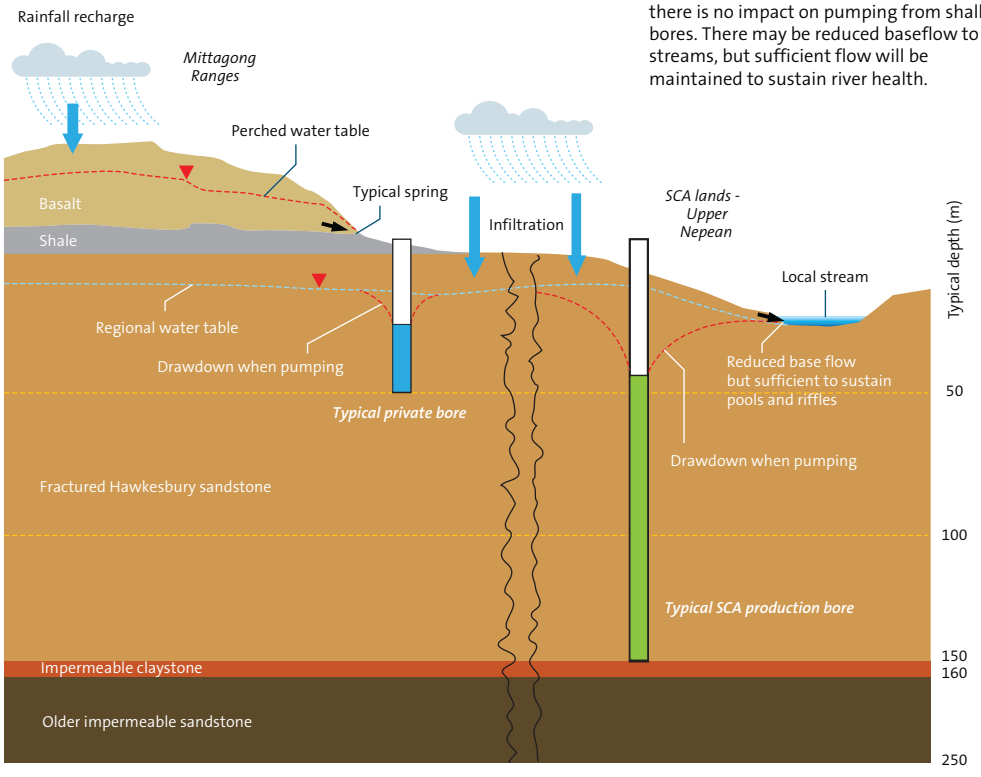
1. Natural groundwater system - current development



Vertical exaggeration is about 20 to 1 and horizontal distance is ~ 5 km, hence this schematic is not drawn as being continuous. Pumping from shallow bores causes only local drawdown of water table. Baseflow to stream is not affected.

Before pumping. The natural water table provides base flows for a nearby stream.

2. Natural groundwater system with proposed borefield development



Because horizontal distance is about 5 km, there is no impact on pumping from shallow bores. There may be reduced baseflow to streams, but sufficient flow will be maintained to sustain river health.

With moderate pumping. Stream baseflows are reduced and access by shallow bores is still available.

Upper Nepean groundwater investigations. A test bore being drilled deep into the sandstone to determine likely pumping rates.

7.5.3 Consultation and management arrangements

If approved, borefield development would proceed in the event of severe drought conditions. Groundwater borefields are likely to be developed progressively. The Upper Nepean groundwater would be discharged into rivers feeding into either the Nepean or Avon Dam for use in either Sydney or the Illawarra.

These groundwater sources will be used to contribute additional water during prolonged droughts. There is no intention to establish groundwater as a permanent drinking water supply source.

A detailed report on the findings at all seven investigation sites will be released in June 2006. The report will include the outcomes of specialist investigations such as detailed water chemistry, analysis to identify the age of the groundwater, borefield modelling and ecosystem impact studies. Studies are still under way to confirm which ecosystems in the local area have groundwater dependence. The report will include these detailed studies at Kangaloon and any progress results from the expanded testing program at Leonay in western Sydney. Findings of the additional Leonay investigations will be made public later in 2006.

Throughout NSW, the long term sustainability of groundwater for all uses (that is, water for both the environment and consumptive users) is achieved primarily through conditions on the licences issued under the *Water Act 1912* and the *Water Management Act 2000*. In the event of severe drought necessitating a decision to use groundwater, extraction of groundwater will be managed primarily through conditions placed on Sydney Catchment Authority licences issued under these Acts.

Groundwater sources across NSW are managed by the Department of Natural Resources to ensure that development of resources is sustainable. Water for the environment, basic landholder rights (stock and domestic) and indigenous purposes are afforded the highest level of protection. Of the remaining consumptive uses, drinking water supply is given the highest priority.

Currently the Department of Natural Resources is progressing the development of macro water sharing plans for those groundwater sources not covered by the eight major plans gazetted in 2003. The Nepean Sandstone source is one of those that will be covered by the *Porous Rock Macro Water Sharing Plan*. This plan will provide appropriate protection for this drought-reserve drinking water supply and specify conditions on the Sydney Catchment Authority licences and approvals providing for its extraction.

Detailed management and monitoring will be required for any large-scale resource development such as the borefields proposed in the Upper Nepean (Kangaloon) and at Western Sydney (Leonay). Detailed monitoring is essential when pumping from a new deep resource. Water level patterns (both drawdown and recovery) need to be closely matched to usage, and observed drawdowns must be closely compared with the predicted drawdowns. Locally, the Sydney Catchment Authority would operate a comprehensive monitoring network within, and at the boundaries of, the proposed borefield to protect the various other users of groundwater.

7.6 Desalination

7.6.1 What is desalination?

Desalination is the process of producing drinking water by removing dissolved solids, primarily salts, from a water source such as seawater, estuarine water, treated wastewater or brackish groundwater. Desalination provides high quality drinking water independent of rainfall and thus is immune from drought and potential climate change impacts.

Desalination is widely used in the Middle East, the United States, Spain, Singapore, Japan, and Trinidad and Tobago, and to supply drinking water on cruise ships. It is also used around Australia – in isolated communities (for example, Kangaroo and Rottnest Islands), for industrial processes, and in mining and power generation (for example at Bayswater power station in NSW). A desalination plant is being built to supply 130 million litres of drinking water per day to Perth. Investigations have also been conducted in Melbourne, on the Gold Coast, on the Central Coast of NSW and for the Olympic Dam Mine in South Australia.

The two most widely used and commercially proven desalination technologies are reverse osmosis (membrane based method) and thermal distillation (evaporative method).

For further information
www.sydneywater.com.au/EnsuringTheFuture/Desalination

In reverse osmosis, the seawater is pressurised to force water molecules through a fine-pore membrane that blocks the salt ions, viruses, micro-organisms and other impurities which are retained by the membrane in a concentrated solution for subsequent disposal. Around 40-45% of the intake water volume is converted to drinking water, while the remainder is returned to the ocean as seawater concentrate (containing around twice as much salt as normal seawater). Reverse osmosis is also used in the recycling of wastewater, although less energy is required for treated wastewater than for seawater owing to the lower salt content of treated wastewater.

Thermal methods remove salts by evaporating seawater and then condensing the vapour back to drinking water. To date, this technology has dominated the seawater desalination market, particularly in the Middle East. However, the energy intensity of thermal methods and advances in the energy efficiency of reverse osmosis technology have led to a significant increase in the market share of reverse osmosis, which has become the most commonly used technology in Australia.

Since the 1980s, the cost of desalinated water using reverse osmosis has reduced by over half owing to advances in membrane technology, improved energy efficiencies (electricity usage has dropped by 40%), economies of scale using larger process trains and pumps, and optimisation based on operational experience.

30

In extreme drought, desalination could provide up to 183 billion litres of potable water each year. While the probability of extreme drought is low, the capacity to deploy desalination boosts average water availability by between 30 and 70 litres per year.

A desalination plant would be housed in a large warehouse-style building as shown in this example

The Ionics Desalcott designed, owned and operated desalination facility at Point Lisas, Trinidad

7.6.2 A feasible option for Sydney?

The *2004 Metropolitan Water Plan* indicated that detailed planning and design for a desalination plant would be undertaken so that, if the drought continued, it would be possible to construct a desalination plant relatively quickly and efficiently. Sydney Water undertook a feasibility study during the first half of 2005 and concluded that desalination is a feasible option for water supply management in Sydney.

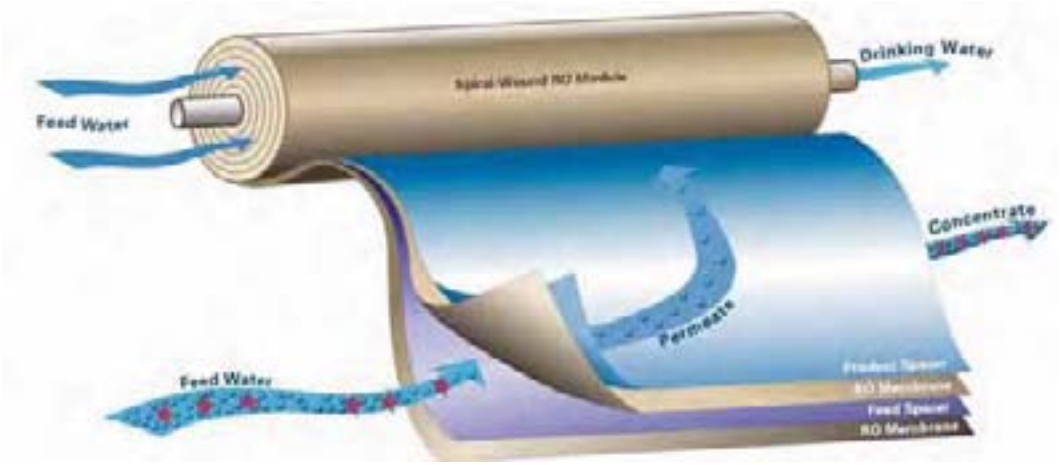
While both thermal and reverse osmosis technologies can produce drinking water meeting Australian standards, the study concluded that reverse osmosis is preferable because thermal desalination uses three times as much energy and more than doubles the cost of drinking water produced.

The feasibility study considered desalination plants with the capacity to produce from 50 to 500 million litres of drinking water per day. A plant with the capacity to produce 500 million litres per day would provide around a third of greater Sydney's current daily water needs, and would significantly reduce storage depletion rates in the event of severe drought.

Sydney Water has acquired a site at Kurnell, undertaken an environmental assessment, consulted the community and sought planning approval for the plant. The Minister for Planning is expected to make a decision on the proposal before mid 2006. As a result of the work that has been undertaken and the work that will be completed by the end of this year, the NSW Government will be in a position to build a desalination plant in around two years from the time that a contract is awarded, should that become necessary.

Desalination readiness is an essential part of securing our water supply

Detail of reverse osmosis membrane



7.6.3 Ensuring security of supply

As outlined in Chapter 2, independent expert analysis of the supply and demand balance has indicated that being ready to construct and operate a desalination plant in response to extreme drought conditions is a necessary component of a multifaceted plan to secure Sydney's water supplies. However, construction of a desalination plant is not required to deliver security of supply: it is sufficient that the Government has the capacity to construct and operate a plant within a relatively short lead time.

The Government now has the capacity to deploy desalination once extreme drought conditions emerge, rather than having to invest 'pre-emptively' in anticipation of critical (and improbable) drought conditions. By the end of 2006, the Government will have invested around $120 million in preparatory works that will reduce the lead time required for the plant to be operational. This investment delivers benefits that significantly outweigh these costs.

