LOWER HUNTER water PLAN

NSW GOVERNMENT | Metropolitan Water Directorate

2014 Lower Hunter Water Plan
NSW Department of Finance and Services

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The Metropolitan Water Directorate is a unit of the New South Wales Department of Finance and Services

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Foreword from the Minister

The lower Hunter is the second largest urban centre in NSW behind Sydney. Its population has grown by 22,500 in the last five years and this growth is underpinned by a strong and diverse economy, as well as the current resources boom.

It is easy to see why over half a million people enjoy the lifestyle offered by the rich culture and natural beauty of the region, and why more people are choosing to make a life for themselves in the lower Hunter.

While we can make some assumptions about how the region's population will grow, our climate continues to create a level of uncertainty that we cannot accurately predict. We can however plan for this climate uncertainty, and we are fortunate to have the right tools and experience to develop and implement considered and robust water plans.

Water planning needs to be flexible and responsive to climatic conditions, and to have appropriate measures in place to ensure our community's water supply can withstand drought.

Extensive investigations have found that the lower Hunter has enough water in average conditions for around the next 20 years. However, because the region's storages are relatively small and prone to natural losses like evaporation, the focus for the first *Lower Hunter Water Plan* is about being prepared for drought. We have time in future plans to re-evaluate the needs for ongoing population and business growth based on the latest available information.

This approach recognises the lower Hunter community's long-term achievements in conserving water and reducing demand, which continue to defer the need for a major new supply. It is also important to note the NSW Government has specifically ruled out building Tillegra Dam and it is not an option to augment water supply in future.

Developing the *Lower Hunter Water Plan* has been a collaborative effort among water agencies, working in partnership with the community to develop a plan that we can all support. It is a responsible plan that maintains a balance between making the most of the water we have, while providing a mix of measures that will see the region through a severe drought.

The *Lower Hunter Water Plan* recognises the continued importance of the region's main water sources, while also reducing the demand for drinking water through water recycling and efficiency measures. The additional security offered by sharing water with the Central Coast is an important part of the plan. Including contingency measures that don't rely on rainfall, such as temporary desalination facilities that can be deployed only if and when needed, enables us to take a flexible approach to insuring against the risk of extreme drought.

The *Lower Hunter Water Plan* will be reviewed regularly to ensure appropriate investments are being made and the region's water needs are being met, now and into the future.

Water supply and security is an important issue for all NSW families and communities. I am very pleased that the lower Hunter now has a robust plan for one of our State's most vital and economically important regions.

Andrew Constance MP
Minister for Finance and Services

Comments from the Independent Water Advisory Panel

An effective plan for meeting the lower Hunter region's water supply needs is of crucial importance to the region. Not only must the plan ensure that supply and demand are matched under 'normal' conditions and during drought, but it must also be cost effective and developed in close consultation with community members.

This plan has adopted a portfolio approach comprising a group of different options, combined to provide diversity of sources and demand management measures, which will be resilient and adaptable in the face of changing circumstances, especially drought. Extensive and rigorous computer modelling has been carried out to optimise and assess portfolios which accommodate growth and respond to drought. The modelling involved replicating the historical rainfall record in hundreds of thousands of different ways. The results suggest that the chosen portfolio should ensure that most basic water supplies are maintained for all droughts with return periods up to approximately 1 in 90,000 years, with options available to further increase security in an extreme drought. The plan thus accepts a very small risk of storages reaching critically low levels, in return for deferring expensive upfront investment.

For anticipated growth over a reasonable planning horizon, the portfolio to be implemented will ensure supply under 'normal' climatic conditions. Small, shallow dams in the system, however, make the region particularly vulnerable to drought, so particular attention was paid to measures which would manage demand and maximise supply under drought conditions, including restrictions, voluntary targets, inter-regional transfers and, if necessary, putting in place portable seawater desalination units – the only rainfall-independent source.

Managing the portfolio in drought conditions will require Government to take key steps on an agreed basis. The beauty of having a 'basket' of measures is that each one need only be implemented when needed, avoiding, or at least deferring, the high cost of major capital works. This amounts to an 'insurance policy' approach to supply, under all but the severest droughts.

A major impact of future climate change is likely to be greater weather extremes; potentially including acute droughts, worse than would be expected under the current climate. Managing that eventuality could test

the identified measures and might be more expensive, with greater levels of uncertainty than anticipated. It is important to note that there is no way to absolutely guarantee storages will never empty, so adaptive plans must be made to meet the most basic water needs, and to manage supplies until drought breaks.

The Independent Water Advisory Panel has overseen the whole process of developing this plan and is particularly pleased at the quality of community engagement, the sophisticated modelling and the use of plain English. Clearly the need for ongoing monitoring and evaluation of the unfolding status of water and demand has been recognised. An annual report to Government on how the portfolio matches forecasts will ensure that the situation is always understood and should be under careful management control.

The *Lower Hunter Water Plan* is a commendable, robust assessment, produced under immense time pressure, and the Panel is glad to be associated with it.

Chris Davis
On behalf of the Independent Water Advisory Panel
Mr Ross Chapman
Dr Tony Church
Ms Kylie Cochrane
Prof George Kuczera
Prof Cynthia Mitchell
Dr WEJ Paradice

Contents

Executive summary

The lower Hunter's water supply is secure for around 20 years. The *Lower Hunter Water Plan* is a package of water supply and demand measures that incorporates the significant contribution of water efficiency and recycled water investments already in place and underway, and builds on these to ensure the region can withstand an extreme drought.

Water is essential for the lower Hunter's communities, its economy and the environment. It is vital that our region can withstand droughts without running out of water.

The lower Hunter's water supplies are very reliable under typical climatic conditions, and will be able to supply the water needs of a growing population and business community in the medium term. However, the region is vulnerable to drought, because water storage levels can fall quickly in prolonged periods of hot dry weather.

The *Lower Hunter Water Plan* sets out how we will ensure there is enough water to supply the people and businesses of the region, as well as how we will respond to severe droughts. It recognises the water needs for the lower Hunter's future growth and prosperity, as well as the needs of the environment.

Developing the plan

The Metropolitan Water Directorate in the Department of Finance and Services led a comprehensive process to develop the plan. This work has been done in consultation with Hunter Water Corporation and other government agencies involved in water management. Four phases of community and stakeholder engagement provided valuable input at each major step in developing the plan.

The planning process involved complex investigations, modelling and analysis to define the problem to be addressed, identify solutions, and support a decision on the final package of supply and demand measures.

Water planners took into account a large range of factors, including population and water demand projections, water supply system modelling, drought security objectives, climate change research, and economic, social and environmental impacts.

In developing the plan, all available and practical options to supply, save, or substitute water were considered and evaluated for how well they could respond in a drought situation. The challenge for planners was putting together the mix of measures to deliver a drought response strategy with the best economic, social and environmental outcomes for the lower Hunter community.

A balanced, adaptable plan

The *Lower Hunter Water Plan* is designed to be flexible to adapt to challenges, such as our highly variable climate patterns and changes to other factors, such as population and business growth, technology and behaviour patterns.

The plan will be reviewed regularly to respond to new information and technologies, and changes to climatic conditions. This allows the balanced portfolio of measures to be adjusted over time, to make sure that it is achieving its objectives.

The *Lower Hunter Water Plan* at a glance

The *Lower Hunter Water Plan* includes actions to supply, save and substitute water that are already in place or underway, as well as additional measures to respond to droughts when they occur.

The measures included in the plan will reduce the amount of water required to serve the lower Hunter's needs, make better use of existing storages, and provide extra supply as a contingency in extreme droughts. Some measures will apply all the time, to reduce demand or substitute supply, while others will only be activated as storage levels fall during droughts. The key elements of the plan are summarised overleaf.

MEASURE	CONTINUING ACTIONS[1]	DROUGHT RESPONSE
Surface water	Chichester and Grahamstown Dams will continue to provide most of the region's water needs each year. Modifications to the water supply network will enable more water to be transferred from the Central Coast to the lower Hunter, as required by the existing transfer agreement. The modelling of transfers to and from the Central Coast will be refined as a tool for optimising transfer arrangements. The NSW Office of Water will continue reviewing water sharing plans and implement related refinements of environmental flow rules through amendments to water licences and approvals.	Water transfers between the lower Hunter and Central Coast systems during droughts in either region will make better use of existing storages and improve drought resilience in both regions.
Groundwater	Groundwater from the Tomago and Tomaree sandbeds will continue to be an important source of water supply for the lower Hunter region. Investigations into the feasibility of new groundwater sources that might boost supplies in a drought will continue, focusing on the Lower Hunter Alluvial groundwater source in the short term.	The amount of water supplied from Tomago sandbeds generally increases in a drought.
Water efficiency	Hunter Water will continue to support water efficiency measures under its existing programs that assist households and businesses to save water. The national Water Efficiency Labelling and Standards (WELS) scheme and the NSW scheme to improve water and energy efficiency through the Building and Sustainability Index (BASIX) will continue to deliver improvements in water efficiency. Together, ongoing residential and non-residential water efficiency improvements are expected to save around 4.5 billion litres of water each year by 2034. Programs to detect leaks and manage pressure in Hunter Water's system are expected to save around 1.7 billion litres a year by 2034.	Additional water efficiency programs for both households and businesses will be activated in drought to help reduce demand as water storages fall. Hunter Water will also invest more in active leak detection and pressure management programs to reduce losses from the water supply system.

1. The 'continuing actions' in the table include actions that relate to both the longer-term supply-demand balance and investment in activities to prepare for drought.

Demand management	Water Wise Rules to help conserve water every day will be introduced as an immediate priority under the *Lower Hunter Water Plan*. These common sense actions are estimated to save around one billion litres of water each year.	Water restrictions will be applied as storage levels fall to reduce both household and business demand and keep as much water in the storages as possible. Restrictions are a quick and effective response to drought. When in place, restrictions will be actively supported by education and awareness campaigns, and enforced through compliance activities.
Recycled water	The Kooragang Industrial Water Scheme will be able to deliver over three billion litres a year of recycled water to industrial users, starting in late 2014. This will bring the total amount of recycled water to nearly eight billion litres each year. Dual reticulation schemes in new developments at Chisholm and Gillieston Heights will provide recycled water to about 1000 properties as development proceeds. Private sector suppliers are likely to play a bigger role in providing water supply, wastewater and recycled water services to new developments, particularly in areas remote from urban centres.	In a drought, additional recycling opportunities may become more viable for customers seeking an alternate supply that does not depend on rainfall.
Rainwater and stormwater use	Rainwater tanks will continue to reduce drinking water use in new developments. If the current trend continues, rainwater tanks are expected to save around 3.4 billion litres of water each year by 2043. Councils and businesses may identify new opportunities to use stormwater as part of integrated water cycle management into the future.	There may be more interest in opportunities for stormwater harvesting for industrial uses or watering of sporting fields in a drought, although their dependence on rainfall makes them less reliable in a drought.
Temporary desalination	To enable a quick response in drought, 'readiness activities' will include site selection studies, technical and environmental investigations, and a review of procurement options. Ongoing research into potential improvements in desalination technology will be monitored.	Temporary desalination plants provide an emergency drought response for a very extreme drought. By planning in advance, the units can be built quickly if and when needed, and they would be removed when no longer required.

'The thing I liked most about participating in the whole process to develop the Lower Hunter Water Plan was being able to have input into an important issue for our community.'

COMMUNITY COMMENT
CONSULTATION WORKSHOP 2013

An integrated water cycle management approach

The *Lower Hunter Water Plan* recognises the importance of managing water resources in an integrated fashion to take into account the full urban water cycle. In line with the National Urban Water Planning Principles, the plan incorporates diverse water supplies and optimises the use of water at different stages of the urban water cycle.

Integrated water cycle management involves an integrated approach to water supply, sewerage, stormwater services and waterway health. It means customers can access different water supplies which are fit-for-purpose. For example, residential customers can use rainwater tanks or recycled water for non-drinking uses, and can reuse their own 'grey water' from washing machines, showers, baths and basins. Households in some new development areas will be able to access recycled water supplies delivered to their homes for non-drinking purposes such as garden watering, toilet flushing and laundry use.

Likewise, an industrial customer may harvest stormwater from their site for operational use, or be supplied with recycled water from a wastewater treatment plant for uses ranging from dust suppression or wash-down, through to steam generation or cooling water in the production process. Water licences and approvals administered by the NSW Office of Water may be required for the construction and operation of stormwater harvesting schemes.

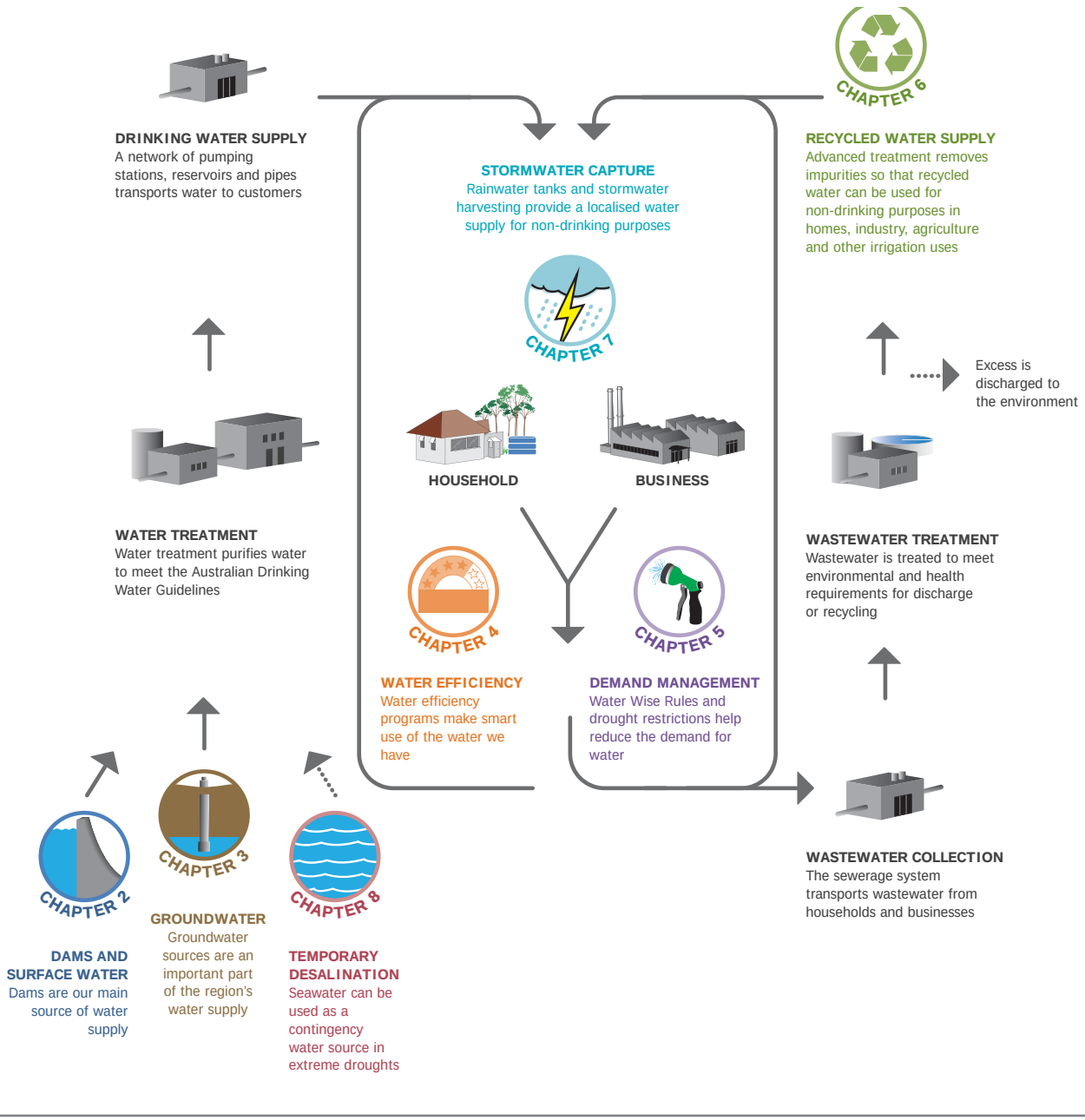
> Managing water on a whole-of-water-cycle basis will deliver diverse water supplies that are fit-for-purpose, and make the best use of water at different stages of the urban water cycle.