Most importantly, having the capacity to act quickly means that the Government can defer actual construction until it is absolutely necessary to secure supplies. This delivers significant financial cost savings (close to $1 billion, relative to proceeding with construction immediately). In addition, deferring construction means that technology improvements can continue – so that, if and when a plant is built, it will be more efficient and cost less to operate. Finally, deferring construction means there is more time to implement water efficiency and recycling measures across Sydney. These can lessen the impact of future droughts by reducing pressure on rainfall dependent supplies, and thus reduce the likelihood of ever reaching critical dam storage levels.

The Government's independent expert analysis has examined the point at which it would be necessary to initiate construction of a desalination plant. Key considerations are the length of time required to construct a plant, and the point at which it would be necessary to commence operating the plant so as to secure Sydney's water supplies. In practice, this means working out the storage level at which a decision would be required to initiate construction.

Kurnell desalination site

The Government's February *2006 Progress Report* indicated that construction contracts for a desalination plant would be awarded if storages reach around 30%. This figure will inevitably be adaptively modified over time. This is because the mix of measures in the supply and demand balance will shift over time, thus changing the rate at which dam levels can be expected to fall in a future drought. (For example, increasing the share of recycled water means less pressure on rainfall dependent supplies relative to the current situation – so, assuming the same amount of water flowing into dams as currently, storage depletion rates would be slower in future.) However, having regard for the mix of measures now in place or proposed, the independent experts' final report now confirms the appropriateness of a level of around 30% of extended storage capacity (that is including the deep water currently being made accessible).

If this level is reached, the desalination plant would have an initial capacity to supply 125 million litres of water per day but its intake, discharge and delivery infrastructure across Botany Bay would be sized to accommodate a larger plant (able to produce up to 500 million litres per day). This would allow the capacity of the plant to be increased quickly in the event of extreme, ongoing drought conditions.

In 2005, the capital cost of such a plant was estimated to be around $1.3 billion, with annual operating costs of $38 million. This includes using 100% renewable energy (see further below). However, the cost of building and operating a desalination plant in the future may be lower due to improvements in technology.

The probability of the Sydney storages falling to critical levels is low due to the system's considerable capacity, new recycling measures, increased water efficiency, and the capacity to use groundwater resources should the drought deepen.

In particular, the newly confirmed groundwater resource means that high quality, cost effective water is available to slow down storage-depletion rates in the event that severe drought conditions return. If groundwater is needed, borefield construction would commence at around 40% of extended storage levels. This would further delay the point in time at which the critical 30% level would be reached, and thus the point at which it would be necessary to start building the desalination plant.

Having the capacity to deploy desalination to secure supplies means that the Government will not need to impose restrictions beyond those that have been in place during the current drought (that is, Level 1 to 3 drought restrictions). More severe restrictions, if imposed, would have entailed significant social and economic costs for end users.

7.6.4 Managing the impacts of a desalination plant

In the unlikely event that it becomes necessary to construct a desalination plant, measures will be put in place to manage the plant's impacts. Key among these are energy use and associated greenhouse gas emissions.

While the efficiency of reverse osmosis technology has improved by around 40% over the last 20 years (and this trend is continuing), reverse osmosis remains an energy-intensive way to produce drinking water, and it is therefore important to manage the greenhouse impacts associated with using desalination technology.

If built, the desalination plant will be powered from the NSW 'grid' rather than using electricity generated on-site. This will ensure a constant and reliable supply of electricity to the plant while also avoiding local impacts associated with the provision of on-site power. The amount of electricity required to power a 125 million litre per day plant is 30 megawatts. To put this in context, NSW currently has around 12,700 megawatts of installed generating capacity. If built, a desalination plant would be expected to operate infrequently – thus reducing the total amount of electricity required to power the plant over its lifetime. Nonetheless, the Government has decided that greenhouse gas emissions associated with powering the desalination plant will be completely offset so that the plant has no net greenhouse impact (see further below).

There has been considerable debate about the relative energy and greenhouse intensity of desalination and other options such as recycling. Using reverse osmosis to turn seawater into drinking water is considerably more energy intensive than using reverse osmosis to convert treated wastewater into drinking water. This is because the salt concentration of seawater is considerably higher than that of treated wastewater. This means that seawater desalination requires both additional membranes and additional energy compared with the conversion of wastewater to drinking water.

In both desalination and recycling, energy is required for the reverse osmosis process as well as for pumping the raw intake water (seawater or wastewater), pre-treatment (for example screening and filtration of seawater, ultra violet or ozone treatment of wastewater), and pumping the final product to end users. Minimising the distance over which it is necessary to transport water will help to minimise energy needs and greenhouse gas emissions. Operating an energy-intensive option infrequently will also help to minimise emissions.

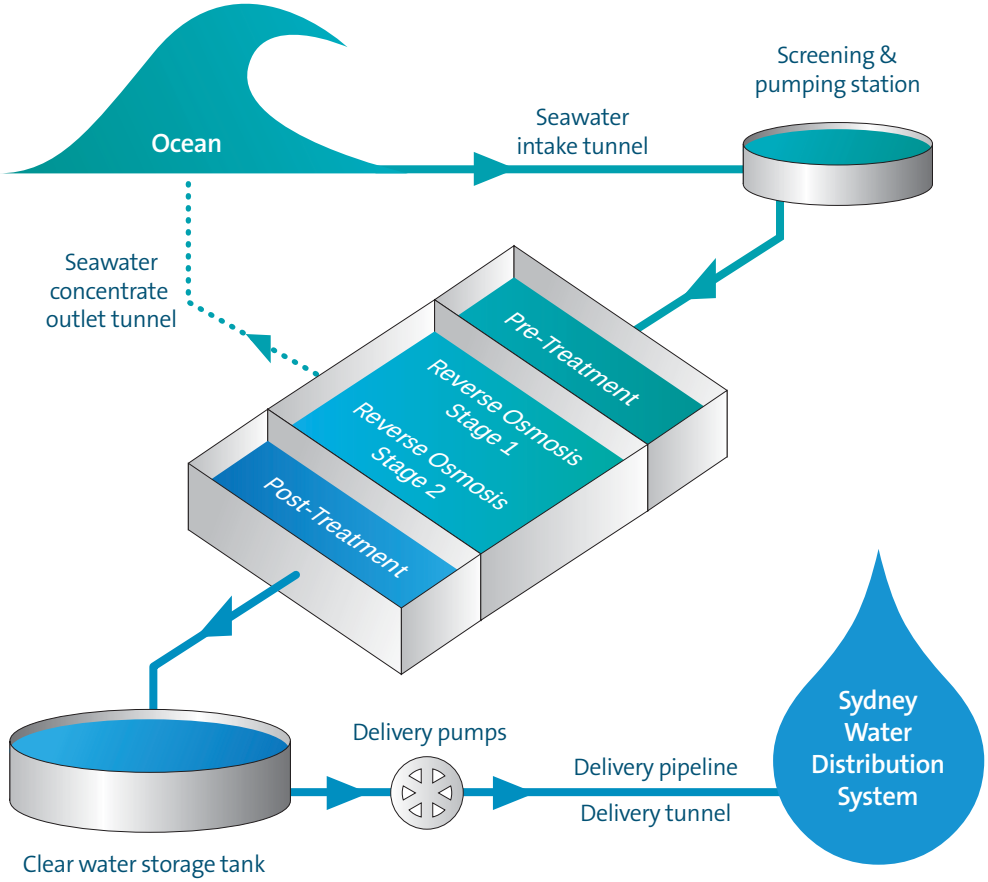
The Government's approach to securing Sydney's water needs takes account of these factors. Chapter 5 outlines the Government's approach to increasing the share of recycled water. By focusing on recycling opportunities located close to sources of high quality wastewater and close to end users, the Government's approach will help to minimise the energy required to treat recycled water and deliver it to end users, thus reducing greenhouse gas emissions.

Deferring construction of the desalination plant will allow the benefits from continuing advances in technology and efficiency to be incorporated if the plant is needed. Technology advances can be expected to lower the plant's energy needs and costs. In the event that construction of a desalination plant becomes necessary, the Government has planned that the desalination plant will be powered using 100% renewable energy.

This does not mean that 'green electrons' will be delivered direct to the plant – this would be problematic, since renewable energy sources such as wind power are intermittent, while a desalination plant requires a constant supply of power. However, as with the voluntary Green Power scheme, an equivalent amount of renewable energy will be generated to match the amount of grid electricity used by the plant. The effect will be that the plant will have no net greenhouse impact.

This commitment will be given effect via the conditions of consent for the desalination project imposed by the Minister for Planning.

The process of using reverse osmosis to turn seawater into drinking water



In addition to energy use and greenhouse gas emissions, other impacts associated with desalination include those on land and marine-based ecologies.

The desalination plant will be located on a site at Kurnell that, before it was acquired by Sydney Water, had been zoned for industrial use and extensively cleared of vegetation. Areas of ecological and potential indigenous significance are limited to conservation areas on the site that will continue to be preserved. Careful management of stormwater, erosion and sedimentation during construction and operation will reduce or avoid impacts on the terrestrial ecology on and off the site. No indigenous heritage constraints have been identified for the development of the site.

Key issues for marine ecology relate to the impact of the intake works and of seawater concentrate discharged from the plant. Intakes and outlets will be located on a rocky reef between 200 and 400 metres offshore in the Tasman Sea. They will be located away from swimming beaches and sensitive marine areas.

The intakes will be designed to minimise the intake of fish, plankton and larvae. The design has been based on ensuring intake velocity is less than the surrounding currents most of the time.

The outlets will be designed to maximise dispersion of the seawater concentrate. Modelling shows that adequate dilution of the seawater concentrate can be achieved in a relatively short distance from the discharge point. The seawater concentrate will be dispersed so as not to affect water quality or aquatic ecology beyond the near-field mixing zone. Salinity at around 50-75 metres from the outlets is expected to be within approximately one part per thousand of background seawater salinity, which itself is within the natural variation in salinity experienced off the coast. From this point the discharge water will continue to disperse through the action of currents.

A pipeline across Botany Bay is the likely option for distributing water from the desalination plant. A number of measures will be implemented to reduce the likelihood and scale of impacts on seagrasses and threatened species – including optimising the pipeline route to avoid seagrass habitat, using construction techniques to minimise habitat loss and control turbidity, and implementing a seagrass restoration program.

Further information can be found in the Environmental Assessment Report available online at **http://www.sydneywater.com.au/EnsuringTheFuture/Desalination/EnvironmentalAssessment.cfm**

7.6.5 What happens now?

To ensure that the Government has the capacity to construct and commission a desalination plant within a short lead time, Sydney Water will undertake pilot testing to optimise designs and complete final plant design blueprints for the desalination plant.

A pilot plant is necessary to ensure that the final plant design is suited to local conditions. Seawater quality data will be gathered, including the level of pre-treatment required before the seawater reaches the reverse osmosis membranes. Testing will be conducted under fluctuating seawater feed conditions and will test the ability of the system to deal with varying weather conditions.

Testing will also be undertaken to:

- confirm that the desalinated water meets water quality targets
- identify optimal cleaning processes
- examine the required composition of seawater concentrate for environmental protection.

The pilot plant will be about the size of a shipping container and will be located on a cleared portion of the desalination plant site. The plant will treat about 250,000 litres of seawater per day – only 0.1% of the volume of water that would be treated by a 125 million litre per day desalination plant.

The water produced by the plant will not feed into the supply system but will be discharged through the Cronulla Sewage Treatment Plant ocean outfall, along with the seawater concentrate that results from the process. The small volume of discharge water (less than 1% of the volume of treated effluent from the sewage treatment plant) will rapidly dilute and will comply with the limits of the sewage plant's environment protection licence.

The pilot plant will be decommissioned and removed after testing is completed.

Example of desalination pilot plant in Perth

What will be done next

- Complete the deep water works at Warragamba and Nepean Dams
- Complete the groundwater pilot testing program at Leonay
- Complete the groundwater investigations at Illawarra and Warragamba
- Publish reports on the investigations at all seven groundwater locations and consult the community about potential groundwater use and borefield construction
- Complete investigations and consult the community regarding potential new Shoalhaven operating rules to increase transfers on using existing infrastructure
- Purchase the design blueprint for a possible future desalination plant

8. Protecting catchment and river health

What this chapter is about

- Protection of water quality in the catchments from which Sydney harvests the majority of its drinking water.
- Provision of water specifically for the environmental health of rivers in the Sydney region.
- Management of the quality of water released from dams for downstream environmental benefit.
- Aspects of the legal framework that will protect water allocated for environmental benefit in the Sydney region.

What has been done for river health

- A wide range of catchment protection actions has been implemented, and others are under way, in Sydney's drinking water catchments.
- Extensive progress has been made by Catchment Management Authorities on catchment protection across Sydney.
- A risk assessment framework has been devised for future developments in the Sydney Drinking Water Catchment with extensive community input via the consultation process for the *Sustaining the Catchments Regional Plan*.
- The Western Sydney Recycled Water Initiative has been approved for further development.
- Technical studies and public consultation are under way on a new environmental flow regime for the lower Shoalhaven River.

What will be done next

- The *Sustaining the Catchments Regional Plan* will be gazetted before mid-2006 and implemented
- Catchment Action Plans will be implemented through partnerships between Catchment Management Authorities, landholders, community groups and local and state government.
- Investigations and consultation will continue in order to determine a new regime of environmental flow releases from Tallowa Dam on the Shoalhaven River.
- Government will decide on a new environmental flow regime for the lower Shoalhaven River.
- Investigations will continue into the best way to configure other dams and weirs in the Sydney region to allow the environmental flows announced in the *2004 Metropolitan Water Plan* to be implemented.
- A new plan for managing nutrient inputs to the lower Hawkesbury-Nepean River from wastewater, stormwater and agricultural run-off will be developed as a paper for discussion with stakeholders
- Development of a monitoring program to assess the effectiveness of new environmental releases from Sydney Catchment Authority's dams will be finalised and a new integrated monitoring program for the Hawkesbury-Nepean considering environmental flows, river health and recycling initiatives will be devised.
- The draft water sharing plan for the Sydney Region will be completed and publicly exhibited.

8.1 Introduction

Sydney's natural environment is greatly valued by residents and visitors. It provides myriad recreation opportunities and a sense of connection for millions of people, in addition to many fundamental resources for a growing population. Sydney's environment represents a wide range of ecosystems, and is home to many types of plants and animals. It is critical that housing, feeding and providing water to a city the size of Sydney be balanced against fundamental environmental needs. Preservation and protection of the region's waterways, and surrounding bushland, are the focus of much effort, reflected in both community-led activities and a wide range of Government controls and initiatives.

Since the *2004 Metropolitan Water Plan*, progress has been made towards dedicating more water to meeting environmental needs and implementing programs that improve the water quality in the region's rivers.

8.2 Protecting the catchments

Improving and protecting the quality of water in the rivers both upstream and downstream of Sydney's major water reservoirs is important both for drinking water supply and for maintaining and improving river health.

Controlling water pollution is an important aspect of protecting Sydney's drinking water supply and the health of rivers downstream of the dams. Management of nutrients in the system is particularly important as they can cause excess growth of algae and aquatic weeds. Bacteria and other pathogens also need to be well managed to protect public health.

The main potential point sources of pollution to the waterways are sewage treatment plants. These facilities are generally licensed by the Department of Environment and Conservation under the *Protection of the Environment Operations Act 1997*, and licences include strict discharge limits and monitoring provisions for pollutants.

Diffuse, or non-point, pollution sources can be major contributors of many types of pollutants to waterways. In rural areas, diffuse sources include agricultural activities, such as cropping, irrigation, livestock grazing and intensive livestock industries, as well as forestry and unsealed roads. Rural runoff can contain elevated levels of sediments, nutrients, bacteria and chemicals such as pesticides. Stormwater from urban areas, such as road surfaces, industrial and commercial premises, parks and gardens, can carry pollutants such as litter, nutrients, bacteria, pesticides, heavy metals, sediment, oils and grease.

Diffuse pollution sources are generally managed by way of catchment-based actions. The Sydney Catchment Authority, the Department of Environment and Conservation, Catchment Management Authorities and local government are working with landholders, householders and community groups to plan, fund and implement programs that aim to protect and improve river health.

Catchment Management Authorities have been established across NSW since 2004 and have been developing Catchment Action Plans for their respective catchments. These plans, which are expected to be finalised and published in the near future, will outline catchment management targets and priorities for activity investment over the next 10 years, with investment priorities determined on a whole-of-catchment basis. The activities will benefit river health, water quality, riparian management and catchment health in general. The *Metropolitan Water Plan* covers an area overlapping the boundaries of three Catchment Management Authorities: the whole of the Hawkesbury-Nepean CMA, part of the Southern Rivers CMA and most of the more recently established Sydney Metro CMA.

8.2.1 Protecting water quality in Sydney's drinking water catchments

The *Sustaining the Catchments Regional Plan*, to be gazetted before mid 2006, will ensure that new development in the catchments of Sydney's major drinking water reservoirs (see map below) will not impact negatively on water quality in those reservoirs.

The *Regional Plan* will include provisions that mean existing land uses that are likely to have a negative effect on the quality of water in the reservoirs may require action to rectify those impacts. A process known as Rectification Action Planning, required under the *Regional Plan,* will prioritise actions aimed at reducing these impacts.

A decision-support system is currently being developed by the Sydney Catchment Authority to indicate areas with highest pollution potential, based on scientific research, spatial data analysis and expert knowledge. These areas will be used in combination with feasibility, cost and social factors to produce a priority list of rectification actions. The Authority's key strategies to protect water quality and manage catchment health focus on managing stormwater, sewage, riparian zones and land management.

Under its Sewage Strategy, the Sydney Catchment Authority has committed $20 million over five years from 2002 to fast-track upgrades to ageing sewage treatment plants in Sydney's water supply catchments. The Strategy includes contributions to plant upgrades at Bowral, Robertson, Bundanoon, Kangaroo Valley, Goulburn, Taralga, Lithgow and Wallerawang. Expenditure is expected to continue in 2006 and 2007, until the program is fully implemented.

The current Catchment Protection Scheme, commenced in 2001, was an initiative of the Sydney Catchment Authority and soil conservation functions in the former Department of Land and Water Conservation. This program is designed to assist landholders carrying out erosion control and land management work, targeting sites that will have the greatest benefit to water quality. Works funded under the Scheme include controlling gully erosion, stabilising streambeds, fencing to keep livestock away from river banks vulnerable to erosion and rehabilitating degraded lands. The Scheme has been continued, enhanced and extended through partnerships between the Sydney Catchment Authority, CMAs and landholders.

For the three year period 2006-2008, the Southern Rivers CMA and Sydney Catchment Authority have jointly committed $750,000 funding for the Catchment Protection Scheme which, together with landholder contributions will mean that on-ground works totalling $1.2 million will occur in the catchment of Tallowa Dam.

The Catchment Protection Scheme also operates in the Hawkesbury-Nepean catchment, as one of the programs under the Hawkesbury-Nepean CMA's Soil and Land Program. The Scheme has a particular focus on the catchment of Warragamba Dam and, in the past year has treated 1,250 hectares for gully erosion and constructed 35 kilometres of fences to protect sensitive areas on private property. As a whole, the Hawkesbury-Nepean CMA's Soil and Land Program will invest close to $9 million in the next three years.

The Hawkesbury-Nepean CMA's River Health Program aims to assist landholders and local government to protect and restore river banks and wetlands throughout the Hawkesbury Nepean catchment, both upstream and downstream of Sydney water supply dams, with more than $15 million committed for the next three years. Works funded include stabilising degraded riverbanks, planting local native species to improve vegetation links and biodiversity, controlling invasive weeds along waterways and fencing banks to protect native vegetation. The CMA also has a Biodiversity Program worth more than $9 million over three years which aims to maintain and improve native vegetation including grasslands, woodlands and forests to enhance biodiversity, as well broader catchment health outcomes.

The Southern Rivers CMA's River Recovery program includes many on-ground activities in the Shoalhaven catchment upstream of Tallowa Dam, such as fencing of river bank vegetation, streambed stabilisation, removal of problem willows and application of measures to control in-stream and bank erosion. The CMA has allocated $700,000 to this program in the 2006-2008 period, with the aim of protecting a further 400 hectares of riparian vegetation through fencing, planting a further 14 kilometres of riparian vegetation and stabilising a further 70 kilometres of streambed. In addition to delivering these direct on-ground works, the CMA also provides extensive support for Landcare's on-ground projects in the upper Shoalhaven River catchment.

8.2.2 Catchment protection actions downstream of the dams

On-going problems with growth of algae and water weeds have been experienced in parts of the Hawkesbury-Nepean system, especially in river reaches downstream of the drinking water catchments which are subject to greater pressures from urbanisation and water extractions. It is Government's objective to manage nutrient inputs in these areas so that agreed river health values, such as water quality suitable for aquatic ecosystems and for recreation, can be achieved. Future increases in the population of Western Sydney will generate additional nutrient loads that must be appropriately managed. In response to these issues, a new plan for managing nutrient inputs to the lower Hawkesbury-Nepean River from wastewater, stormwater and agricultural run-off will be developed by the Department of Environment and Conservation as a paper for discussion with stakeholders.

The Government has recently announced new funding for harvesting of the current outbreaks of water weeds in the Hawkesbury-Nepean and the establishment of a new scientific committee that will consider and advise on mechanisms for managing and reducing excess aquatic weed growth in the river over time.

As described in Chapter 5 and illustrated in the chart below, the Western Sydney Recycled Water Initiative is likely to reduce sewage treatment plant discharges of algae-causing nutrients to the Hawkesbury-Nepean River and its tributaries. Estimates of the levels of nutrients to be removed are now being refined. Models of the river are being specifically developed for the Initiative, including components to increase understanding of how river water quality and river flows can be managed to lessen the incidence of algal blooms. The models will be supported by on-the-ground monitoring co-ordinated across relevant organisations.

In the longer term, it is likely that there will be increased use of water recycled from wastewater under the Initiative, for purposes such as agricultural irrigation, third pipe systems to new homes in western Sydney and, possibly, further substitution for dam releases to meet environmental needs. These increases in recycling of water from sewage effluent will lead to further reductions in the quantities of nutrients reaching the Hawkesbury-Nepean waterways.