All these examples have a benefit in substituting a lower grade water supply where high grade drinking water is not required, reducing the demand on the water sources that supply our drinking water.

The *Lower Hunter Water Plan* outlines how the region will respond to drought using an integrated approach to water management. The diagram opposite showcases the elements of the urban water cycle, and provides a guide to the essential elements of the plan.

Using recycled water for irrigation

The urban water cycle and the *Lower Hunter Water Plan*



Setting the scene

The *Lower Hunter Water Plan* has been developed to make sure the people of the lower Hunter have enough water to meet their needs for the medium term, including being able to withstand a drought much more severe than previously recorded in the region.

The plan is also concerned with protecting the health of the river systems in the region that are impacted by the water supply system. Modelling for the plan includes proposed refinements to environmental flow rules to better mimic natural conditions. These will be implemented through the water sharing plans and water licences managed by the NSW Office of Water.

The *Lower Hunter Water Plan* sets out the mix of supply and demand measures that will:

- provide water security during drought
- ensure reliable water supplies to meet growing water demand due to a growing population and increased business and industry activity
- help protect aquatic ecosystems
- maximise net benefits to the community.

The plan continues programs already in place to improve water efficiency and recycle water. These programs are an important part of the urban water cycle because they reduce demands on drinking water supplies. The plan also sets out measures that can be put into place as water storage levels fall during a drought. This 'portfolio' approach recognises that the best solution is generally based on a combination of measures rather than a single option.

The *Lower Hunter Water Plan* also sets out an adaptive management approach that will include monitoring the effectiveness of the plan, investigating new technologies, analysing new information, and monitoring developments in climate change research and best practice water management.

Water supply in the lower Hunter

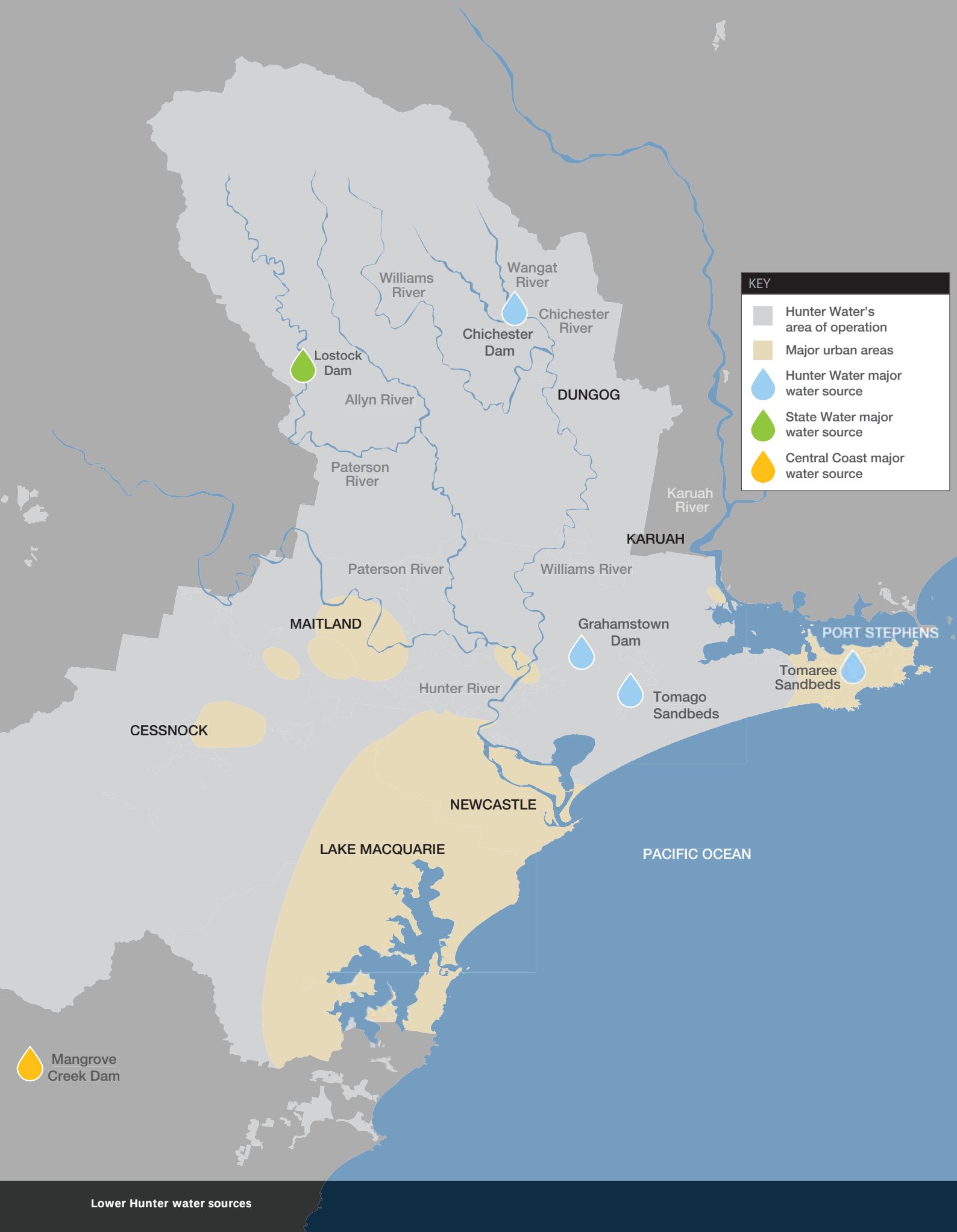
The lower Hunter is the seventh largest urban area in Australia and is home to over half a million people. Hunter Water Corporation is the major utility responsible for supplying drinking water to the region and for treating and disposing of wastewater. Hunter Water owns and maintains the network of water storages, pipes and treatment plants that deliver high-quality water to its customers.

Water is supplied to Hunter Water's customers from two main surface water sources – Chichester Dam and Grahamstown Dam – together with groundwater from the Tomago and Tomaree sandbeds. A small amount of water is also drawn from either the Paterson River or Allyn River to supply the town of Gresford.

The water storages in the lower Hunter have the capacity to store 276 billion litres of water to deal with our variable climate patterns. This means that we have enough water in storage to cope with most periods of hot, dry weather.

The water supply system covers a wide area of 5,366 square kilometres (see figure overleaf), stretching to Singleton shire in the north-west and adjoining the Central Coast in the south.

Providing safe, high-quality water is essential. Our drinking water is treated to meet the *Australian Drinking Water Guidelines*, which are among the highest in the world. Hunter Water has programs in place to monitor water quality at every stage of the supply system.



Lower Hunter water sources

Private sector involvement in water supply

For over 120 years, Hunter Water has been responsible for providing water, wastewater and some stormwater services to the community of the lower Hunter region. Now the private sector can also play a role in providing water and sewerage services in New South Wales.

The NSW Government established a third-party access and licensing system through the *Water Industry Competition Act 2006* (WIC Act) to harness the innovation and investment potential of the private sector in the water industry.

A licensing system, managed by the Independent Pricing and Regulatory Tribunal, enables private sector providers to operate within the industry, supplying drinking water, recycled water and sewerage services, while continuing to protect public health, consumers and the environment.

These systems have the potential to reduce drinking water use by including recycled water and stormwater as part of an integrated water cycle management approach. In Sydney, private utilities are servicing both new land release areas and high rise residential and commercial developments. In the lower Hunter, private sector operators estimate that a significant proportion of the projected new homes in the region could involve private sector services using decentralised recycled water systems.

Private operators have indicated they can provide innovative and affordable solutions, particularly to service new development areas that are remote from urban centres and existing water and sewerage infrastructure. Local examples include proposed new developments at Wyee and Catherine Hill Bay.

The *Lower Hunter Water Plan* recognises and supports the role the private sector can play in the water industry.

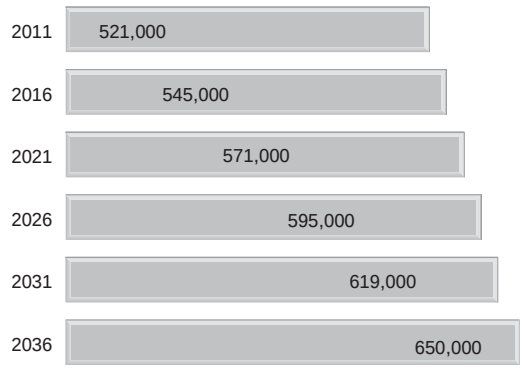
Demand for water in the lower Hunter

The lower Hunter's demand for water is currently around 67 billion litres a year on average. There are a number of factors that influence how much water we use and how this will change over time. Population growth and demographic changes, variations in the housing mix, the water efficiency of household appliances, and changes in business and industry use can all affect water demand. Changes in rainfall patterns also cause fluctuations in use from year to year.

Water demand forecasts for the lower Hunter take into account all these factors to estimate how much water we will use in the future. Water demand for the *Lower Hunter Water Plan* was modelled using historic usage patterns, together with predictions about population growth, business trends, and the ongoing adoption of water-efficient appliances and rainwater tanks.

Population growth is a key driver of residential water demand. The population in Hunter Water's area of operations is expected to reach around 650,000 by 2036, a 25 per cent increase since 2011.

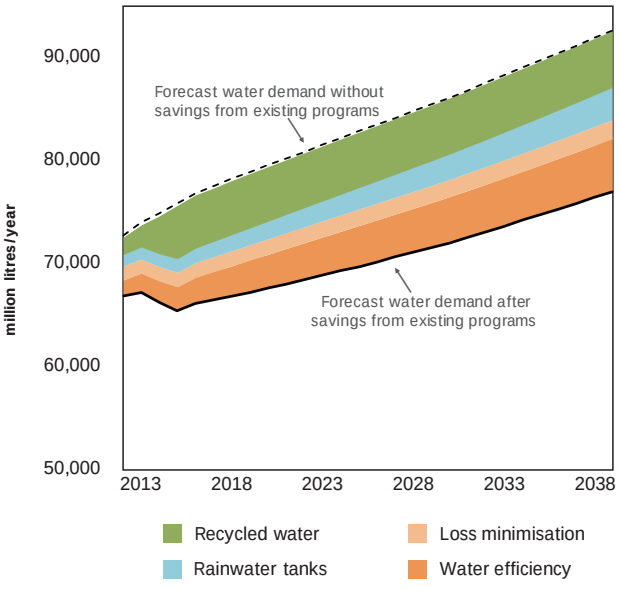
Estimated population served by Hunter Water Corporation



In the lower Hunter, water efficiency programs for households and businesses, adoption of water saving appliances, recycled water initiatives, changes in business and industry use, and water saving requirements for new houses mean the demand forecast is lower than it would otherwise have been. In fact, we are using about the same amount of water now as in 1970, even though around 200,000 more people now live in the region.

Existing water conservation programs are a very important part of the portfolio of measures that make up the *Lower Hunter Water Plan*. These programs include water efficiency, recycled water and rainwater tanks, which all contribute by reducing current and future water demand. This is illustrated in the graph below.

Reduction in water demand due to water conservation programs

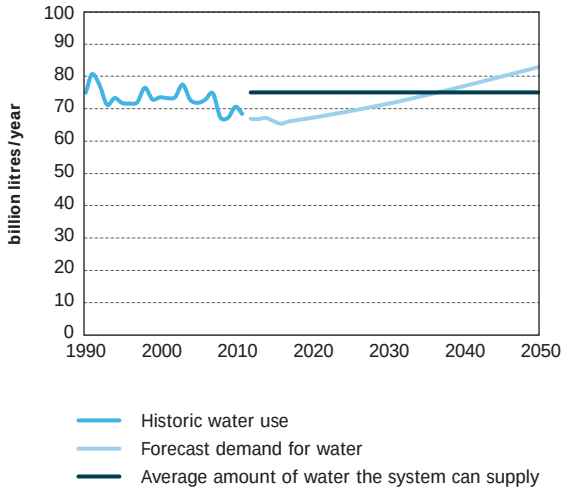


Balancing supply and demand

A key objective of water supply planning is to ensure there is enough water to meet the needs of households, businesses and the environment in the long term. Planners take into account the impact of uncertain climate patterns, service level objectives, and the operation of the water supply system to estimate the volume of water that can be supplied from the storages each year.

Our current water supply system can supply an average of around 75 billion litres of water each year to the people of the lower Hunter. Taking into account forecast population growth of just over 100,000, and water consumption trends, there will be enough water to supply the region for around 20 years under typical climate conditions.

Water supply and demand in the lower Hunter



It is important that we invest in new supplies only when they are needed. Deferring investment means we avoid 'gold plating' the system so the people of the lower Hunter are not paying for unnecessary infrastructure, and limited finances can be used for more immediate needs.

While we don't need to increase water supplies to meet long-term growth now, investigations into demand and supply options to meet growth will continue. When needed, these will be included in future plans for the region so new measures can be operational when they are needed.

Planning for drought

Although water supplies in the lower Hunter are sufficient to provide water to the community for the medium term, our water supplies are vulnerable to droughts because the storages are relatively small or shallow and water levels can fall quickly.

We need to plan for rare drought events because running out of water would have an enormous impact on the lives of people and on businesses in the region and on the State as a whole. Even though the chance of such a drought is extremely low, historical records show that the lower Hunter's climate is highly variable.

As the graph opposite shows, while the lower Hunter's storages tend to remain at between 80 and 100 per cent full most of the time, they can fall very quickly during droughts. Over the last 120 years, there have been four severe droughts – in the 1900s, the 1940s, the 1960s and the 1980s. The lower Hunter was not affected as badly as most other parts of NSW in droughts during the 1990s and 2000s.