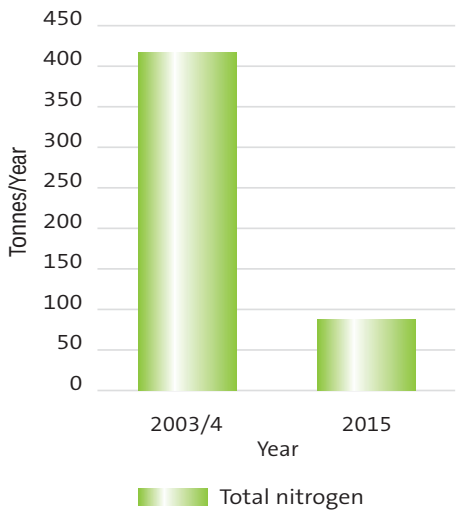
One of the Hawkesbury-Nepean CMA's recent programs downstream of Sydney's water supply dams was the Hawkesbury Lower Nepean Riverbank Management Program. More than half

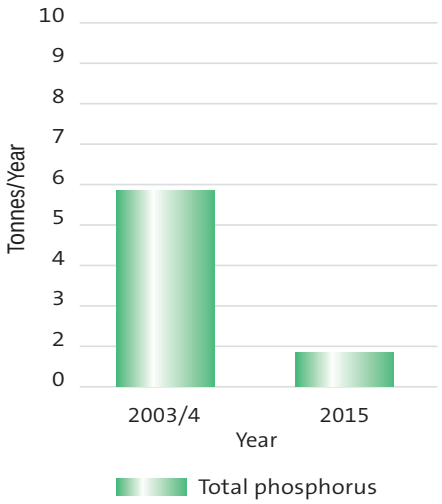
a million dollars was invested in the program in 2004-05, with results for the year including 6.9 kilometres of riverbank under rehabilitation, fencing of 1.6 kilometres of riverbank to prevent trampling by cattle and revegetation of river banks with 5,700 native tree saplings and shrubs. Similar actions will continue in the lower Hawkesbury-Nepean under the CMA's other River Recovery Program.

The Southern Rivers CMA's River Recovery program, mentioned above in section 8.2.1, also operates in the Shoalhaven catchment downstream of Tallowa Dam and involves similar activities that will seek to improve river corridor habitat condition and control river bank erosion to enhance outcomes from environmental flow releases. In the three years to 2008, the CMA will continue support for Landcare activities in the lower Shoalhaven and $200,000 will be spent on providing 90 hectares of riparian habitat protection by fencing, planting 8 hectares of riparian vegetation and stabilising 10 kilometres of streambed.

The Sydney Metro CMA is recently established and is in earlier stages of developing its Catchment Action Plan. It is likely that its catchment actions will be targeted through local government, which are the main landholders in the urbanised areas covered by the Sydney Metro CMA.

Estimated changes in nutrient inputs to the Hawkesbury-Nepean River associated with the North West Scheme of the Western Sydney Recycled Water Initiative





More information on catchment actions

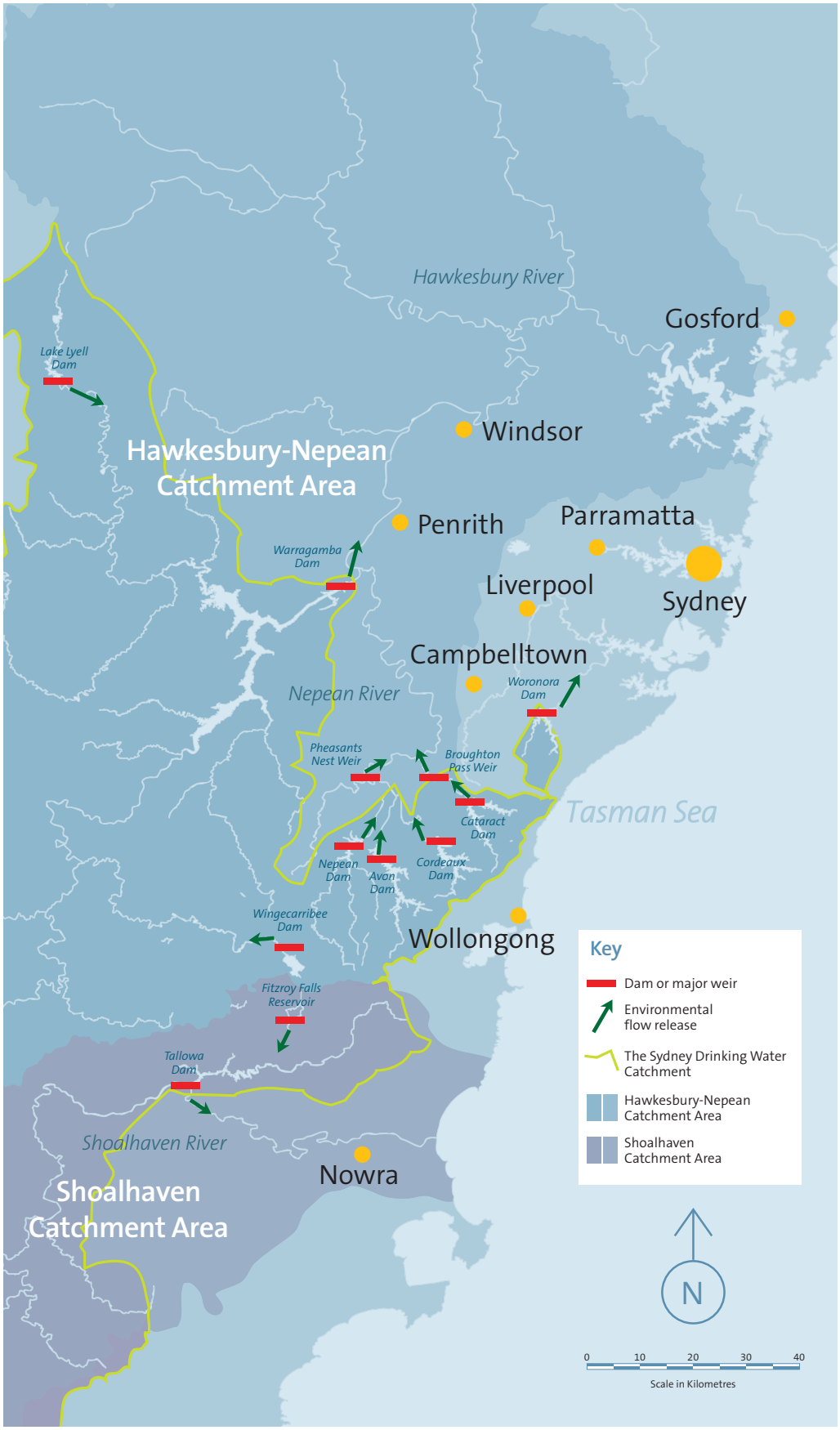
Catchment Management Authorities were established in NSW under the *Catchment Management Authorities Act 2003*, with a focus on providing for proper natural resource planning at the catchment level. The *Metropolitan Water Plan* concerns drinking water either harvested or consumed across an area which overlaps with the boundaries of three Catchment Management Authorities:

- Hawkesbury-Nepean CMA
  http://www.hn.cma.nsw.gov.au
- Southern Rivers CMA
  http://www.southern.cma.nsw.gov.au
- Sydney Metro CMA
  http://www.sydney.cma.nsw.gov.au

Since the formation of the Sydney Catchment Authority in 1999, there have been comprehensive two-yearly audits of the Sydney Drinking Water Catchment, which includes consideration of raw water quality, management of water resources, land condition and ecosystem health. The audits report the state of the catchment and pressures on catchment health and identify gaps in current responses to pressures and catchment health.

- Past audit reports are available from the SCA website at **http://www.sca.nsw.gov.au/publications/#CatchmentAudit**
- and the most recent audit presented to the Minister for the Environment in December 2005 is available from **http://www.environment.nsw.gov.au/water/sdwc2005.htm**

Catchments and structures where environmental flow releases are required in the *Metropolitan Water Plan* area



8.3 Water for the environment

Environmental flows to restore river health are progressively being implemented in river systems across Australia. In NSW, environmental flows are being provided so that, as far as possible, the pattern of streamflows that would have occurred naturally in the rivers is restored.

Environmental flows are provided both by deliberately releasing water from dams and by rules which limit the volume and timing of river extractions by water users. In both cases, the objective is that the resulting streamflow of rivers and streams mimic the natural flows in those systems. Consequently, in wetter times, the aim is that a greater volume of streamflows be reserved as environmental flows and, conversely, in drier times, lesser volumes of environmental flows are needed.

There are many ways by which restoring elements of the natural stream flows can contribute to the health of rivers. About half the fish species present in the Hawkesbury-Nepean system, for instance, need to move into different parts of the system to complete their breeding cycle. To allow this to occur, the depth and speed of water over certain features in the river - such as waterfalls, shallow rocky patches and weirs - must be in the right range for the fish to be able to cross.

In the Sydney region, environmental flow releases reflecting the pattern of inflows to reservoirs have been in place at the Sydney Catchment Authority's Woronora Dam since December 2002 and Delta Electricity's Lake Lyell since January 2001. The Sydney Catchment Authority is also required to make water releases to Fitzroy Falls that mimic the natural flows that would have occurred before the construction of Fitzroy Falls Dam. At Sydney Catchment Authority's other major dams and weirs, current interim environmental flow releases are of a volume similar to inflows experienced during relatively dry conditions.

In 2001, the NSW Government established the Hawkesbury-Nepean River Management Forum to advise Government on the environmental water requirements the Forum considered were needed to restore the long term health of the major rivers providing freshwater in the Sydney Region. Major interest groups were represented in the Forum process. As part of the *2004 Metropolitan Water Plan*, and as part of its response to the recommendations of the Forum, the Government announced that it would implement new environmental flows for dams and for major weirs in the Hawkesbury-Nepean catchment.

8.3.1 Environmental flow releases for the Upper Hawkesbury-Nepean River

Analysis reported in the *2004 Metropolitan Water Plan* concluded that the environmental flow releases decided for the four Upper Nepean dams are likely to help alleviate an on-going problem of overgrowth of aquatic weeds in reaches of the downstream Hawkesbury-Nepean, with consequent increase in opportunities for river-based recreation. If such flows were not implemented, it was predicted that the health of the Hawkesbury-Nepean would have declined in a number of ways, including fewer native fish species, a lesser diversity of invertebrate animals (such as insect larvae and worms) and increasing incidence of floating weeds in the river.

Under the *Metropolitan Water Plan*, Avon Dam is the Government's first priority for the new environmental releases. Works will be commissioned in October 2006 to enable the new flow regime to be commenced when appropriate. Unlike the other dams, for many years there have been no regular releases of water from Avon Dam to the river downstream. One of the principal reasons for this was that the available infrastructure did not allow for the full range of releases from the Dam.

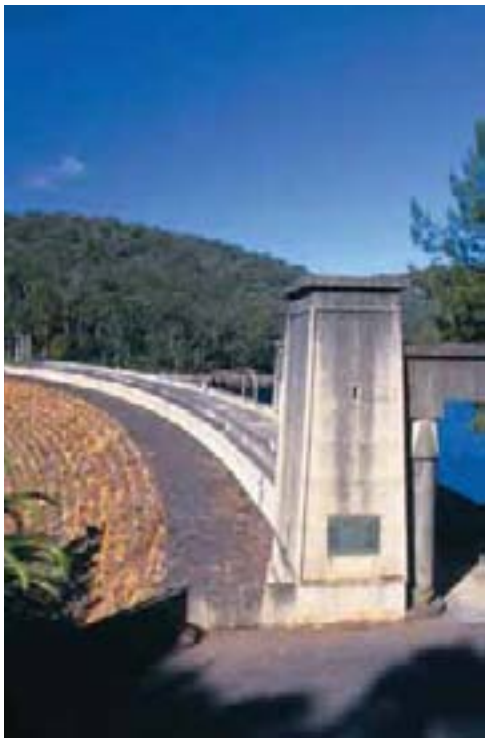


Photo credit: TVU Pty Ltd., Copyright Sydney Catchment Authority

Avon Dam

The Sydney Catchment Authority is currently constructing works at Avon Dam, in conjunction with the deep-water access project at Nepean Dam. The works entail new pipes and valves that will allow releases of water from 1 million litres per day to 1,350 million litres per day, when the Dam is full. This water will be released via a multi-level offtake that permits the quality of water most suitable for the downstream environment to be chosen for release to the river. In detail, the project at Avon Dam includes:

- tunnelling though the base of the dam to expand the existing outlet
- connecting the existing high-level outlets to the deep storage outlets via a 450 mm pipe
- installing valves in the deep storage outlet structure to release water over a wide range of flow rates
- constructing a new outlet structure to dissipate the energy of the released water, and
- installing monitoring equipment.

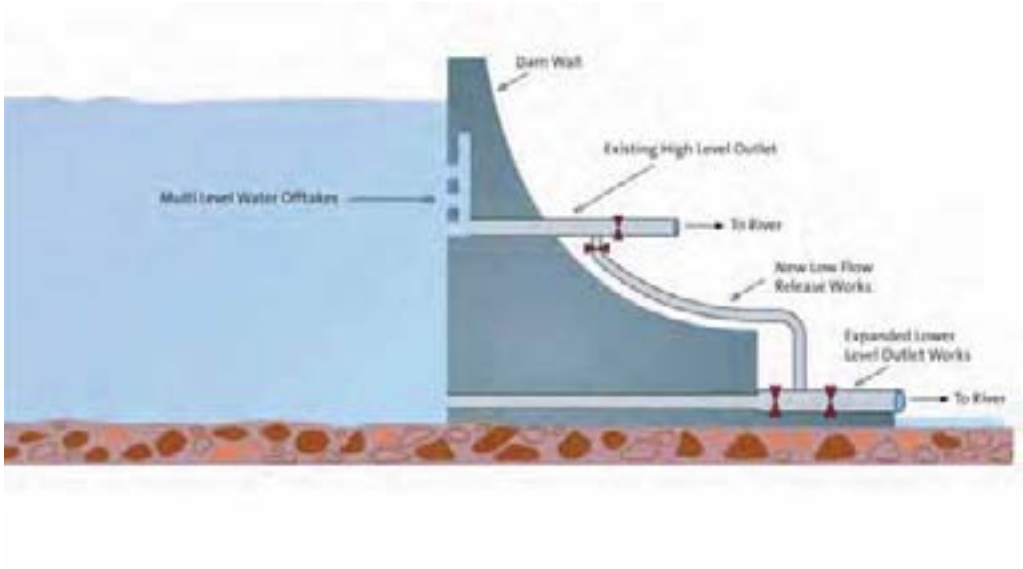
The volume of water releases from Avon Dam will be linked to monitored inflows to the Dam. The Sydney Catchment Authority has awarded a contract to install new streamflow monitoring gauges in the catchment of the Dam, so that environmental releases can be based upon the natural inflows. An environmental monitoring program is being developed to measure changes in the downstream river health.

Additional works, similar to those now under way at Avon Dam, are being developed to allow similar releases at other water supply structures in the Upper Nepean, namely Cataract, Cordeaux and Nepean Dams by 2009 and at Pheasants Nest and Broughtons Pass Weirs sometime earlier.

8.3.2 Environmental flow releases for the lower Hawkesbury-Nepean River

A final regime of environmental flow releases from Warragamba Dam will not be formally set until 2015, but increases to interim environmental flows will be considered for the period starting 2009, provided sufficient water is available.

Schematic of new outlet works being installed at Avon Dam to allow a full range of environmental flows to be released to the river downstream



8.3.3 Environmental flow releases for the lower Shoalhaven River

In 2005, the Government commenced a process of formal community consultation relating to future water sharing for the Shoalhaven River and Lake Yarrunga (the reservoir impounded by Tallowa Dam). The Government convened the Shoalhaven Community Reference Group, including representatives of the Southern Rivers Catchment Management Authority, Shoalhaven City Council and local indigenous, community, tourism, fishing and environment organisations. The Group has been considering information for a future environmental flow regime for the lower Shoalhaven.

Consultation on a new environmental flow regime for the lower Shoalhaven River is continuing through the Shoalhaven Community Reference Group, with a view to having a recommended regime for consideration at the end of 2006. The security of Shoalhaven City Council's water supply which relies on extractions from the river downstream of Tallowa Dam, will be guaranteed no matter what regime of environmental releases is implemented at Tallowa Dam. As described in Chapter 7, section 7.4, the discussion paper on the Shoalhaven Scheme to be released in mid-2006 will include options for the future environmental flows regime for Tallowa Dam.

A wide range of studies commenced in 2005 to better understand the water needs of the lower Shoalhaven River. Scientific studies are being undertaken to increase understanding of how the physical and ecological attributes of the lower Shoalhaven are likely to change in response to a different regime of river flows. The height and velocity of water at different places in a river can, for instance, determine whether fish are able to move to the various parts of the river needed for different parts of their lifecycles. The physical action of a river's flow can, for instance, affect the distribution of the coarse and fine material that makes up the river bed which, in turn, is important for determining which plants and animals are able to live there. Inputs of freshwater are important for determining the characteristics of the estuarine part of a river. Studies such as these are being made in the lower Shoalhaven River and, together with findings of past investigations, will be considered by technical experts to determine the most effective regime of environmental releases from Tallowa Dam for the benefit of the river (see case study box overleaf).

Places, values and items important for Aboriginal and historic heritage, and that could be affected by a changed river flow regime downstream of the Tallowa Dam, are being documented. Investigations into other areas of social importance and of economic importance related to flows in the lower Shoalhaven will also be undertaken.

8.3.4 Improving the quality of environmental flow releases

The construction of Tallowa Dam in the 1970s, and the consequent formation of Lake Yarrunga, altered the physical properties of water in the river downstream and, in particular, its thermal characteristics. The timing of fish migration and spawning can be adversely affected by unnatural variations in water temperature which, in turn, can affect fish populations and the catch levels for the fishing industry. These issues have been a concern for the Shoalhaven fishing community, especially bass fishers.

Historically, before Tallowa Dam was built, there was not much difference between river water temperatures observed upstream and downstream of the dam wall site. As is the case with many reservoirs, in the warmer months, the water in Lake Yarrunga tends to form into layers of different temperatures, with the coldest water at the bottom and the warmest water nearer the top. When such thermal stratification occurs, the water in Lake Yarrunga also tends to be low in dissolved oxygen and metals and organic matter in the bottom sediments are released into the water column.

The Sydney Catchment Authority has been working to improve the quality of water released from Tallowa Dam and has spent $400,000 installing an aeration system at the Dam. Regular field tests have been undertaken since October 2005 to determine the temperature, dissolved oxygen and metal concentrations in the released water and the river. Results of testing showed clear stratification of the water in October 2005, before aeration commenced, with warmer water at the surface and very cold water at the bottom. In December 2005, a month after aeration commenced, some mixing of the layers was seen, and the water near the Dam wall was completely mixed and uniform in temperature by January 2006.

Although monitoring has not yet been conducted over a full year, a comparison with historical data suggests that the concentrations of dissolved metals (iron and manganese) were significantly lower in the summer of 2006 than they have been in the past five summers.

The aeration of Lake Yarrunga appears to have increased the overall temperature and oxygen levels in the water, and water released from the Dam is now similar in quality to the water in the upstream rivers, which are representative of conditions prior to construction of Tallowa Dam. It is apparent that continued aeration during the summer months will result in good quality water being released into the Lower Shoalhaven from the current outlet at the bottom of the Dam wall.

Case study: Lower Shoalhaven fish passage and habitat study

Trial water releases in the low to moderate flow range were especially made from Tallowa Dam between October 2005 and January 2006 to verify critical water depths and velocities in the river downstream. Three different levels of water release were selected for assessment, as shown below.

Downstream measurements included the depth of water over riffles, which are the shallow areas where water flows rapidly over rocky or gravelly parts of the stream bed. The extent to which various habitats, such as riffles and reedy patches, were wetted under different river heights was also measured. These physical attributes will help determine the critical flow thresholds in the river for fish passage and for providing different in-stream habitats to support a diversity of plants and animals.

Releases of water from Tallowa Dam, Sep 2005 – Jan 2006 (million litres per day)

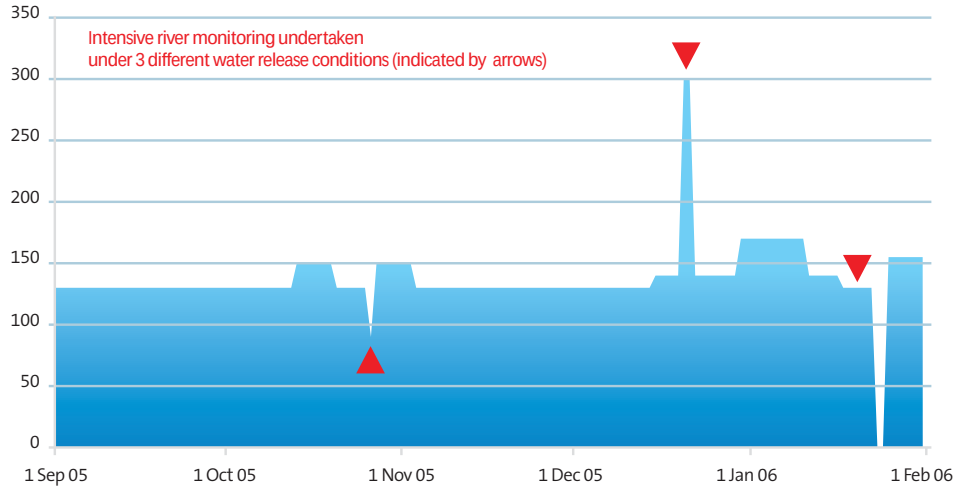


Photo credit: The Ecology Lab

Shoalhaven River immediately downstream of Tallowa Dam, 2005

In late October 2005, planned dam releases were made to allow environmental investigations of the lower Shoalhaven River under conditions typical of dry weather.

Measuring water depth at a riffle in the lower Shoalhaven River, 2005

Ecologist measuring water depth over a riffle about one kilometre downstream of Tallowa Dam. Shallow water can limit the ability of fish to pass riffles when river flows are low.

Schematic of aeration system operating at Tallowa Dam since October 2005 to improve the quality of the water releases for the downstream river environment

Before aeration

After aeration

The aeration equipment has raised the temperature of water in the lower depths of the Dam. The schematics show actual water temperature condition immediately upstream of the Dam wall in September 2005 (before aeration) and March 2006 (after aeration)

Additionally, the Sydney Catchment Authority is investigating other works and measures to ensure water releases of appropriate quality can be made in accordance with the future regime of environmental flows releases currently being determined for the lower Shoalhaven, as described above.

8.3.5 Providing fish passage

As described above, many types of fish need to move between different parts of rivers to complete their life cycles. In some cases, management of river flows can provide appropriate water depths and velocities to enable fish to move across natural features and built structures that would otherwise prevent their passage. In other cases, barriers in the river may require some modification to allow fish to pass.

The Sydney Catchment Authority is continuing with its work to install infrastructure at Tallowa Dam to improve fish passage. To allow fish to move from the river below the Dam to the reservoir behind the Dam, a fish lift will be installed. This lift comprises a hopper that first encloses fish downstream of the Dam, then physically lifts them over the Dam and releases them into the water in the lake. Fish are attracted to the hopper by the flowing water. The lift operates on a time cycle.