Although they are rare, a severe drought can happen at any time, as was experienced with the 'millennium drought' in many regions of Australia - including our neighbours in Sydney and the Central Coast. In some areas, this drought was worse than any previously recorded. The lower Hunter was very fortunate to avoid water restrictions in the millennium drought because of a series of localised storm events, including the memorable *Pasha Bulker* storm in 2007.

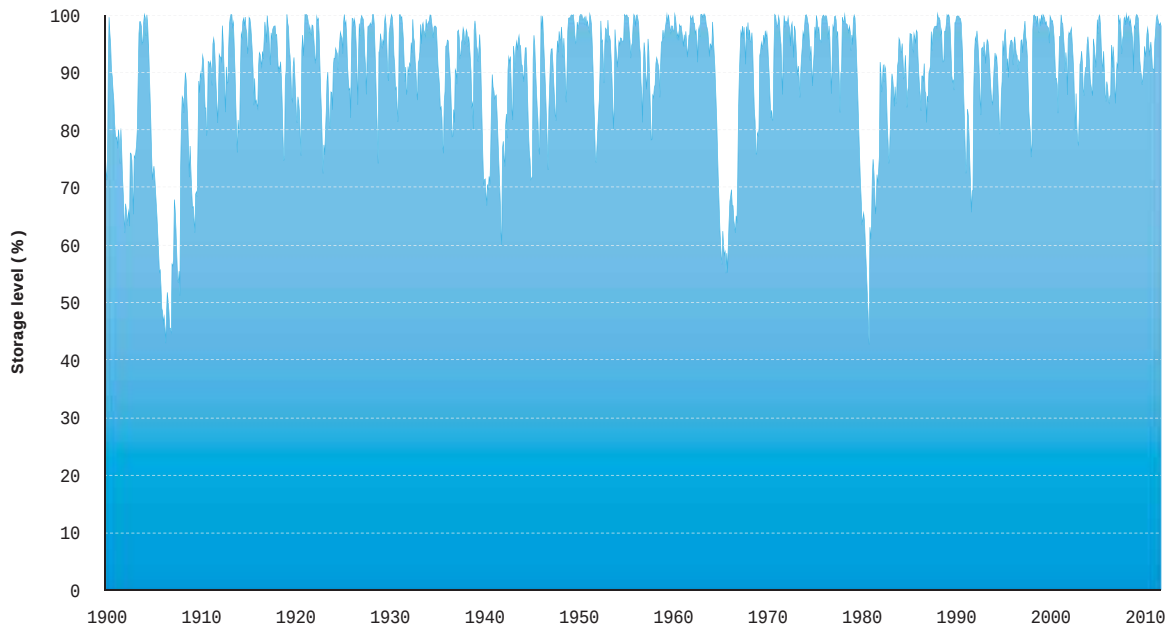
We don't know when droughts will occur, or how severe they will be, so it is important that we are ready with a range of actions that we can put into place quickly, if needed.

Some actions take longer to implement than others, because of design and approval processes and construction times. Planning for drought ensures we have time to respond to any drought that may come our way.

Drought portfolios need to include actions that can be put in place quickly, can be scaled up or down, and switched on or off as needed. Reducing dependence on rainfall, both through lower demand and a more diverse range of supply measures, also improves the resilience of the system to climatic variability.

Modelling for the *Lower Hunter Water Plan* demonstrated that, by implementing the measures outlined in the plan, our water supply system could withstand a drought significantly worse than any drought on record.

Simulated water storage levels in the lower Hunter
based on historic climate, current water storages and current demand



Implications of climate change

The impacts of future climate change on our weather patterns and water supplies are still unclear, however it is not expected that it will have any significant impact on water supplies over the planning period for the *Lower Hunter Water Plan*.

The NSW Government is involved in a number of research projects related to the potential impact of climate change on rainfall and runoff and how that may affect future water security for the metropolitan regions of NSW.

As climate predictions for these regions continue to improve, the latest research findings will be included in the water supply modelling so we can better incorporate the potential impacts into our future planning.

Developing the plan

A collaborative process

The Metropolitan Water Directorate led a whole-of-government process to develop the *Lower Hunter Water Plan*. This collaborative approach has ensured consistency between the plan and other policies, including the *Lower Hunter Regional Growth Plan* being developed by the Department of Planning and Infrastructure. This approach has also ensured the needs of the environment have been considered along with the needs of water users in the region, through environmental regulations and the water sharing plans for the region's rivers.

Along with the Metropolitan Water Directorate, the government organisations involved in developing the plan were:

- Hunter Water Corporation
- Department of Premier and Cabinet
- NSW Treasury
- NSW Office of Water
- Office of Environment and Heritage
- Environment Protection Authority
- Department of Primary Industries
- Department of Planning and Infrastructure
- NSW Health
- NSW Public Works
- Gosford City Council and Wyong Shire Council (for the Central Coast Water Corporation).

Planners also worked in close consultation with the community and other stakeholders to develop the plan, so their values, priorities and preferences could be incorporated into decision-making.

Community members and representatives from a range of stakeholder groups were involved in four sets of workshops from December 2012 to September 2013.

The workshops were held at key points throughout the planning process and are described below.

December 2012

In the first round of consultation, participants identified a set of community and stakeholder values about water planning (see box below). These values acted as a reference point for developing the plan, as well as feeding into the assessment of options from the community's point of view.

February 2013

The second round of consultation involved discussion about the latest demand forecast and the broad categories of supply and demand measures.

April / May 2013

In the third round of consultation, the short-listed options being considered for the plan were discussed in more detail. Workshop participants provided feedback on the options and explored the concept of portfolios by working in groups to develop 'sample portfolios' that reflected the community values.

Feedback from these workshops, along with technical information and expert input, was then used in the multi-criteria analysis to help the planning team rank the options.

September 2013

A public discussion paper was released in August 2013 as supporting information for a fourth round of consultation. The discussion paper outlined the process for developing the plan and invited feedback on a short-list of six portfolios.

At the workshops, participants discussed the differences among the portfolios and considered trade-offs among cost, environmental and drought security features.

A similar workshop with representatives of the Aboriginal community expanded the community values to include cultural perspectives and provided feedback on the portfolios.

This feedback was used to support a decision on the final portfolio for the *Lower Hunter Water Plan*.

Community values for water planning

In addition to the overarching value of 'a process we can trust', the community values developed through the workshops were:

- sustainable solutions and water conservation
- a fair and affordable system
- safe, healthy water for all uses
- protecting the natural environment
- a secure, reliable supply for all
- a strategic, balanced and adaptable plan
- investing dollars wisely
- respecting the Aboriginal cultural value of 'life water'

Community engagement workshop

In 2012, the NSW Government established a new Independent Water Advisory Panel of water experts drawn from a range of disciplines to provide independent strategic and technical advice on urban water planning for the lower Hunter and greater Sydney regions. The independent panel provided valuable input throughout the planning process.

The planning framework

The planning framework for the *Lower Hunter Water Plan* was consistent with the National Urban Water Planning Principles adopted by all Australian governments (see box below).

A portfolio approach underpinned development of the plan. A portfolio is a set or sequence of water management measures, timings and rules. The portfolio approach involves building and analysing combinations of supply and demand measures (including those already in place) to achieve the best mix for delivering a secure water supply.

Drought response portfolios considered for the *Lower Hunter Water Plan* were made up of different measures to be implemented as water storage levels fall. Lead times for design, approvals and construction were taken into account when developing and analysing portfolios. The discussion paper *Building the Lower Hunter Water Plan* provides more detailed information on the planning framework.

The planning framework considered opportunities for staging and flexibility to adapt to uncertainties like climate change, population growth and new technologies over the life of the plan, using an approach that economists call 'real options' thinking. This approach aims to keep options open as long as possible to achieve efficient investment decisions.

National Urban Water Planning Principles

National principles for urban water planning should be universally applicable when developing plans to manage the supply/demand balance of a reticulated supply for an urban population.

Key principles to achieve optimal urban water planning outcomes are:

- **Deliver urban water supplies in accordance with agreed levels of service**
- **Base urban water planning on the best information available at the time and invest in acquiring information on an ongoing basis to continually improve the knowledge base**
- **Adopt a partnership approach so that stakeholders are able to make an informed contribution to urban water planning, including consideration of the appropriate supply/demand balance**
- **Manage water in the urban context on a whole-of-water-cycle basis**
- **Consider the full portfolio of water supply and demand options**
- **Develop and manage urban water supplies within sustainable limits**
- **Use pricing and markets, where efficient and feasible, to help achieve planned urban water supply/demand balance**
- **Periodically review urban water plans**

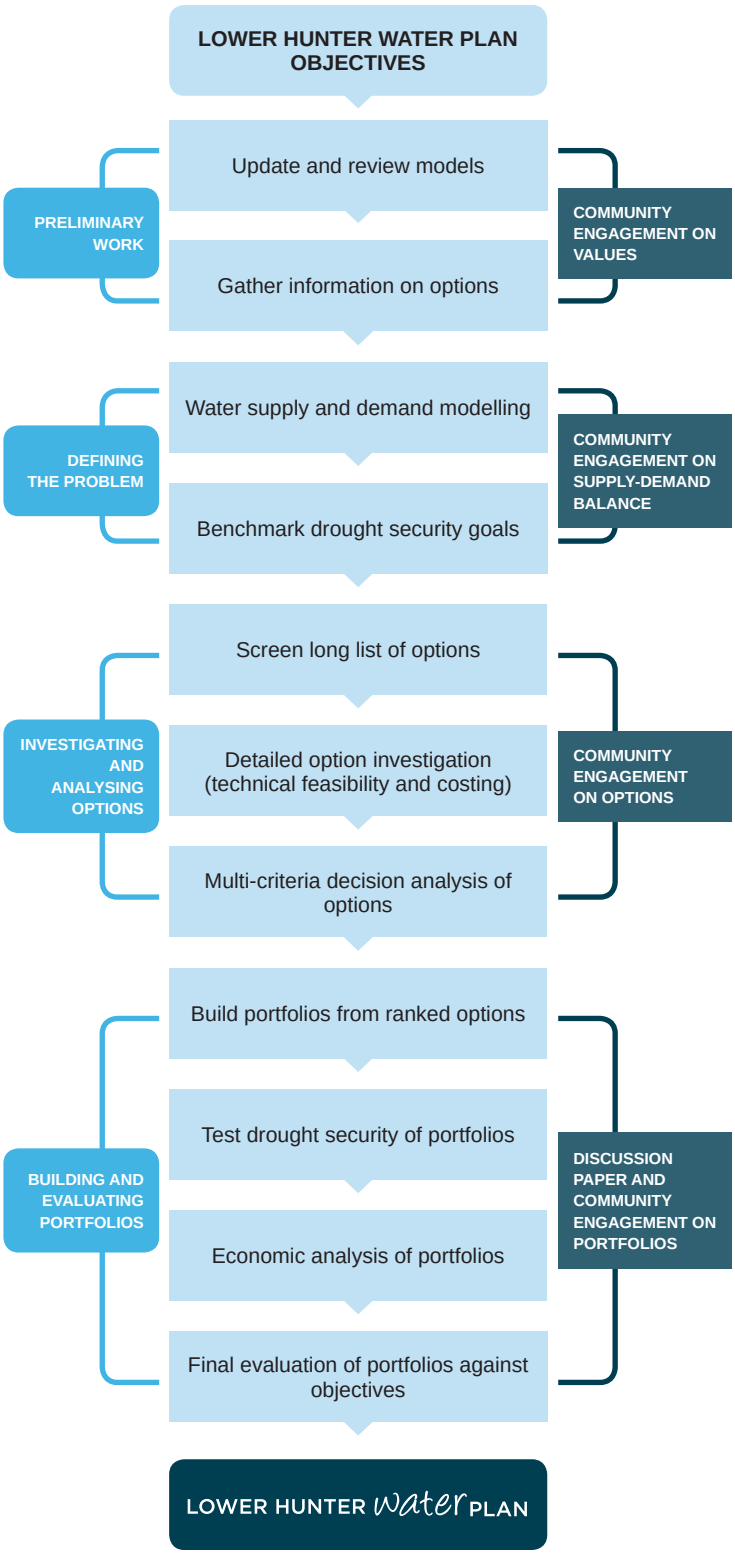
www.environment.gov.au/water/policy-programs/urban-reform/nuw-planning-principles.html

The key steps in the planning process that supported the decision on the final portfolio, or mix of measures, that make up the *Lower Hunter Water Plan* were:

- defining water supply needs by forecasting demand over the planning period and modelling water supply and drought scenarios
- testing the feasibility of identified water supply and demand measures through technical investigations and costing
- understanding the values of the community and stakeholders relating to water planning for the lower Hunter
- ranking the short-list of measures through analysis of economic, social, environmental and risk factors, including input from the community on how the options related to their values
- building portfolios and modelling them to understand the level of drought security they can provide
- cost-effectiveness analysis using a probabilistic model to compare the costs of portfolios under a large number of potential climate scenarios
- seeking the community's feedback on portfolios through a discussion paper and a series of workshops
- identifying the mix of measures for the *Lower Hunter Water Plan* through a final assessment of portfolios based on economic, social, environmental and risk factors.

The overarching framework to support a decision on the preferred portfolio for the *Lower Hunter Water Plan* involved 'multi-criteria decision analysis'.

Multi-criteria decision analysis brought together the outcomes of the detailed water supply system modelling and the economic analysis with feedback from the community and a qualitative environmental assessment. It allowed planners to consider the multiple objectives of the *Lower Hunter Water Plan* in an open and transparent way and involve the community and stakeholders in this process.



Multi-criteria analysis was applied at several points through the planning process. It was used to assess and compare individual measures based on five criteria – cost per unit of drought security, environmental impact, consistency with community values, flexibility to respond to change, and certainty of implementation. Measures were ranked based on this analysis and the ranking was the starting point for building portfolios. At the portfolio stage, portfolios were assessed based on cost, risk, social and environmental outcomes.

Two key inputs into the analysis of portfolios were the *hydrological modelling*, to determine their drought security and the *economic analysis*, to compare their costs.

The drought security of each portfolio was estimated using Hunter Water's Source Model (SoMo) - a sophisticated computer model that represents how the water supply system, including any new measures, will perform under different climate conditions.

By generating hundreds of thousands of potential climate scenarios, including droughts more severe than any we have experienced, the model can estimate the probability of running out of water.

Portfolios being considered for the *Lower Hunter Water Plan* were modelled in SoMo to test the chance that storage levels would fall below ten per cent (which is effectively empty) over the planning period. Only portfolios with a very low probability (between 1 in 40,000 and 1 in 100,000) were retained for further analysis. As discussed above, this was because the probability of running out of water may be very low, but the consequences would be extreme for the people and businesses of the lower Hunter region.

The costs of portfolios were then analysed using the total expected present value cost of each portfolio, based on a probability of triggering investment across a large range of possible climate scenarios.