As well, the Sydney Catchment Authority is currently evaluating options to enable the safe passage of fish downstream from the lake to the river, with detailed studies nearing completion.

Implementation of environmental flow releases from dams and weirs in the Upper Hawkesbury-Nepean River will include consideration of fish passage needs.

8.4 Integrated monitoring for the Hawkesbury-Nepean

The Government is developing an integrated monitoring program for the Hawkesbury Nepean River that will provide information on river health, the outcomes of environmental flows and recycling initiatives. This program will build on previous monitoring work and provide an information base for adaptive management as the *Metropolitan Water Plan* is carried out. Its development is expected to be completed by the end of 2006.

8.5 Formalising protection of environmental water

NSW water legislation provides for the establishment of formal rules to reserve water to meet fundamental ecosystem needs. Underlying this is the recognition that some water should be reserved solely to meet fundamental ecosystem needs and should not be extracted for any consumptive purpose. As described above, under the *Metropolitan Water Plan*, the Government is implementing new environmental flow release regimes for major dams and weirs in the Sydney region. These releases are complemented by controls on river extractions, both upstream and downstream of the dams, having regard to the natural streamflow characteristics of those rivers.

A suite of rules to provide for and protect environmental water in rivers of the Sydney region are either in place now, or will be soon established, as follows:

- rules defining releases of environmental water from major structures such as dams and weirs
- individual licence limits that define the maximum amount of water that water users can extract in one year, averaged over several years
- an overall long term extraction limit for all the rivers in the Sydney region, made up of several component sub-regional extraction limits, that together define the total annual amount of water permitted to be extracted for consumptive purposes, including urban water supplies, agriculture, mining, and so on
- cease-to-pump rules in each stream, or group of streams, which define a very low flow level, below which irrigation extraction will not be allowed
- in specific areas, where a spike in extractions could compromise the local stream environment, daily flow sharing rules which limit the amount of water each licensee can extract on any given day
- the planned Reasonable Use Guidelines (see Chapter 6) which will limit the amount of water that each domestic and stock rights holder can extract
- the ability of a licensee to nominate that water allowed for extraction under their licence be reserved as environmental water for river health benefit from time to time, or for long periods of time.

The main legislative mechanism the Government will implement to effect all these rules for protecting environmental water, as well as sharing water between users, is a water sharing plan made under the *Water Management Act 2000*. Where appropriate, the water sharing plan will specify the transition from current arrangements for protection of environmental water, such as the provisional environmental flow release regimes in place at the majority of Sydney Catchment Authority dams, to decisions made under the *Metropolitan Water Plan* and implementation of new measures in relation to limits on river extractions. The water sharing plan covering the rivers of the Sydney region is currently under preparation and, when completed, will be exhibited for public comment before being gazetted.

What will be done next

- The *Sustaining the Catchments Regional Plan* will be gazetted before mid-2006 and implemented
- Catchment Action Plans will be implemented through partnerships between Catchment Management Authorities, landholders, community groups and local and state government.
- Investigations and consultation will continue in order to determine a new regime of environmental flow releases from Tallowa Dam on the Shoalhaven River.
- Government will decide on a new environmental flow regime for the lower Shoalhaven River.
- Investigations will continue into the best way to configure other dams and weirs in the Sydney region to allow the environmental flows announced in the *2004 Metropolitan Water Plan* to be implemented.
- A new plan for managing nutrient inputs to the lower Hawkesbury-Nepean River from wastewater, stormwater and agricultural run-off will be developed as a paper for discussion with stakeholders
- Development of a monitoring program to assess the effectiveness of new environmental releases from Sydney Catchment Authority's dams will be finalised and a new integrated monitoring program for the Hawkesbury-Nepean considering environmental flows, river health and recycling initiatives will be devised.
- The draft water sharing plan for the Sydney Region will be completed and publicly exhibited.

9. Creating a dynamic and competitive water industry

What this chapter is about

This chapter details a range of existing and proposed reforms designed to encourage the participation of the private sector in water and wastewater services in Sydney. Private sector involvement is expected to lead to significant innovation in metropolitan water service provision. However it is paramount that public health and the environment be protected at all times.

These reforms are key elements of a comprehensive package to facilitate innovative water recycling by the private sector.

Specifically these reforms:

- establish a new framework for the regulation and licensing of new private sector service providers to protect public health and the environment for the community
- facilitate access to existing water, wastewater and recycling networks in the greater Sydney and Hunter regions to avoid the costs and inconvenience of construction of duplicate networks where there is spare capacity and other criteria are met
- simplify the process of obtaining raw materials necessary for water recycling through new streamlined procedures for sewer mining applicants
- amend the *Pipelines Act 1967* to facilitate the construction and operation of new pipelines
- make it easier and faster to obtain environmental planning approval for small recycled water plants that do not discharge to the environment, and
- provide guidance to local councils and developers to assist in the approval and operation of decentralised (or non-reticulated) recycled water plants and systems.

Key achievements to date

- The Independent Pricing and Regulatory Tribunal has completed a major investigation into the provision of water and wastewater services in the greater Sydney region which considered a range of options for water and wastewater market structure to encourage increased competition and private sector participation, including potential access arrangements for third parties.
- The Government has considered and endorsed the recommendations of this investigation and is progressively implementing these reforms.
- The first round of the Water Savings Fund allocated over $9.2 million to the private sector to fund water saving and recycling projects.
- The Government has called for registrations of interest from private companies to provide new recycled water services in the Camellia area in order to identify the most imaginative, cost-effective and sustainable option available.
- Bringing together Government and industry to achieve a secure water supply. Hundreds of people in the private sector are employed in delivering the *Metropolitan Water Plan*, including plumbers, scientists, builders and engineers.

These innovative approaches set the lead in involving the private sector in sustainable delivery of water services in Australia.

What will be done next

- A regulatory framework will be established for increased competition and innovative service delivery in the water industry
- Following a process of consultation, legislation will be introduced to Parliament to establish a framework for the regulation and licensing of new private sector service providers and an access regime
- Amendments to the system of environmental planning and assessment will also be introduced to make it easier to obtain approval to construct small recycling plants
- New procedures for streamlined sewer mining applications will be implemented

9.1 Introduction

Key components of the *Metropolitan Water Plan* are new measures to harness the resources of the private sector and direct the forces of competition to the metropolitan water industry to develop innovative methods of providing water services. Meeting the challenge of securing Sydney's long-term water supply requires the innovation, resources and cooperation of both the Government and the private sector.

Over the past decade, competition reforms have been implemented to create dynamic energy and telecommunications markets. Consumers have benefited from competition through lower prices, the development of new products and, increasingly, the ability to make choices among energy and telecommunications providers.

To encourage increased levels of water recycling and the delivery of other innovative services, the Government proposes to implement similar competition reforms in Sydney's water industry. In doing this, the NSW Government is leading the way toward developing an innovative and efficient water industry in which the delivery of services by the private sector is a core component.

Once these reforms are implemented, new water service providers will have the opportunity to participate in a more innovative water industry that offers households and businesses more choices including alternative wastewater treatment and recycling services.

The NSW Government is adopting a prudent, adaptive approach to reform, to ensure that the introduction of greater competition is consistent with broader community objectives.

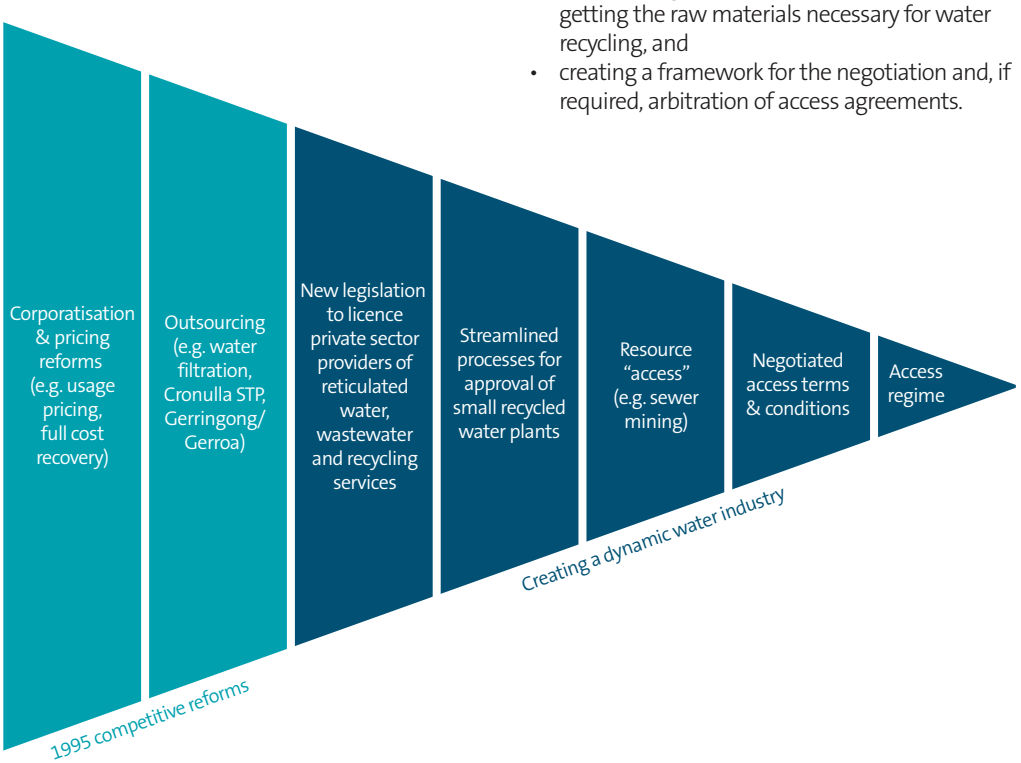
The Government's first and pre-eminent priorities for the metropolitan water industry are the protection of public health, the environment and consumers. The proposed reforms recognise the Government's resolute commitment that these objectives will not be compromised. For example, it will be enshrined in the proposed rules that:

- both public and private suppliers, as a minimum, comply with water quality guidelines and meet environmental obligations
- consumers retain the opportunity to purchase essential water and wastewater services at postage stamp prices, and
- water supply and services are guaranteed through clearly identified and allocated obligations of the 'supplier of last resort'.

New South Wales is leading Australia in the introduction of competition to the metropolitan water industry.

As illustrated below, these reforms build on a process begun in the mid 1990s. They take the next step to:

- establishing a new framework for the regulation and licensing of new private sector service providers that ensures protection of public health and the environment for the community
- simplifying the process of obtaining approval to construct a small recycled water plant
- streamlining the procedures associated with getting the raw materials necessary for water recycling, and
- creating a framework for the negotiation and, if required, arbitration of access agreements.



9.2 New suppliers: new licences

To ensure that the community's economic, social, health and environmental needs are safeguarded, a new licensing framework is being developed to regulate privately owned reticulated water, wastewater and recycled water suppliers.

Under proposals that are the subject of consultation, new suppliers would be required to achieve at least the same standards of water quality as existing publicly owned suppliers and to meet equivalent obligations to protect the environment and consumers' interests.

The new licensing framework is being designed to ensure: water quality and safety for protection of public health; safe, reliable and equitable supply of essential services to the community; and the protection and enhancement of the quality of the environment in NSW.

Subject to the outcomes of consultation, the new licensing regime will:

- require all licensed suppliers of drinking water, wastewater and recycled water services to comply with the relevant water quality guidelines to protect public health, and
- retain safety net protection for the most vulnerable in society, including concessions for pensioners and others in financial need.

Under proposals for consultation:

- the licensing framework will apply initially to new service providers in the Sydney, Blue Mountains, Illawarra and Hunter regions, subject to a future review
- licences to supply drinking water, recycled water and wastewater services through a reticulated network will be issued by the Minister for Water Utilities, on the recommendation of the Independent Pricing and Regulatory Tribunal
- incumbent water supply authorities will continue to have their prices regulated, but new competitive suppliers will be subject to price regulation in limited circumstances
- the existing regulation of publicly owned water supply authorities will be maintained
- current health and environmental requirements will be maintained and will apply equally to existing publicly owned providers and new entrants
- all suppliers of drinking water through a reticulated network will be required to be licensed
- all suppliers of wastewater services through a reticulated network will be required to be licensed
- suppliers of recycled water through a reticulated network will also be required to be licensed, except where that network exclusively supplies recycled water to large consumers for industrial use only
- the *Sydney Water Act 1994* and the *Hunter Water Act 1991* and both organisations' operating licences will be reviewed and amended to clarify Sydney Water's and Hunter Water's responsibility as the supplier of last resort and as the provider of consumer 'safety net' protection designed to ensure the continuing availability of essential services for the most vulnerable in society.

9.3 Access to infrastructure

The water and wastewater industry is characterised by large scale essential infrastructure such as trunk mains, sewerage pipes, and reticulation networks. The difficulties inherent in duplicating such infrastructure can present a significant barrier to entry for new market entrants.

The NSW Government will encourage the development of innovative new services through the establishment of an access regime which facilitates the efficient use of existing infrastructure.

An access regime will enable new water, wastewater and recycled water suppliers in the Sydney, Blue Mountains, Illawarra and Hunter areas to negotiate to use spare capacity in existing significant water and wastewater pipes, thereby avoiding the need to build duplicate networks. The right to negotiate access to infrastructure will enable new suppliers to compete with Sydney Water and Hunter Water, creating incentives for increased innovation and efficiency.

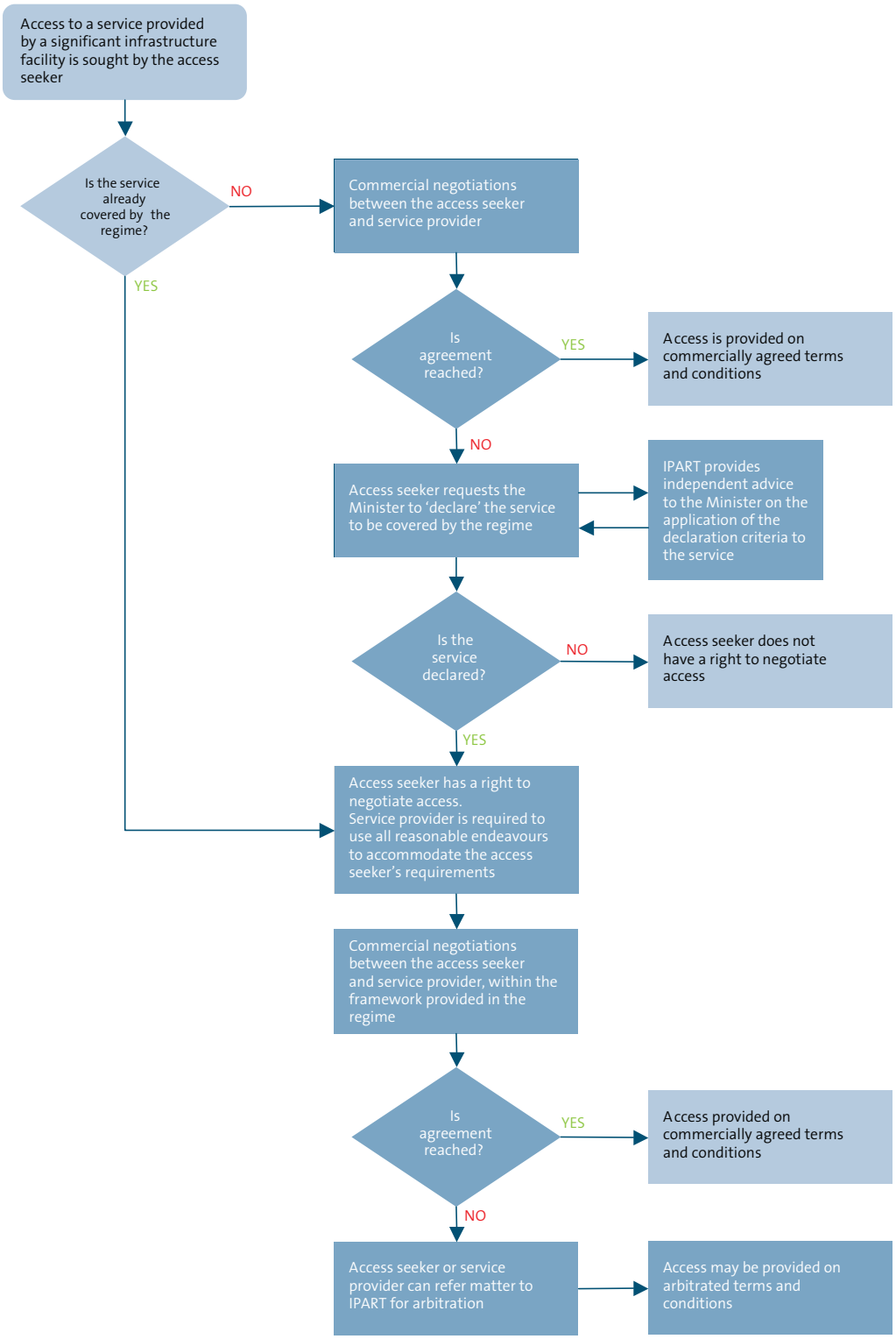
By gaining access to the spare capacity of existing infrastructure, new service providers will be able to avoid inefficient and unnecessary duplication of the existing infrastructure. For example, under proposals currently the subject of consultation, new suppliers would be able to negotiate to use greater Sydney's or the Hunter's existing wastewater pipes to take their customers' wastes away where there is spare capacity and other criteria are met.

The access regime will not provide a right to obtain a resource (such as wastewater for recycling) or to use a production process facility (such as a treatment plant).

Under proposals the subject of consultation:

- the access regime will initially apply to drinking water, recycled water and wastewater infrastructure in the Sydney, Illawarra, Blue Mountains and Hunter areas only, with geographic scope subject to future review
- a service may be 'declared' as being covered by the access regime if the Minister, with advice from the Independent and Pricing Review Tribunal, is satisfied it meets prescribed 'declaration criteria'. This process is outlined in the diagram on page 114
- the effect of coverage is that an access seeker will have an enforceable right to negotiate 'in good faith' for access to a covered service
- the regime will provide for IPART to arbitrate disputes, including determining appropriate terms, conditions, and prices for access to the services, should those commercial negotiations fail
- the regime will apply consistently to public and privately owned infrastructure
- services which comprise production processes (for example, a treatment plant) will be excluded from the declaration process, and
- to provide increased certainty to private sector investors, services can be protected from declaration on the basis of:
  - being provided following a competitive tender which included IPART-approved access terms
  - being granted a 'binding no-coverage ruling' (that is, where the Minister, on advice from IPART, certifies that the declaration criteria are not met), or
  - a voluntary access undertaking made by the service provider and approved by IPART.

Seeking access to services under the proposed Access Regime



9.4 *Pipelines Act*

The Pipelines Act 1967 is being amended to streamline the licensing process in order to simplify and speed up the process of granting licences.

Among other things, that Act facilitates the construction and operation of new pipelines by allowing prospective pipeline owners to apply for a licence, which carries with it a statutory right to use land for the purposes of laying pipes.

To date the Act has primarily been used by owners of gas pipelines. However, it has the potential also to apply to pipelines which convey other substances, including water and wastewater.

Recognising the Act's potential importance to the water and wastewater industries, the Minister for Water Utilities has been allocated joint responsibility for the administration of the Act, alongside the Minister for Energy.

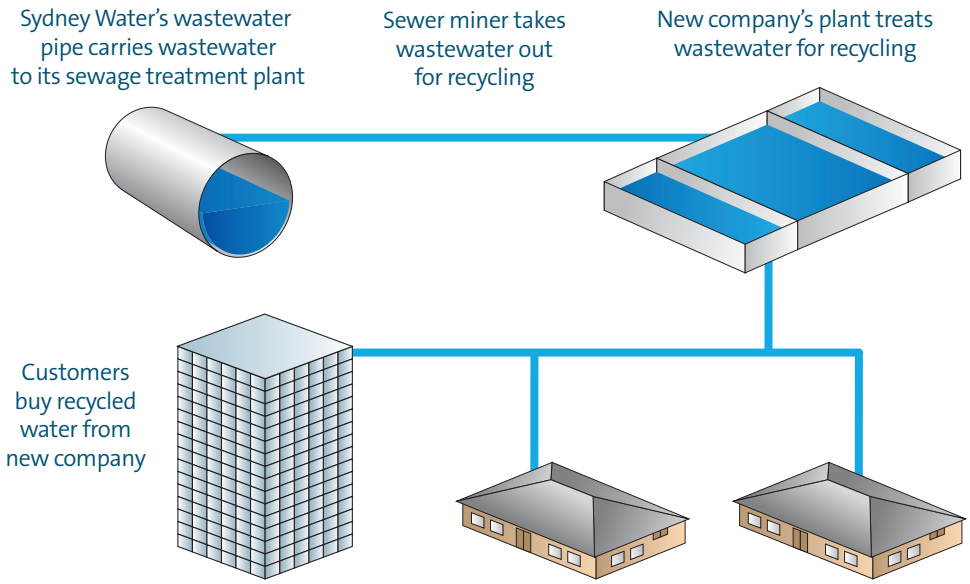
9.5 Streamlined sewer mining

Sewer mining involves the extraction of wastewater from the wastewater system and is a process by which recycled water producers can obtain their raw product. They 'mine' the sewers for the primary ingredient of recycled water, which is then treated before being supplied to customers for use in industry, agriculture, garden watering, toilet flushing and other non-drinking purposes.

To make it easier for new recycled water companies to operate in Sydney, streamlined sewer mining procedures have been developed to enable them to obtain raw ingredients. These procedures enhance the information currently available for applicants and include an independent dispute mechanism, in the event that it is required.

Procedures are available at **www.sydneywater.com.au**

Streamlined sewer mining policies make it easier to recycle



9.6 Easier and faster development approvals for small recycling plants

Amendments will be made to the environmental planning and assessment system to streamline the development consent process for new small recycling plants so as to further encourage investment in recycled water.

Until now, the environmental planning and assessment system has treated new recycled water initiatives in the same way as sewage treatment systems and works. As such, privately owned recycled water plants required the preparation of an environmental impact statement, as they were classified as a 'designated development' under the *Environmental Planning and Assessment Regulation 2000.*

A review of the provisions applying to recycled water treatment plants has indicated that the higher level of assessment required for these recycled water 'designated developments' is no longer justified in many cases. Accordingly, the regulations are being amended so that recycling systems can be treated differently from sewage treatment plants.

A higher capacity threshold will be applied to recycling systems for residential, landscaping, forestry or agricultural purposes (from 750,000 to 1,500,000 litres per day).

In addition, an environmental impact statement will not be required, regardless of size, where the end-use is exclusively for industrial purposes and the only discharge is to a licensed sewerage system (that is, not to the environment).

The existing lower threshold of 750,000 litres per day would remain for sewage treatment works which discharge to the environment.