Inputs to this analysis included:

- the capital (upfront) and operating (ongoing) costs
- the volume of water supplied or saved
- the lead times for implementing options within the portfolios.

The non-monetary cost of experiencing water restrictions was also included in the analysis. This value was estimated through a 'choice modelling' study to estimate the community's willingness to pay to avoid drought restrictions for all households. The benefit of reducing the restrictions estimated in the study was minimal and did not impact significantly on the portfolios considered. This is discussed further in Chapter 5.

The multi-criteria decision framework brought together the outcomes of the hydrological and economic analyses, along with assessment of environmental impacts by expert planners. The outcomes from the community engagement workshops and consultation with Aboriginal community representatives were also incorporated into the decision on the final mix of measures for the plan.

Introducing the measures in the plan

The following chapters outline the portfolio of measures adopted for the *Lower Hunter Water Plan*:

2 Existing dams and sharing water

3 Making use of underground water

4 Water efficiency makes the most of the water we have

5 Demand management encourages less water use

6 Water recycling helps save our drinking water

7 Capturing rain and stormwater

8 A contingency measure that doesn't depend on rain

Looking to the future

Actions to monitor and evaluate the *Lower Hunter Water Plan* and guide an adaptive approach to future plans include:

- monitoring population projections and changes in water demand
- monitoring and reviewing ongoing climate change research to better understand the implications for the lower Hunter's water supplies
- monitoring research into new technology and innovative water management practices
- liaising with the NSW Office of Water on implementing changes to environmental flow rules for the region's river systems in accordance with water sharing plans
- investigating long term water demand and supply options for future plans
- continuing the partnership with the community for future water plans.

'The most useful part of these workshops was listening to different opinions and views with representatives from community, industry, government, and environment groups.'

COMMUNITY COMMENT
CONSULTATION WORKSHOP 2013

Existing dams and sharing water

Dams play a vital and ongoing role in supplying drinking water for the lower Hunter region. Around 90 per cent of the region's drinking water supply comes from Chichester Dam and Grahamstown Dam, with the other ten per cent supplied from groundwater. These amounts can vary from year to year.

Hunter Water manages the dams, and works in partnership with Hunter Local Land Services, local councils, landholders, government agencies and other stakeholders to protect the health of the drinking water catchments.

Water can also be transferred between the lower Hunter and Central Coast water supply networks under an agreement developed in 2006, when the Central Coast experienced a severe drought. The ability to transfer water between the two regions will continue to be important in making best use of existing dams to benefit the communities in both regions.

Contribution of dams to our water supply

Chichester Dam

Chichester Dam has supplied the lower Hunter community with water for 90 years. The dam was built between 1917 and 1926, and first supplied water to the community in 1923.

The dam's catchment is largely within the Barrington Tops National Park, which is a declared wilderness area. As a result, the catchment is one of the most pristine in Australia, with large areas unaffected by human activity.

Chichester Dam

Chichester Dam can store over 18 billion litres of water. A gravity pipeline transports water to the Dungog Water Treatment Plant. Around half the water from the dam is supplied to the Maitland, Cessnock and Beresfield areas. The rest is supplied to Newcastle, where it blends with water from Grahamstown Water Treatment Plant.

The cost of supplying water from Chichester Dam is the lowest of all Hunter Water's sources, largely because water can be transported by gravity rather than pumping, using less electricity. The dam is small compared with its large catchment so it readily 'fills and spills' after medium to heavy rainfall, with water flowing over the spillway and down the river.

As a result of its reliability and low cost, water from Chichester Dam is used as often as possible. Averaged over the last ten years, the dam has supplied around 38 per cent of the region's water supply, as shown in the pie chart overleaf.

Grahamstown Dam

Grahamstown Dam was built between 1955 and 1965 and is the lower Hunter's largest drinking water supply dam. It can store around 182 billion litres of water.

Grahamstown Dam is called an 'off-river storage' because it is filled by pumping water from the Williams River at Seaham Weir, in addition to rainfall on its surface and run-off from its own catchment.

Due to its large surface area and shallow depth, a lot of water can be lost through natural processes like evaporation. In a hot dry summer, Grahamstown Dam can lose as much water by evaporation as it supplies to customers (about 200 million litres per day). Although early investigations looked at ways of covering the surface of the dam to reduce evaporation, the current

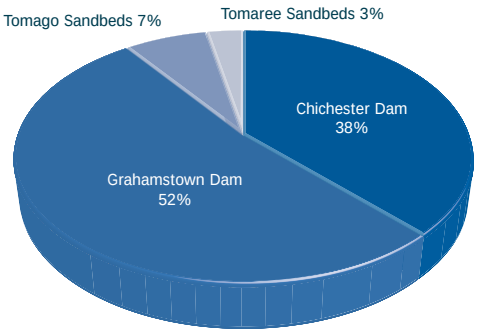
Grahamstown Dam

technologies are not viable because of the very large surface area of the water storage. Changes in technology will be monitored in case the feasibility changes in the future.

The Balickera pump station and canal are used to transfer water from the Williams River to Grahamstown Dam. The decision on when to pump from the Williams River depends on the amount of flow and water quality in the river, and whether there is space in the dam. The water licence issued by the NSW Office of Water sets rules on how and when water can be pumped.

Water from Grahamstown Dam is treated at Grahamstown Water Treatment Plant before being pumped to supply areas such as Medowie, Stockton, Kooragang Island, Newcastle and Lake Macquarie. Over the last ten years, Grahamstown Dam has supplied an average of around 52 per cent of the region's water supply.

Water supply sources
Average contribution from 2003/04 to 2012/13



Protecting the aquatic environment

Dams and weirs affect the natural flow of water in rivers and streams. To help lessen these impacts, some water is released from the storages back into the river downstream of the dam. These releases are called environmental flows. They help maintain the ecology and biodiversity of ecosystems that depend on water. Environmental flows are in addition to the flows that naturally spill when the dam fills in high-flow events.

Fishways can also be built at dams and weirs to allow fish to move up and down stream.

Chichester Dam and Seaham Weir are licensed by the NSW Office of Water. The water licences include conditions called 'environmental flow rules' which aim to help protect aquatic health by providing a share of water for the downstream environment.

Proposed refinements to environmental flow rules for Chichester Dam and new conditions for Seaham Weir have been modelled in parallel with developing the *Lower Hunter Water Plan*. This is important because environmental flows affect how much water is available for the water supply system. The proposed changes to the environmental flow rules aim to achieve more variability in flows to reflect natural wetting and drying conditions instead of a steady flow. This approach is consistent with the changes to environmental flow rules proposed by the NSW Office of Water for other rivers in the Hunter region.

A fishway to allow for fish passage

Mangrove Creek Dam

Sharing water between regions

Helping neighbours in a drought

In the early 2000s, the Central Coast experienced its worst drought since records began in 1885. The water level in the main storage, Mangrove Creek Dam, dropped to around 10 per cent in early 2007. The lower Hunter storages were relatively full due to a series of weather events called 'east coast lows' that brought significant rain to our catchments. These weather events include the *Pasha Bulker* storm in 2007.

The lower Hunter was able to supply water to the Central Coast to help maintain supplies through that extreme drought. An agreement was signed in 2006 to transfer water between the regions, with the daily transfer rates depending on the storage levels in each region.

The Central Coast water supply system

The main Central Coast water storages are the large Mangrove Creek Dam (190 billion litres) and the smaller Mardi and Mooney Mooney Dams. Water treatment plants located at Somersby and Mardi treat water from the dams to meet drinking water guidelines.

Since the last drought, over $100 million was invested by Gosford and Wyong councils and the Commonwealth Government to improve the security of the Central Coast's water supplies. Completed in 2012, the new pipeline and pumping stations allow more water to be pumped into Mangrove Creek Dam from Wyong River and Ourimbah Creek, so the region has more resilience for future droughts.

How does the transfer link work?

The lower Hunter and Central Coast water supply systems are connected by a pipeline linking reservoirs at Morisset and Kanwal. This link can transfer up to 33 million litres of treated drinking water per day south to the Central Coast water supply network.

The transfers do not move water between dams, as it is more efficient to simply transfer water between the two drinking water supply systems. For example, Hunter Water can supply the northern customers of the Central Coast. When this occurs, less water would need to be drawn out of Mangrove Creek Dam. Similarly, when water is transferred north from the Central Coast to supply Hunter Water customers in south-western Lake Macquarie, more water can remain in Grahamstown Dam.

At present only 13 million litres of water a day can be transferred north to the lower Hunter network. Wyong Shire Council is planning to construct a new pipeline from Mardi to Warnervale which will supply Central Coast customers in the Warnervale area and also meet commitments under the existing transfer agreement.

When this pipeline is completed in around 2017, the capacity to transfer water north to the boundary of the lower Hunter system will increase to 30 million litres a day.

Hunter Water will also need to modify its water supply system to remove 'bottle-necks' in order to receive 30 million litres a day of water from the Central Coast. This involves building a new pipeline, constructing a new water pumping station at Wangi, and modifying the existing water pumping stations at Morisset and Fennell Bay.

The price for water transferred under the existing water transfer agreement between the two regions is set by the Independent Pricing and Regulatory Tribunal. The water quality would be similar, as both water utilities must treat the water to meet the *Australian Drinking Water Guidelines*.

Constructing the Hunter – Central Coast pipeline

Transferring water between regions is a core component of the *Lower Hunter Water Plan*. The existing two-way agreement with the Central Coast can facilitate better use of existing storages, so that both regions are more resilient to cope with drought.

A 'watching brief' on other options

Lostock Dam is located on the Paterson River approximately 93 kilometres north-west of Newcastle. The dam is managed by State Water and can store around 20 billion litres of water when full. It supplies water for agricultural irrigation, but the volume of water available is not used to its full capacity.

If the lower Hunter region were to access water from Lostock Dam for drinking water supply in the future, a new water treatment plant and pipeline to connect to the existing water supply network near Maitland would be required. Transferring water from Lostock Dam has not been included in the *Lower Hunter Water Plan* at this time because the higher cost and longer lead time to construct the infrastructure required make it less suitable as a drought response compared with other measures. The potential to access water from Lostock Dam may be revisited in future planning processes.

It is important to note the NSW Government has ruled out building Tillegra Dam and it is not an option for future supply.

What would happen in a drought?

The two-way connection between the lower Hunter and Central Coast drinking water networks can provide additional water during drought to customers in either region. The daily transfer rate depends on water levels in the storages in each region, up to the maximum rate set by the agreement. For example, if storages in the lower Hunter were dropping, Hunter Water could purchase water from the Central Coast, allowing more water to remain in Grahamstown Dam for future use. Transfers would stop if the Central Coast storages were too low.

In a different drought scenario, Hunter Water could supply water to customers at the northern end of the Central Coast, as occurred in 2006-07.

Modelling indicates that there are different situations when each region can help the other. Transferring water between the Hunter and Central Coast helps to make better use of the combined water in existing storages, so both regions are more resilient to cope with drought.

In a very severe drought, both regions may be reduced to very low storage levels. This is why it is important for both regions to have other contingency plans in place for extreme events, which may be very unlikely but could have major consequences for the households and businesses in each region. These contingency measures can include supplies that do not depend on rainfall (discussed further in Chapter 8).

Looking to the future

- Wyong Shire Council and Hunter Water will construct new pipelines and water pumping stations to increase the transfer capacity so that up to 30 million litres a day of water can be transferred north in accordance with the existing water transfer agreement. This work is currently planned to be completed in 2017.
- The Central Coast councils and Hunter Water will continue working together to improve the modelling tools that simulate what would happen under different drought scenarios, and optimise the arrangements for inter-region transfers. A new integrated water supply model will provide better information to optimise the existing transfer arrangements, and support opportunities to work together on options for both drought and future longer-term planning.
- The Metropolitan Water Directorate, Central Coast councils and Hunter Water will continue working together on options to enhance the existing transfer agreement to benefit both regions. Options include the potential to consider transferring water outside drought periods, if one region has plentiful supplies and the other region's storages are lower, or increasing the transfer capacity between the regions. The aim would be to optimise the combined storage levels so that both regions are in a better position if a drought occurs.
- The NSW Office of Water (NOW) is responsible for implementing environmental flow rules through regulatory instruments such as water sharing plans and water licences. NOW will continue to consult with key stakeholders in the lower Hunter and Central Coast as relevant water sharing plans in the two regions are reviewed, and environmental flow rules are refined and implemented.

'Inter-regional transfers make use of some existing infrastructure and are a good flexible long term investment.'

COMMUNITY COMMENT
CONSULTATION WORKSHOP 2013

Making use of underground water

Groundwater plays an important role in the drinking water supply system for the lower Hunter region. In the last ten years, an average of around ten per cent of the region's drinking water supply has been sourced from the Tomago and Tomaree sandbeds, but the amount varies from year to year and can be as high as 30 per cent.

Investigations are continuing into other potential sources of groundwater which might be suitable to access in a drought.

Contribution of groundwater to our water supply

Tomago sandbeds

The Tomago sandbeds catchment covers an area of 109 square kilometres from Tomago to Lemon Tree Passage. Most of the catchment is a State Conservation Area. There are a number of ecosystems in the area that depend on access to groundwater, including trees and other plants, wetlands, and coastal sand dune systems.

The aquifer can store approximately 100 billion litres of water above sea level. It is refilled by rain that falls directly on the sand surface. The sandbeds are around 20 metres deep on average, but reach a depth of 50 metres in some places.

Hunter Water may access up to around 60 billion litres in accordance with a licence issued by the NSW Office of Water.

Water is extracted from the Tomago sandbeds using a network of bores and vacuum stations, before being treated at the main Grahamstown Water Treatment Plant. A small treatment plant at Lemon Tree Passage also supplies water extracted from the sandbeds to the north-eastern areas of Tanilba Bay, Karuah and Lemon Tree Passage.

When the water in the sandbeds drops to a set level, pumping from the sandbeds must stop to minimise potential impacts on the ecosystems that depend on the groundwater. Coastal groundwater systems also need to be managed carefully to avoid the risk of fresh groundwater being impacted by contamination with salt water from the sea.

The *Water Sharing Plan for the Tomago Tomaree Stockton Groundwater Sources* is currently under review, and the new plan is expected to commence in July 2014.

Tomaree sandbeds

The sandbed systems within the Anna Bay and Nelson Bay areas are located within the protected area of the Tomaree National Park, with a catchment area of around 16 square kilometres.

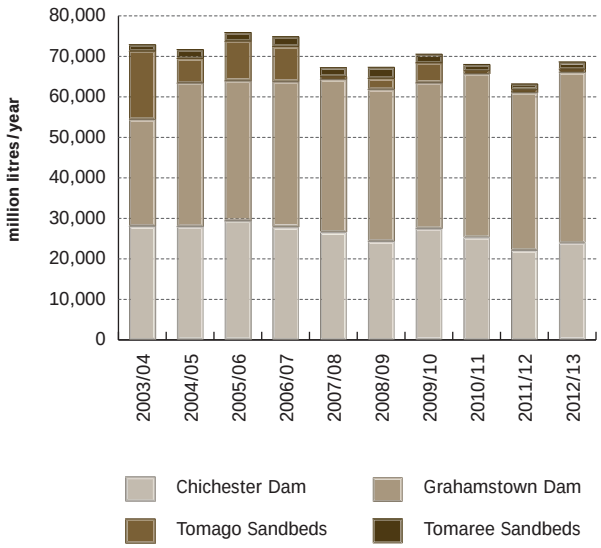
The Tomaree sandbeds can store about 16 billion litres of water. The system can supply around seven million litres of water a day to the local area, after treatment at either the Anna Bay or Glovers Hill Water Treatment Plant. If needed, additional water can be supplied to the Tomaree peninsula via a pipeline from the Grahamstown Water Treatment Plant.

A bore pump at Tomago

What would happen in a drought?

In normal climate conditions, the Tomago groundwater source can reduce the water needed from the surface water sources of Chichester Dam and Grahamstown Dam. In recent years, around ten per cent of the region's drinking water supply has been sourced from the Tomago and Tomaree sandbeds on average, although this can be as high as 30 per cent. The variation from year to year is illustrated in the graph below.

Surface and ground water sources
Annual extraction from 2003/04 to 2012/13



The Tomago groundwater source is a particularly valuable reserve to supplement supplies from other sources in a drought. In a severe drought it may be viable to access new sources of groundwater. This is discussed further below.

Aerating groundwater from Tomago sandbeds

Groundwater from the Tomago and Tomaree sandbeds will remain an important source of drinking water for the region, in normal climate and in drought.

A 'watching brief' on other options

As part of the technical investigations for developing the *Lower Hunter Water Plan*, studies were initiated into other potential groundwater sources.

These included the Lower Hunter Alluvial groundwater source, near the junction of the Hunter and Paterson Rivers in the Morpeth-Bolwarra area. Investigations have only reached a preliminary stage, and further work is required into the feasibility of this potential new source of groundwater to understand if it could be used to boost supplies in a drought.

There are thought to be three separate aquifers in the Lower Hunter Alluvial groundwater source. The shallowest is located approximately six metres below the ground surface. Two deeper aquifers may lie at depths greater than 20 metres below the ground surface. Investigations are focusing on identifying the deeper aquifers, and if they are found, further investigations into available volumes and water quality would be needed.

If the Lower Hunter Alluvial groundwater source is found to contain suitable water, further studies would be required before it could be considered as a viable drought option. Any future drought water supply would require planning for a small borefield and supporting infrastructure to be installed, and some form of water treatment plant, depending on the water quality.

Another option that may be further explored is the potential to treat and use groundwater pumped out of underground coal mines on the western side of Lake Macquarie.

At this time, use of mine water is not considered suitable for drought contingency planning. During investigations for the *Lower Hunter Water Plan*, it became clear that occasional use of the water during a drought would not suit mining operations, due to the need to pump water

out of the mine continuously. As there are no significant opportunities near the mine water source to use the water for non-drinking purposes, the main benefit from this potential future source would be achieved if it could be used for drinking water.

To be suitable for use as drinking water, the groundwater would require treatment to meet the *Australian Drinking Water Guidelines*, and the process would need to be acceptable to NSW Health. Preliminary investigations considered a conventional water treatment plant followed by desalination using reverse osmosis.

Modelling indicated that continuous use for drinking water supply would incur much higher costs for treatment and pumping into the water supply system compared with other options outlined in the *Lower Hunter Water Plan*.

Looking to the future

- Groundwater from Tomago sandbeds will remain an important source of drinking water for the lower Hunter region, in normal climate and in drought.
- The *Water Sharing Plan for the Tomago Tomaree Stockton Groundwater Sources* is being reviewed by the NSW Office of Water, and a new water sharing plan is expected to commence in July 2014. Any changes arising from the review process will need to be considered as part of an adaptive management process for the *Lower Hunter Water Plan*.
- Other potential new sources of groundwater supplies will continue to be investigated, focusing on the Lower Hunter Alluvial in the short term.
- Using water from underground coal mines may be further investigated, in consultation with NSW Health and other interested stakeholders.

Water efficiency makes the most of the water we have

The total amount of water used by households and businesses in the lower Hunter is now less than it was 40 years ago. These savings have been achieved through a combination of:

- 'user pays' pricing, introduced in 1982, so that customers pay more if they use more water
- household water efficiency measures, achieving significant reductions in water use per person
- various changes in business use, including water efficiency measures, water recycling, and the closure of some major industries (including BHP Steelworks).

The lower Hunter region now uses about the same amount of water on average as it did in 1970, although the population supplied by Hunter Water has grown by around 200,000.

Water efficiency programs saved around 1.2 billion litres of water in 2012/13. Water efficiency initiatives include programs to:

- help customers save water in the home by using more water-efficient appliances
- assist businesses and schools to use water more efficiently
- minimise leakage from the water supply system.

During a drought, additional measures to reduce water use and help our water storages last longer include drought restrictions, and further water efficiency and loss minimisation programs.

We all have a part to play

Household water use accounts for about 56 per cent of total water used in the lower Hunter. As shown in the pie chart, this is made up of around 49 per cent used by customers living in houses, and seven per cent by those living in flats and units.

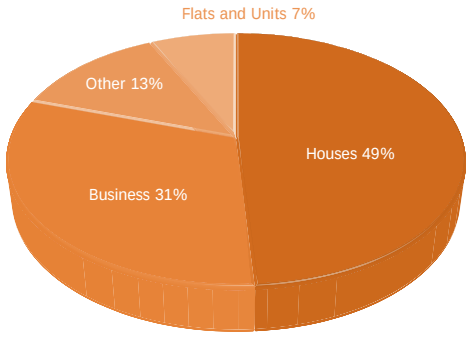
The remaining 'non-residential' customers include industries, businesses, office buildings, schools, hospitals, shopping centres, hotels, restaurants, councils and recreational facilities. For simplicity, we will call these collectively 'business customers'. Business customers currently account for about 31 per cent of the water used in the lower Hunter region.

The remaining 13 per cent (labelled 'other' in the pie chart) includes water used by Hunter Water and for firefighting, together with water leakage and metering errors.

There has been a gradual change in the share of water used by household and business customers over the last 25 years.

Before 1990, households used less water than businesses. With population growth and changes in the regional economy, households now account for a larger proportion of water use.

Breakdown of water supplied to customer groups by Hunter Water in 2012-13

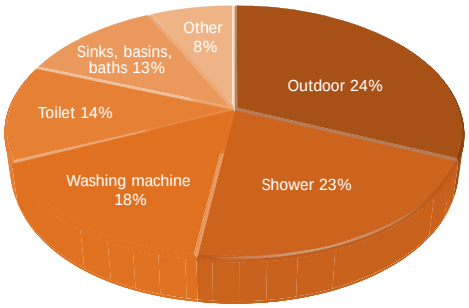


Household water efficiency

With households accounting for more than half of the water use in the lower Hunter, household water efficiency programs will continue to play a vital role in saving water both inside and outside the home.

Understanding where water is used in the home can help target programs to improve water efficiency. The pie chart shows the typical breakdown of water use for a household.

Where households typically use water



Increases in indoor water efficiency will continue to be achieved by householders installing water-efficient shower heads, tap aerators and dual flush toilets, together with more water-efficient washing machines and dishwashers. Initiatives to save water outdoors include using a trigger nozzle on garden hoses and choosing plants that need less water.

Water efficiency programs for households offered by Hunter Water currently include:

- *Showerhead exchange program* – this program is run in conjunction with local councils. Customers can take their old showerhead to an office of Hunter Water or their local council, and exchange it for a more water-efficient showerhead. There are two options, one is free and the other is available at a cost of $50 (a saving on the recommended retail price of $199). Water savings from using a more efficient shower head are estimated at over 25,000 litres each year, reducing both water and energy bills.
- *Hunter Region No Interest Loans Scheme* – Hunter Water provides financial support to help low income customers who meet certain conditions to buy a water-efficient washing machine.

More information on these programs can be found at: www.hunterwater.com.au/Save-Water/Save-Water-Initiatives/

Exchanging a showerhead

Water efficiency measures have been implemented by many households in the lower Hunter, as indicated in a survey conducted by the Hunter Valley Research Foundation in 2011. The survey found that for the households that responded:

- 90 per cent had dual flush toilets
- 80 per cent had installed water-efficient showerheads.

Figures for the uptake of water efficiency programs suggest some may be reaching their full potential. However, water efficiency savings in households will continue through further technology improvements in water-efficient appliances, together with two main initiatives at national and state level - the national Water Efficiency Labelling and Standards (WELS) scheme and the Building and Sustainability Index (BASIX) – see box at right.

> With households accounting for more than half the water used in the lower Hunter region, household water efficiency programs will continue to play a vital role in saving water inside and outside the home.

Water Efficiency Labelling and Standards (WELS) scheme

The WELS scheme, which began in 2005, enforces mandatory ratings and labelling for a range of appliances and fittings, and develops minimum performance standards for products.

As new water-efficient appliances and fittings are released to retailers, customers are encouraged to purchase these new products when their existing, less efficient ones need replacing.

By 2021, it is estimated that using water-efficient products will help reduce domestic water use across Australia by more than 100 billion litres each year. The main savings are being achieved from more efficient showers, washing machines and toilets.

More information can be found at www.waterrating.gov.au/**. The WELS website has a wide range of information for industry and consumers, including advice on how to compare the water efficiency ratings of appliances.**

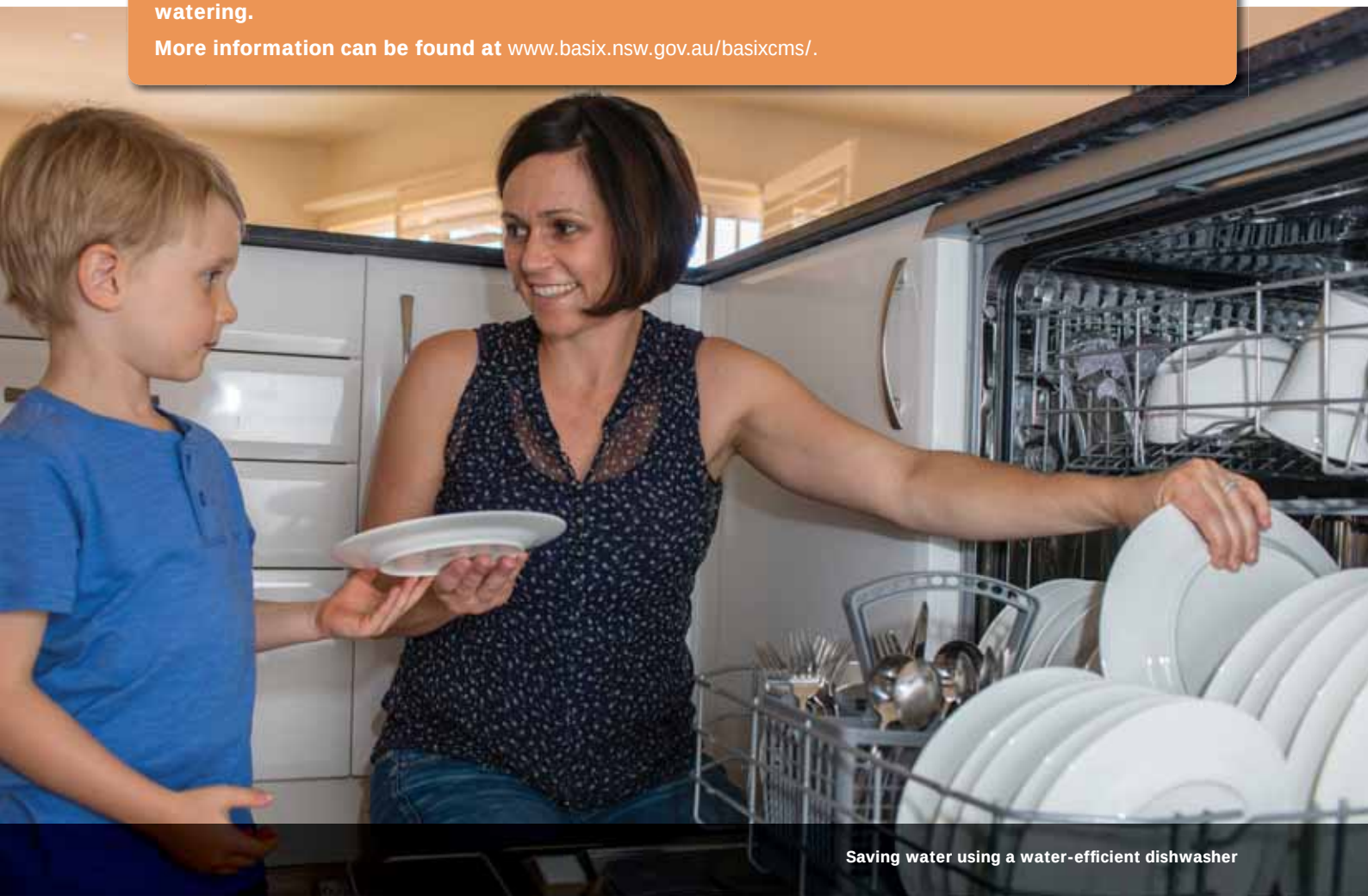
Building and Sustainability Index (BASIX)

Since 2005, BASIX has applied to all new homes in NSW, aiming to reduce water and energy use across the state. BASIX is a planning policy that ensures new residential properties are designed to use less drinking water. BASIX also applies to housing alterations and additions worth over $50,000. New or altered homes must achieve a 40 per cent reduction in drinking water use, compared with a pre-BASIX statewide benchmark of 90,340 litres of water per person each year (or 247 litres a day for each person).

Homes can meet BASIX requirements by using water efficient appliances and installing a rainwater tank. Where available, BASIX can be met by connecting to a supply of recycled water.

A review of BASIX certificates for the lower Hunter found that 97 per cent of certificates indicated connection to a rainwater tank, with connection to a recycled water scheme accounting for the remaining three per cent. Most tanks had a volume in the range 3000 - 5000 litres, and more than 90 per cent of homes connected their rainwater tanks for toilet and laundry end uses as well as garden watering.

More information can be found at www.basix.nsw.gov.au/basixcms/.