While preparation of an environmental impact statement will no longer be compulsory, an environmental assessment such as a Statement of Environmental Effects or a Review of Environmental Factors will be required for new recycling plants. This will ensure that impacts on the environment and public health are assessed and minimised. Further, the consent authority, usually the local council, always has the option of requiring more information, for example where the area includes high water tables, highly permeable soils, or very sensitive habitats.

Proposed water recycling training courses for council and local utility officers to be conducted during 2006 will cover these assessment issues. The new approach and thresholds for recycling systems will be a welcome change for private sector companies looking to enter or expand in the water services industry.

The Beverley Park recycled water treatment plant

9.7 Guidelines for the approval and operation of privately owned recycled water plants and systems

The reforms described above and the application of the Building and Sustainability Index (BASIX) to multi-unit dwellings from October 2005 are expected to increase interest in the construction and operation of small-scale water recycling plants and systems. For example, as a mechanism to comply with the BASIX water efficiency targets, a recycled water system could be located in the basement of an apartment block to provide recycled water for toilet flushing to all residents and for garden use.

Approval to construct a recycled water plant is currently, and will continue to be, provided by local councils. However, most local councils in the Sydney region do not have experience in regulating recycling plants and systems.

To protect public health and assist councils, a regulatory framework and associated guidelines are being developed for the approval and operation of new small recycled water plants and systems. Expected key elements of the guidelines for the approval and operation of new small plants include:

- a systems management plan, including an operations and maintenance plan
- strong reliance on independent accreditation for installation and operations, and
- a requirement for regular monitoring, reporting and auditing.

The guidelines will assist councils and those interested in operating small-scale recycled water plants in apartment blocks and other multi-dwelling buildings or for industrial use.

The guidelines will also improve the consistency and efficiency of the governance of these systems, by providing more efficient approval, inspection and monitoring arrangements for multi-unit dwellings and other small wastewater systems.

The Government will finalise the details of both the approval arrangements and the operational guidelines by mid 2006. A key step in the finalisation process is agreement on the operational detail with local government, including a training program for council and water utility officers who deal with recycling systems, whether as part of the development consent process under the *Environmental Planning and Assessment Act 1979* or the approvals process under the *Local Government Act 1993*.

9.8 What does this mean for Sydney's businesses and householders?

These reforms are directed towards providing value for money and new choices for businesses and households.

Licensing new service providers should mean that, as businesses and householders get the benefits of innovation and choice in the water services delivered to them, their health and the environment will continue to be protected.

By gaining access to the spare capacity of existing water, wastewater and recycled water pipelines, new service providers will be able to avoid the inefficient duplication of the existing infrastructure and construction impacts.

Streamlined processes for sewer mining help to make it easier for private sector providers to produce recycled water for businesses and householders at more locations across Sydney.

A more straightforward development consent process for new small recycling plants is designed to encourage private sector investment in water recycling.

New development consent processes will be supported through guidance to local councils and developers to assist in the approval and operation of these new small recycled water plants.

What will be done next

- A regulatory framework will be established for increased competition and innovative service delivery in the water industry.
- Following a process of consultation, legislation will be introduced to Parliament to establish a framework for the regulation and licensing of new private sector service providers and an access regime.
- Amendments to the system of environmental planning and assessment will also be introduced to make it easier to obtain approval to construct small recycling plants.
- New procedures for streamlined sewer mining applications will be implemented.

10. Implementing the Plan

10.1 Working in partnership

Historically, urban water provision has been concerned with supplying enough water to meet ever-increasing demands at low cost to consumers. Now, however, there is a growing need to manage demand for drinking water, and to invest in alternative supply options, so as to ensure a sustainable supply and demand balance into the future. This represents a shift from demand-driven planning to a more supply-constrained, integrated planning approach.

This *2006 Metropolitan Water Plan* details the Government's strategy for balancing supply and demand to meet Sydney's growing water needs, and for securing Sydney's water needs against the risk of deep drought. The *Plan* relies on a diverse mix of measures on the supply side and the demand side, which are to be enacted by a range of players:

- individual Government agencies
- councils
- industrial and commercial enterprises
- agriculture
- private sector participants in the water industry
- community groups, households and individuals.

Government has a key role to play – providing leadership, developing regulatory settings, operating and maintaining extensive water and wastewater infrastructure, promoting efficiency and recycling and protecting the environment and public health. Its agencies are responsible for providing a safe and reliable water supply to more than four million people living in Sydney, the Illawarra, the Blue Mountains and adjacent areas.

The main NSW Government agencies involved in implementing actions in this *Plan* are outlined in the table below.

Achieving a cost effective and sustainable supply and demand balance requires a collaborative partnership between all players. Such an approach is particularly important to realise the benefits of newly emerging technologies, which enable Sydney to embrace a more diverse mix of supply and demand side measures and realise significant cost savings. Recent regulatory reforms – such as the development of a proposed third party access regime – reinforce the need for a collaborative approach involving a larger number and more diverse range of players.

New technologies have implications not just for the range of players involved in the water sector, but also for the fundamental approach adopted to meeting Sydney's water needs. In the past, the limited suite of rainfall dependent options available necessitated 'pre-emptive' investment in large scale infrastructure – such as dams and

Sydney Catchment Authority	Supplies bulk water on a day-to-day basis; protects raw water quality through the management of the drinking water inner catchments and protection actions in the wider catchments
Sydney Water Corporation	Treats the bulk water in its filtration plants and delivers it through the distribution network; manages wastewater; and implements a wide range of programs to increase water efficiency and recycling
Department of Energy, Utilities and Sustainability	Administers the Water Savings Fund, Water Savings Action Plans, develops guidance on recycling
Department of Planning	Implements BASIX to reduce water use in dwellings
Department of Environment and Conservation	Licenses wastewater treatment plants and develops policy settings to protect river health
Department of Natural Resources	Allocates water for urban consumption, irrigation and environmental water (through water sharing plans and licensing)
Department of Health	Protects public health through appropriate water quality standards
Department of Primary Industries	Promotes water efficiency in the agricultural sector
Independent Pricing and Regulatory Tribunal	Determines prices for water and wastewater services
The Cabinet Office, Metropolitan Water Directorate	Central coordination across agencies of water planning for the greater Sydney metropolitan region

trunk mains – to meet the needs of a growing city, and to protect Sydney against the impact of deep droughts. This approach delivered low cost water but also had impacts on the environment.

While the Sydney system – dominated to date by rainfall dependent options – has sufficient capacity to meet water needs during normal and even quite severe drought conditions, there have been limits to the system's capacity to ensure security of supply during very deep and prolonged droughts. The potential impacts of climate change highlight the importance of adopting a more diverse mix of rainfall and non-rainfall dependent options.

Fortunately, as illustrated in the preceding chapters, technologies are now available that can help meet water needs and deliver security of supply, often without the need for large-scale, pre-emptive investment. As well as new water supply technologies, water conservation is playing an increasingly important role – reflecting the shift in focus from demand-driven to more supply-constrained planning.

10.2 Moving to an adaptive management approach

The emergence of new options allows for a more incremental approach to meeting water needs – rather than relying on 'lumpy' investments built years in advance. Water utilities around Australia are now adopting an 'adaptive management' approach. Rather than prescribing now how water needs will be met over the next 25 years, adaptive management means having the capacity to respond to circumstances as they change, taking advantage of new information and technologies as they emerge, and avoiding costs by deferring investment until it is needed. The approach adopted in this *Plan* reflects this new thinking – particularly with respect to measures required to provide security of supply in deep drought.

To be effective, such an approach needs to be supported by institutional arrangements that:

- encompass a wider range of players and measures
- provide for careful monitoring and evaluation of needs and trends, and
- ensure that appropriate responses are developed and implemented as required.

Existing institutional arrangements for managing Sydney's water needs, including during drought periods, encompass such an approach. Achieving a cost effective and sustainable supply and demand balance requires a collaborative partnership between all the players. The Cabinet Office provides central coordination of water planning. This collaborative process relies heavily on cross agency analysis and planning, commissioning specific strategy assessments, and on extensive work by Sydney Water and the Sydney Catchment Authority to validate and inform the process, and to develop and assess options. The process has included regular briefings and feedback from the Chief Executive Officers of all relevant agencies (Government departments and utilities).

These arrangements may need to evolve to accommodate recent developments – such as the decision to develop a third party access regime – and future developments, as required. The Government will consider these issues over the next year and outline any proposed changes as part of the review of this *Metropolitan Water Plan* (discussed further below).

Features of an adaptive management approach

10.3 Adaptive management in practice

Features of an effective adaptive management approach include:

- constantly improving knowledge to inform decisions
- ongoing investment in readiness (to enable rapid deployment of options such as groundwater and desalination, if required)
- monitoring and evaluation to ensure that savings from demand reduction programs are realised

In light of this, the Government's independent consultants' report identifies a number of areas where further work is required in order to ensure that the supply and demand balance continues to be met, and that optimal economic and environmental outcomes are achieved. These are outlined below and discussed in more detail in their report.

In particular, ongoing work is required to:

- examine the implications of different operating rules and environmental flow regimes for the Shoalhaven river
- complete current investigations into groundwater availability to boost supplies during drought
- develop an optimal restrictions regime to apply in future droughts (including consideration of a revised reliability criterion)
- implement, monitor and evaluate the effectiveness of water saving and recycling programs, and ensure that these programs deliver the savings currently anticipated
- improve understanding of underlying demand trends (due to urban consolidation, demographic and housing mix change, technology improvements, behaviour change etc) and revise per capita demand projections, as appropriate
- evaluate any new supply or demand side measures (for example, new groundwater reserves identified as potentially viable drought supplies, new recycling or water saving options etc)
- improve understanding of the likely impacts of climate variability and climate change (the NSW Government's study on the impact of climate change on Sydney's water supplies, undertaken in conjunction with the CSIRO and the University of NSW, is due for completion in the next 2 to 3 years)
- maintain readiness to deploy groundwater and desalination within short lead times, if required and
- periodically review trigger levels for groundwater and desalination, taking account of any changes to the supply and demand mix and/or technology improvements that would shorten lead times.

The Government has accepted these recommendations for further work, and will incorporate the results of these investigations into regular reviews of the *Metropolitan Water Plan*.

Just as this *2006 Metropolitan Water Plan* is an adaptation of the *2004 Plan*, so this Plan will itself be modified to reflect information and developments emerging from this point on. The Government will prepare status reports each year, to confirm that analysis underpinning the projected supply and demand balance remains valid, and that no developments have occurred that fundamentally alter the general approach of the *Metropolitan Water Plan* in force at the time.

Every four years, a major review will be conducted and a new *Metropolitan Water Plan* will be produced. The first of these four-yearly reviews will commence late in 2007 – the timeline has been brought forward in this case because of the new data on key aspects of the supply and demand balance which are expected in 2006 and 2007, such as the results of the studies currently under way into groundwater reserves for use in drought.

10.4 Incorporating expert and community input

The Government has established a new Metropolitan Water Independent Review Panel to provide expert input on metropolitan water planning matters. The Panel will comprise experts in relevant fields, such as urban water management, the economics of urban water systems, water conservation, attitudinal research and environmental issues.

The Panel's independent expert advice to the Government will form a significant input to the four-yearly reviews of the *Metropolitan Water Plan* and the development of subsequent iterations of the *Plan*.

Community input is an important part of water planning for Sydney. The Premier has asked the Panel to consider how community views on water saving, recycling, supply and river health options can best be integrated into ongoing planning for the supply and demand balance. The Panel will recommend consultation methods and will oversee consultation for the review of this *2006 Plan* and the development of the next *Plan*.

Further information about these processes will be made available at **www.waterforlife.nsw.gov.au**