Saving water using a water-efficient dishwasher

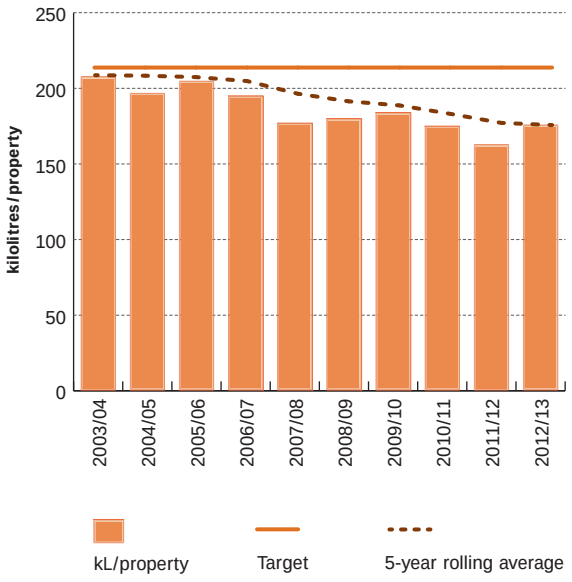
Water conservation target

Hunter Water's Operating Licence includes a water conservation target for annual residential water consumption to be equal to or less than 215 kilolitres (1 kilolitre = 1000 litres) a year for each residential property, based on a five-year rolling average. As shown in the graph below, the average has been trending downward since 2005/06, although some fluctuations occur due to climate variability (ie, some years are wetter and some are drier).

The five-year rolling average is now 175 kilolitres per property, which easily meets the target. For comparison, Sydney's annual residential water use is around 190 kilolitres per property[2].

The downward trend reflects the benefits of water savings from household customers using water more efficiently and replacing older appliances with more efficient models as they wear out.

Annual water use by residential customers



Community education programs

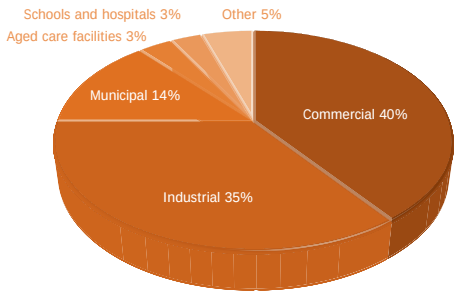
Since water saving starts with education and awareness, it is important for Hunter Water to play an ongoing role in helping educate the community about the many aspects of water supply, treatment and conservation. Current initiatives include:

- advertising campaigns which promote water efficient behaviour
- Hunter Water's website includes a dedicated 'Save Water' section that provides information on how to be water efficient in the home and garden
- contributing funding for the educational Bubbles and Supa Squirt Water Saving Show, catering for students from kindergarten through to year six
- contributing to the Australian Water Association's collaborative project to enhance water education resources linked to the school curriculum
- promoting water-saving products and gardening tips at relevant community events
- a community grants scheme that provides funding to community organisations for water conservation and educational projects
- promoting the national WELS scheme to encourage customers to choose household appliances that save both water and energy
- a new water education centre being constructed as part of the advanced water treatment plant for the Kooragang Industrial Water Scheme, to raise community awareness about sustainable urban water management and water recycling.

Business water efficiency

The breakdown of water use for key categories of business customers is shown in the pie chart below.

Breakdown of water use by business customers



2. Source: National Performance Report 2011-12: Urban Water Utilities, National Water Commission, March 2013

There are more than 20,000 businesses in the lower Hunter. Some small businesses use less water than a typical household, while others use a very large amount of water. The top 30 customers - who each use more than 50 million litres a year - together use more water than other business customers combined.

As part of its everyday operations, Hunter Water offers programs to help business customers reduce their water consumption by understanding and changing the way they use water, using equipment that is more water-efficient, investigating options for recycling, and reducing loss and waste.

The programs currently offered by Hunter Water to help businesses improve their water efficiency are:

- *Voluntary water audits* - subsidised audits are offered for major customers whose water use is over 30 million litres a year, leading to development of a Water Efficiency Management Plan
- *Hunter Water Business Savers Program* - provides a free water audit of amenities and commercial kitchens to 20 customers each year. The customer with the best water saving project is recognised with a prize at the Hunter Business Awards.

A wide range of businesses have already participated in the voluntary water audit and business saver programs. These include hospitals, aged care facilities, restaurants and clubs, food processing industries, educational facilities, sporting centres and holiday parks.

The existing programs will be expanded in a drought to try to achieve even more water savings. This is discussed later in this chapter, under the heading 'What would happen in a drought?'

Case Study 1: Hunter Water Business Savers

In 2012, the East Maitland Bowling Club was the winner of the Hunter Water Business Savers Award for their innovative ideas on water saving in the kitchen.

The Hunter Water Business Savers program aims to improve water efficiency in amenities and commercial kitchens for Hunter Water's business customers.

The East Maitland Bowling Club has replaced two existing water-cooled woks in their kitchen with air-cooled woks. They also installed two 10,000 litre rainwater tanks to use for irrigating the bowling greens.

The water savings from the project are estimated to be over three million litres per year.

As part of the Business Savers program, Hunter Water offers a prize of $10,000 towards water-efficient equipment upgrades, rainwater tank installation, recycling and grey water reuse projects. The projects are judged on water savings, cost effectiveness, innovation and appeal of the project for widespread adoption in the region.

Chef Ming Liang at East Maitland Bowling Club

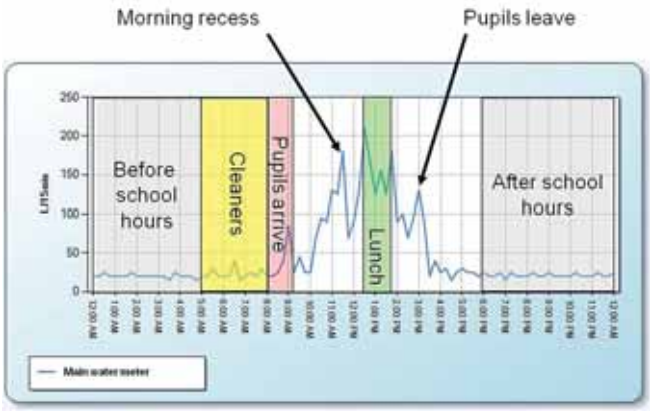
The program has been running since 2009 and has so far worked with 94 customers to identify 155 million litres of water saving opportunities, which would fill 62 Olympic sized pools.

Case study 2: Saving water in schools

A student monitors school water usage

To help local schools save money on their water bill, in 2013 Hunter Water provided 65 local schools with data loggers to connect to the school's water meter to track water usage in real time. The data loggers relay the information to an electronic portal that can be viewed by teachers, students, administrators, and Hunter Water staff in the water efficiency team.

The graph shows a typical trend in water use at a school during a normal day. Alerts can be set up through the online portal to be sent to mobile phones and/or email to advise if there is a spike in water usage overnight or on weekends, indicating a possible leak or vandalism.



Leaks are often in underground pipes and can waste many thousands of litres per day. Being able to respond quickly to such leaks can save schools thousands of dollars in water usage charges.

Minimising water lost through leaks

Hunter Water maintains the systems that deliver water to the people of the lower Hunter. Like all water supply systems around the world, the lower Hunter's water distribution system can lose water due to leaks and breaks. Leaks are caused by deterioration of joints and fittings, and by cracks in the pipes caused by ground movement or pressure changes.

Hunter Water's leak reduction programs use the latest methods and technologies to detect and repair hidden leaks and reduce the amount of water lost. The active leak detection program currently surveys around 1200 kilometres of water mains each year, so that the whole water supply system can be checked over a five-year cycle.

The main focus of activities to minimise losses from the water supply system involve:

- actively detecting and repairing leaks, using listening devices to survey the water supply network and identify hidden leaks before they would normally be seen and reported
- reducing pressure in the pipes in selected zones with higher pressure to reduce the frequency and volume of leaks.

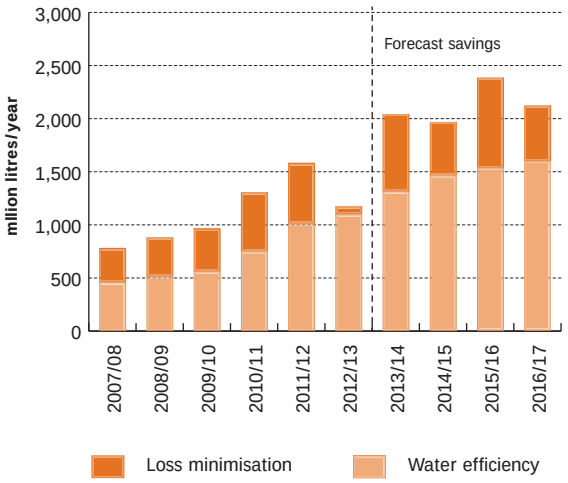
Water utilities compare their water loss performance using an international system called the 'Infrastructure Leakage Index', which shows how water losses compare with the theoretical lowest possible level of leakage that could be achieved by a water supply system. Hunter Water's performance is ranked in the 'excellent' category, along with all major Australian water utilities.

Leaks in pipelines on private property are the responsibility of the owner, and initiatives discussed in the water efficiency section can help customers find and reduce these leaks.

How much water is being saved?

Savings from water efficiency and loss minimisation programs have increased steadily in recent years, as shown in the graph at right. Over the next four years, the total water savings from these programs are estimated to total over 2000 million litres a year.

Estimated savings from Hunter Water's efficiency and loss minimisation programs



Note: The savings from the water loss minimisation programs in 2012/13 appear lower due to the timing of the contract for that year, resulting in most of the savings being recorded within the 2013/14 year.

What would happen in a drought?

Everyone has a part to play in improving water efficiency – household and business customers as well as Hunter Water. The water efficiency initiatives discussed above aim to reduce overall water use and help our water storages to go further. In a drought, these programs would be expanded under the *Lower Hunter Water Plan* to provide even more savings when we need them most.

Household water efficiency – expanded drought program

In a drought, water efficiency programs to help households voluntarily save water would be staged as water storage levels drop, ramping up in parallel with drought restrictions (discussed in Chapter 5). Each stage would continue the programs from the previous stage, and expand on them as shown in the table below.

DROUGHT LEVEL	WATER STORAGES	PROPOSED ADDITIONAL HOUSEHOLD WATER EFFICIENCY PROGRAMS
Level 1	60%	Increase marketing of showerhead exchange program Free shower timers for customers to collect Free do-it-yourself water saving kits Expand multi-media advertising, education and awareness programs to encourage water savings indoors with key messages reminding customers about taking shorter showers, using washing machines and dishwashers with full loads, repairing leaking taps, how much water different activities use and savings that can be achieved from water-efficient appliances Complemented by tips about saving water outdoors, linked to Water Wise Rules and restriction levels Expand school water audits and encourage students to take the water-saving messages home and apply them
Level 2	50%	Introduce a rebate for installing a new dual flush toilet (WELS 4 star) Further expand advertising, education and awareness programs, emphasising key messages about indoor and outdoor savings as above
Level 3	40%	Introduce a rebate for purchasing a water-efficient washing machine (WELS 4.5 stars) Further expand advertising, education and awareness programs, emphasising key messages about indoor and outdoor savings as above

Business water efficiency – expanded drought program

During a drought, water efficiency programs targeting business customers would be expanded as shown in the table below. Similar to programs for households, these voluntary programs would be staged as water storage levels drop, operating in parallel with drought restrictions. These voluntary programs would provide incentives to help businesses improve their water efficiency, and be prepared before mandatory drought restrictions are introduced and become progressively more stringent (discussed in Chapter 5).

Repairing a water main

DROUGHT LEVEL	WATER STORAGES	PROPOSED ADDITIONAL BUSINESS WATER EFFICIENCY PROGRAMS
Readiness	70%	Expand the number of major customers (those using more than 50 million litres a year) that participate in water audits and develop a Water Efficiency Management Plan (WEMP). Develop water conservation toolkits to raise awareness of water-saving opportunities, targeting key industry sectors with high water use. Start recruiting participants for Level 1 water audits. Develop marketing and communications material encouraging water-efficient amenities and cleaning equipment.
Level 1	60%	Voluntary water audits and development of WEMP for customers using less than 50 million litres a year. Introduce subsidised audits to improve irrigation for open space, ovals, commercial nurseries, farms and market gardens. Promote best practice guidelines for commercial vehicle cleaning industry. Encourage a minimum water efficiency standard for showers and taps (WELS 3 star) for customers using more than 10 million litres a year. Encourage a minimum water efficiency standard for cleaning equipment (high pressure and trigger operated spray guns) for customers using more than 10 million litres a year. Roll out water conservation toolkits for specific industries. Prepare and distribute guidelines to restaurants on replacing water-cooled woks with air-cooled woks.
Level 2	50%	Maintain Level 1 programs for irrigation water audits and water-cooled woks. Expand education and awareness programs (including water conservation toolkits) and minimum water efficiency standard for taps, showers and cleaning equipment (WELS 3 star) for customers using more than 5 million litres a year.
Level 3	40%	Introduce a subsidy to assist with replacing water-cooled woks with air-cooled woks. Continue expanding education and awareness programs and minimum water efficiency standard for taps, showers and cleaning equipment.
Level 4	30%	Continue expanding education and awareness programs and minimum water efficiency standard for taps, showers and cleaning equipment.

Business water efficiency programs encourage and support the early adoption of water efficiency measures that eventually become mandatory if drought restrictions become more severe. The early adoption of water efficiency measures ensures that water savings start earlier, and help slow the drop in water supplies.

Minimising water losses from leaks – expanded drought program

In normal climate conditions, the active leak detection program would deliver a survey of the entire water supply network over a five-year cycle. In a drought, this program would be accelerated to cover the network within three years.

Additional pressure management zones would also be implemented, to reduce water loss due to background leakage.

Existing water efficiency programs for households and businesses would be expanded in a drought to try to achieve even more water savings.

Looking to the future

- Water efficiency and leak reduction programs will continue to deliver savings in water use, operating at the local level as well as the state and national levels (for BASIX and WELS schemes respectively).
- These programs would be progressively expanded in a drought, with responsibilities shared among household and business customers and Hunter Water.
- By adopting water efficiency measures early, particularly when incentive programs are available, businesses have the opportunity to be better prepared before drought restrictions are in place and become increasingly stringent.

'When all parties contribute to water savings, it diminishes the likelihood that storages will be drawn to critically low levels'

COMMUNITY COMMENT
CONSULTATION WORKSHOP 2013

Demand management encourages less water use

Ensuring a secure supply of water relies on balancing both water supply and customer demand. With every measure that reduces customer demand, more water remains in our storages, helping to defer the need for major investment in new infrastructure on the supply side. In Australia and internationally, a number of approaches have been used to manage demand, ranging from water use rules to pricing.

Most utilities in Australia apply restrictions during drought to reduce demand so water in storages lasts longer. 'Water Wise Rules' are common sense actions that help conserve water every day, and were introduced by many utilities as restrictions were lifted after the millennium drought. These demand management approaches are more successful when the community is committed to using water wisely.

Water Wise Rules

What are Water Wise Rules?

Water Wise Rules are simple, common sense actions that help conserve water every day. Water Wise Rules already apply in Sydney, the Central Coast, and many other cities in Australia. They are similar to water saving tips that Hunter Water already promotes and many people apply every day.

Sydney and the Central Coast have similar rules that focus on efficient outdoor water use. Water Wise Rules were introduced in Sydney in 2009 after six years of drought restrictions. The Central Coast introduced Water Wise Rules in 2012, after a decade of water restrictions.

The lower Hunter has not experienced a long period of drought restrictions since the 1980s. The region was fortunate during the last drought as the water storages were replenished by significant rainfall in 2007.

The *Lower Hunter Water Plan* introduces similar Water Wise Rules in the lower Hunter as an immediate priority. The rules will apply to all customers – households and businesses – and are summarised in the box below.

Water Wise Rules for the lower Hunter

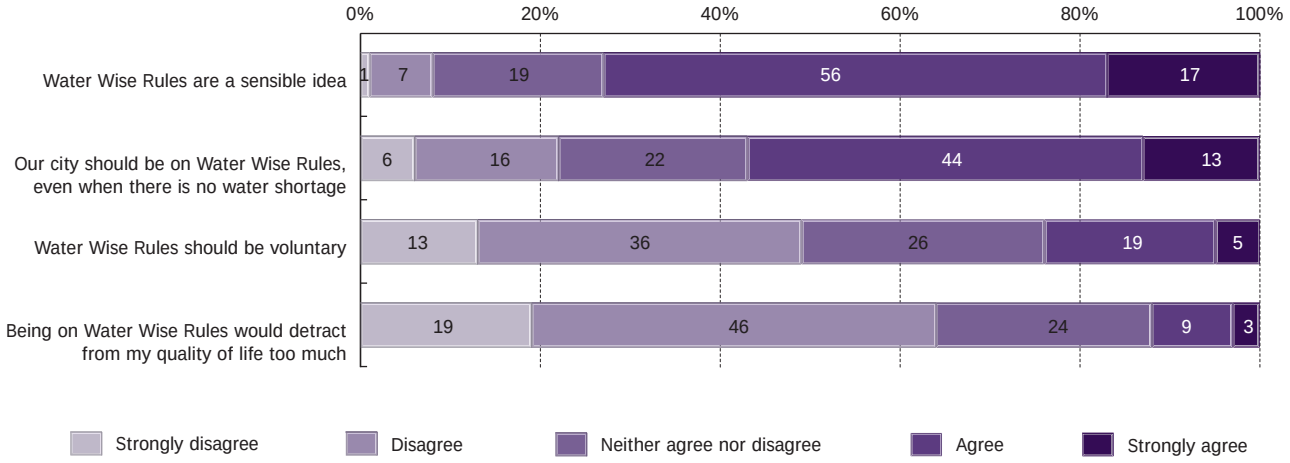
- All hand-held hoses must have a trigger nozzle
- Watering with a sprinkler, irrigation system or trigger nozzle hose is permitted any day before 10am or after 4pm, to avoid the heat of the day
- No hosing of hard surfaces such as paths and driveways
- All vehicles should be washed with a bucket, trigger nozzle hose or pressure cleaner.

By adopting Water Wise Rules to improve the efficiency of outdoor use – all the time, not just during drought – we can make better use of our available water supplies.

Water Wise Rules are estimated to achieve ongoing water savings of around 2.5 per cent of current residential water use, or around one billion litres a year.

Community support is vital for Water Wise Rules to be successful. A survey of lower Hunter residents as part of developing the *Lower Hunter Water Plan* indicated strong support for introducing Water Wise Rules to the region, with 73 per cent saying that Water Wise Rules are a sensible idea, and 57 per cent agreeing that our region should have Water Wise Rules even when there is no water shortage. The results are shown in the graph overleaf.

Community attitudes to Water Wise Rules



Drought restrictions

Drought restrictions can be used to limit water use by households and businesses in times of drought to help reduce the demand for water and slow down the drop in water storages. Restrictions may include actions such as banning fixed sprinklers, limiting hours and days when watering with a hose or drip irrigation system is permitted, and banning all household outdoor use completely when storage levels are very low.

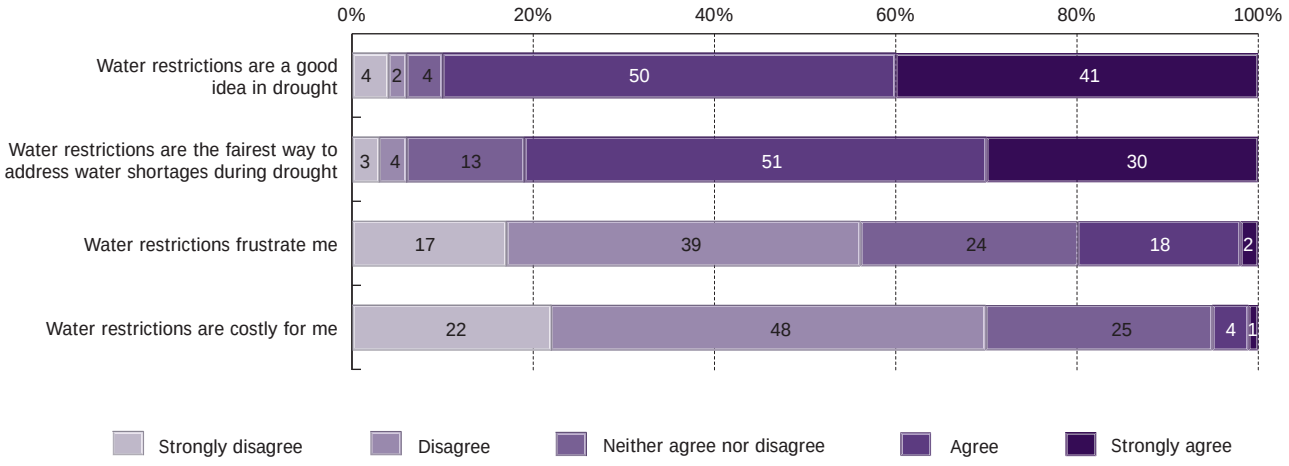
Restrictions, which apply equally across the whole community, are mandatory and enforceable under the *Hunter Water Regulation 2010*. Over the long term, the lower Hunter region is likely to have restrictions in place for less than five per cent of the time.

While drought restrictions do impose some costs on the community (for example, inconvenience and adverse impacts on gardens and playing fields) as well as impacting some industries, they are an effective and relatively low cost way of responding to a drought. Compared with drought responses involving the need to build new infrastructure, restrictions are flexible and relatively easy to start and stop.

As with Water Wise Rules, a survey of lower Hunter residents as part of developing the *Lower Hunter Water Plan* found that the community strongly supports water restrictions, with 91 per cent thinking that restrictions are a good idea during drought, and 81 per cent responding that water restrictions are the fairest way to address water shortages during drought. The responses are shown in the graph opposite.

Chichester Dam levels during 1980s drought

Community attitudes to drought restrictions



Choice modelling survey confirms community support for restrictions

Since drought restrictions do impose some costs on the community, and constrain customers from using water exactly as they might choose, it is reasonable for water planners to consider these costs as part of the economic analysis of measures to respond to drought.

Choice modelling is a sophisticated survey technique that puts forward different scenarios compared with the current situation, and asks respondents to choose which scenario they prefer. The Metropolitan Water Directorate engaged La Trobe University to undertake a choice modelling survey in the lower Hunter to find out if household customers might be willing to pay more to reduce the chance of the community experiencing water restrictions.

The purpose of the lower Hunter study was to estimate the value the community places on improving water supply availability during drought, by asking about their willingness to pay to reduce the likelihood, severity and duration of community-wide restrictions. The survey was conducted in June-July 2013, with over 400 responses.

The survey results indicate that the lower Hunter community is only willing to pay a relatively small amount to avoid restrictions. On a broad scale, the maximum willingness-to-pay to eliminate all restrictions in the lower Hunter was estimated to be around $15 million. However, to eliminate restrictions altogether – while still achieving an acceptable level of drought security – would require a major new source of supply, costing some hundreds of millions of dollars.

The willingness to pay to reduce the chance of restrictions, without eliminating them entirely, was also estimated and included in the economic analysis. Again, the results indicated the community was only willing to pay a relatively small amount to reduce the chance of restrictions.

The results from the choice modelling survey support the feedback from other community engagement activities, that the lower Hunter community accepts the occasional use of drought restrictions as a relatively low-cost measure to make our water supplies last longer in a drought.

What would happen in a drought?

The aim of water restrictions is to reduce the rate that storage levels drop and make the available water last longer. Restrictions are triggered as total water storage levels drop, becoming stricter at lower levels.

What would restrictions mean for households?

Drought restrictions limit the way households can use water, particularly outdoors. Advertising will also encourage households to be more efficient in their indoor water use. The key elements of each level of restrictions are summarised in the table below.

'Water use targets' are a way of encouraging the community to conserve more water during drought by advertising a set target for maximum daily water use per person. Water use targets are usually put in place when restrictions have reached the maximum level (including a total ban on outdoor use) as a way of encouraging the community to make voluntary reductions in indoor water use to achieve more savings.

Water use targets are implemented using multi-media advertising campaigns, to provide feedback to the community on the region's water use per person and encourage people to strive together to reduce water use even more. The community would be encouraged to reduce water use by having shorter showers and minimising waste in the bathroom, kitchen and laundry.

An indicative water use target for the lower Hunter would be 140 litres a day for each person. This target is based on an understanding of the lower Hunter's water usage in the home and outdoors, as well as considering the experience of other water authorities in the millennium drought.

Drought restriction levels and the corresponding target water use for households are illustrated in the diagram opposite. In normal times, the average water use per person is around 198 litres a day. Each level of restrictions aims to reduce this progressively, so that by the time level 4 restrictions apply, the target for each person is 140 litres a day. To help give an idea of what these volumes mean, hand watering the garden for five minutes, or one five-minute shower, each use around 50 litres of water.

RESTRICTION LEVEL	TOTAL WATER STORAGE LEVEL	RESTRICTIONS ON HOUSEHOLD CUSTOMERS	EXPECTED WATER SAVING (AS A PERCENTAGE OF HOUSEHOLD DEMAND)
Level 1	60%	No sprinklers at any time. Watering using a handheld hose with a trigger nozzle or a drip irrigation system is permitted between 5pm and 9am, but only on three days a week. Existing pools can only be topped up using a hose with a trigger nozzle.	4%
Level 2	50%	Watering with a handheld hose with a trigger nozzle or a drip irrigation system is reduced to two days a week. Vehicles can only be washed and rinsed using a bucket. Existing pools can only be topped up using a bucket.	9%
Level 3	40%	Total ban on outdoor use of drinking water.	21%
Level 4	30%	Multi-media advertising program to encourage indoor savings (voluntary).	29%

What would drought restrictions mean for businesses?

Water use by business customers is quite diverse. As discussed in Chapter 4, water efficiency programs for business customers have been designed to provide education and incentives to help businesses to use water more efficiently before restrictions apply stricter rules. The key features of business water restrictions are summarised in the table below.

RESTRICTION LEVEL	WATER STORAGE LEVEL	RESTRICTIONS ON BUSINESS CUSTOMERS	EXPECTED WATER SAVING (AS A PERCENTAGE OF BUSINESS DEMAND)
Level 1	60%	No sprinklers except for limited irrigation for open space and sports ovals. All customers using over 50 million litres a year to develop and implement a Water Efficiency Management Plan (WEMP)	6%
Level 2	50%	Limited irrigation of open space and sports ovals will only be permitted if the irrigation system meets minimum water efficiency standards. All customers using over ten million litres of water a year to develop and implement a WEMP. Particular customer groups (such as nurseries and car washes) using more than two million litres a year will also be required to develop and implement a WEMP.	7%
Level 3	40%	Outdoor watering ban except where alternative (non-drinking water) sources are used.	9%
Level 4	30%	Commercial kitchens to use air-cooled woks (no water-cooled woks).	11%

The role of pricing

The introduction of user pays pricing in the lower Hunter in 1982 has made a significant and lasting contribution to water use. Paying for the amount of water used sent a strong price signal to customers to discourage excessive or unnecessary water use. Water use fell immediately, deferring the need for a new source of water supply that had been planned at the time.

The graph below shows the historical water use in the lower Hunter since 1893. It shows the drop in usage due to restrictions in the 1980s drought, followed by the introduction of the user pays pricing system in 1982. The lower Hunter was the first region to introduce user pays pricing, and it is now the norm in Australia.

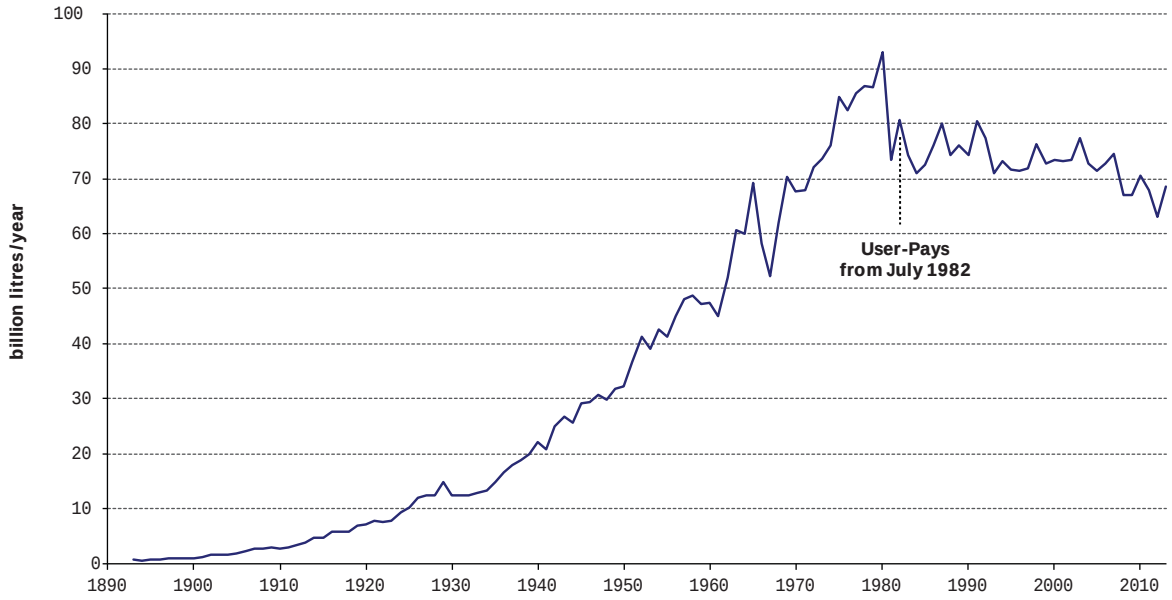
As outlined in Chapter 4, the total amount of water used by households and businesses in the lower Hunter has declined over the last 40 years, even though the population has grown by 200,000. This has been achieved by a combination of user pays pricing, together with household water efficiency measures and various changes in business use, including water efficiency measures, water recycling, and the closure of some major industries (including BHP Steelworks).

The Independent Pricing and Regulatory Tribunal sets the prices of water and sewerage services in the lower Hunter, greater Sydney and the Central Coast. Water prices are set so that they recover the efficient costs of providing a secure supply.

Water pricing is a complex issue and pricing regulators give careful consideration before new pricing approaches are introduced for metropolitan water supplies. It would be critical for any approach adopted to protect the long-term interests of water users and ensure that water supply for essential purposes is affordable for all households.

The Metropolitan Water Directorate is undertaking further work on water pricing issues for the review of the *2010 Metropolitan Water Plan* for greater Sydney. The outcomes of this work will be monitored and may influence future planning and pricing considerations for the *Lower Hunter Water Plan*.

Total water supplied from Hunter Water's sources 1893 to 2013



Looking to the future

- Water Wise Rules will be introduced immediately in the lower Hunter. These are simple, common sense actions to conserve water every day.
- Drought restrictions remain an important, effective and relatively low cost tool for responding to future droughts.
- Experience in other regions, including Sydney and the Central Coast, highlights that effectively communicating and enforcing drought restrictions are critical to achieving significant reductions in water use.
- A watching brief will be maintained on pricing issues to consider any potential future application for the lower Hunter region.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Water recycling helps save our drinking water

Water recycling involves treating and reusing wastewater or grey water in homes, industry, irrigation and agriculture. The key role of recycled water in the *Lower Hunter Water Plan* is to reduce pressure on water supplies by reducing demand for drinking water. Using recycled water for non-drinking purposes makes the drinking water supply go further, and can help delay the need to invest in major new supply infrastructure. The plan does not propose recycling water for drinking water purposes.

Recycled water must be treated to a level that is appropriate and safe for the particular end use. Different types of reuse have different treatment requirements to make the recycled water 'fit for purpose'. Producing higher quality recycled water will generally involve higher treatment costs.

Because water is heavy and costly to move around by pumping, recycled water projects tend to be more viable when the customers are located close to the source of the wastewater, such as near a wastewater treatment plant or sewer main, or where a recycled water scheme is within a cluster development. There can also be economies of scale where a number of industrial customers in a centralised location can be supplied with a larger volume of recycled water at a lower cost than supplying many small household customers with much smaller volumes.

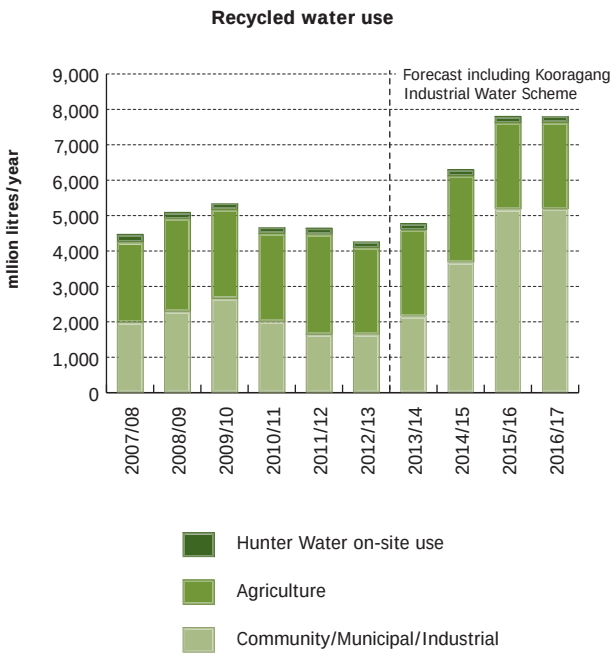
We know from the extensive community engagement undertaken to develop the *Lower Hunter Water Plan* that water recycling is strongly supported by the community.

How is recycled water used in the lower Hunter now?

Recycled water is currently used in the lower Hunter for industry, irrigation and agriculture, as well as on-site use at wastewater treatment plants. Around four to five billion litres of recycled water is currently used in the lower Hunter each year, as shown in the graph at right. This is forecast to significantly increase to nearly eight billion litres a year after the Kooragang Industrial Water Scheme starts operation in late 2014.

The main uses of recycled water currently include:

- irrigation use by golf courses, a trotting track, and the Kurri Kurri TAFE
- industrial use at sites including Eraring Power Station and the Oceanic Coal Washery
- agricultural use by local farmers, woodlots and the Karuah effluent reuse enterprise



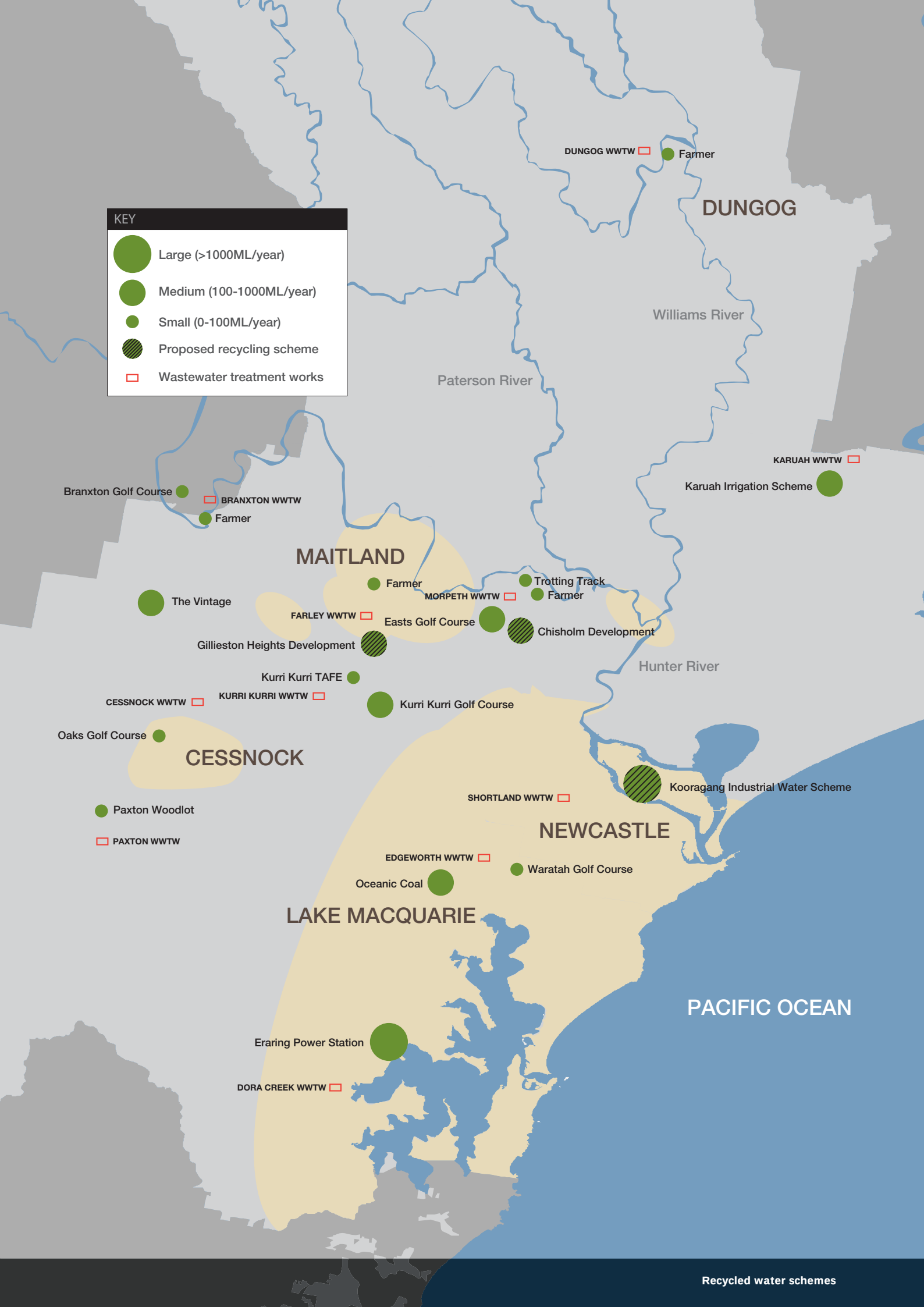
Hunter Water's current recycled water schemes provide recycled water from ten wastewater treatment works as detailed in the table below. The locations of Hunter Water's current and proposed recycled water schemes are shown on the map opposite.

WASTEWATER TREATMENT WORKS	RECYCLED WATER SCHEME
Branxton	Branxton Golf Club, local farmer and The Vintage Golf Club
Cessnock	Stonebridge Golf Club
Dora Creek	Eraring Power Station
Edgeworth	Oceanic Coal, Waratah Golf Club
Farley	Local farmer
Karuah	Karuah Effluent Reuse Enterprise
Kurri Kurri	Kurri Kurri Golf Club and Kurri Kurri TAFE
Morpeth	Easts Golf Club, McColl Engineering (trotting track irrigation) and local farmer
Paxton	Paxton Woodlots
Dungog	Local farmer

Eraring Power Station uses recycled water

'Recycling water can save lots of water and reduce demand, and there are some good local projects'

COMMUNITY COMMENT
CONSULTATION WORKSHOP 2013


KEY
Large (>1000ML/year)
Medium (100-1000ML/year)
Small (0-100ML/year)
Proposed recycling scheme
Wastewater treatment works
DUNGOG WWTW
Farmer
DUNGOG
Williams River
Paterson River
KARUAH WWTW
Karuah Irrigation Scheme
Branxton Golf Course
BRANXTON WWTW
Farmer
MAITLAND
Farmer
Trotting Track
MORPETH WWTW
Farmer
The Vintage
FARLEY WWTW
Easts Golf Course
Chisholm Development
Gillieston Heights Development
Hunter River
Kurri Kurri TAFE
CESSNOCK WWTW
KURRI KURRI WWTW
Kurri Kurri Golf Course
Oaks Golf Course
CESSNOCK
Kooragang Industrial Water Scheme
SHORTLAND WWTW
Paxton Woodlot
PAXTON WWTW
NEWCASTLE
EDGEWORTH WWTW
Waratah Golf Course
Oceanic Coal
LAKE MACQUARIE
PACIFIC OCEAN
Eraring Power Station
DORA CREEK WWTW
Recycled water schemes

New opportunities for industrial recycling

Recycled water is suitable for a range of industrial uses including dust suppression, generating steam, cooling tower water, wash-down and other industrial operations.

In 1994, the Hunter region led the way when Eraring Power Station was the first plant in the world to reclaim water from sewage and use it as feedwater to high pressure boilers, saving nearly four million litres of drinking water a day.

The next generation of major industrial water recycling in the lower Hunter is the construction of the Kooragang Industrial Water Scheme, which started in 2013. The scheme includes an advanced water treatment plant and water education centre in Mayfield West, and an eight-kilometre pipeline to provide high quality recycled water to industrial customers on Kooragang Island. When complete in late 2014, the project will use the effluent from Shortland wastewater treatment plant to produce nine million litres of recycled water a day for industrial use.

This project will increase the total recycled water use in the lower Hunter to nearly eight billion litres a year, or around 12 per cent of the total wastewater treated.

The Kooragang Industrial Water Scheme will reduce the demand for drinking water by around 3.2 billion litres a year by directly substituting recycled water for the existing use of drinking water by industries. This represents nearly five per cent of current drinking water use. By reducing demands on the drinking water supply system, recycled water projects delay the need to find new sources of supply to meet increasing demands from business and population growth. Recycling projects also help drinking water supplies to last longer in a drought.

New opportunities for household water recycling

New opportunities for residential use of recycled water have been investigated in developing the *Lower Hunter Water Plan*.

Recycling water for residential use for non-drinking purposes is more likely to be achievable in new growth areas, due to the high costs of laying recycled water pipes in existing urban areas and retrofitting the plumbing to existing homes.

'Dual reticulation' involves two sets of pipes supplying water to customers – one for drinking water and one for recycled water. The recycled water is delivered to households in purple pipes so that customers and plumbers don't confuse it with drinking water.

After rainwater tanks, the reticulation of recycled water is the second most common choice for an alternative water supply to meet BASIX requirements for improved water efficiency in new developments.

Hunter Water has already started dual reticulation schemes in new developments at Chisholm and Gillieston Heights, and these will provide recycled water to about 1000 properties as development proceeds.

The *Water Industry Competition Act 2006* facilitates private sector involvement in the water industry and the *Lower Hunter Water Plan* recognises and supports the role the private sector can play in providing water, wastewater and recycling services.

Private operators have indicated they can provide innovative and affordable solutions, particularly to service new developments that are remote from urban centres

Advanced water treatment plant under construction for the Kooragang Industrial Water Scheme

Pipes and fittings for recycled water supply

and would otherwise require substantial infrastructure investment. Examples of these 'decentralised systems' include new developments at Wyee and Catherine Hill Bay. Private sector operators estimate that a significant proportion of the 70,000 projected new homes in the region could involve private sector services using decentralised recycled water systems.

What would happen in a drought?

Recycled water schemes contribute to improved long-term water security by reducing the demand for drinking water and helping our existing water supplies last longer, in normal climate and in drought. This is one of the benefits of implementing the Kooragang Industrial Water Scheme now.

Water recycling is less suited to providing a robust, immediate response during a drought as there are often significant lead times to implement a project. However, new opportunities may become more feasible during a drought, as customers recognise the value of recycled water for the longer term benefits of a continuous source of water which does not depend on rainfall.

Using recycled water for non-drinking purposes makes our drinking water supplies go further and can help delay the need to invest in new water supply infrastructure to meet the needs of a growing community.

Looking to the future

- The Kooragang Industrial Water Scheme will be operating in late 2014 and will reduce the forecast demand for drinking water supplies by around 3.2 billion litres a year. There may be opportunities to expand the scheme in future.
- Dual reticulation schemes in new developments at Chisholm and Gillieston Heights will provide recycled water to about 1000 properties as development proceeds.
- Private sector involvement in providing water supply and/or wastewater services also has the potential to reduce demand on the water supplies of the lower Hunter by incorporating water recycling in other new developments, particularly in areas that are remote from urban centres.
- An adaptive management approach will be used to ensure actual water use across the lower Hunter region is monitored and the demand forecasts are regularly updated to reflect the latest available information and the savings achieved from any additional recycled water projects.

Capturing rain and stormwater

Rainwater tanks and stormwater harvesting projects provide an opportunity to substitute alternative sources of supply for uses that do not require drinking water quality. This reduces demand on drinking water supplies. They are an important element of integrated water cycle management.

While these are important initiatives for long term sustainability, rainwater tanks and stormwater harvesting projects rely on rainfall so they are not able to provide as robust a response during a drought as some other measures.

Household rainwater tanks

How is rainwater used?

Rainwater tanks have long been a valuable source of drinking water for many households in rural areas of Australia, where a town water supply may not be available.

Rainwater tanks can also be installed in new or existing homes with a town water supply. The water can be used in place of drinking water for a variety of non-drinking uses such as toilet flushing, laundry use, outdoor watering, car washing and topping up swimming pools.

Rainwater tanks are an efficient way to harvest rainfall as almost all of the rain that falls onto the roof can be collected and diverted to a tank for use. Rainwater tanks that are connected for internal household uses provide the greatest savings, by substituting rainwater where drinking water would otherwise be used all year round. When connected to internal plumbing for toilet flushing and use in the laundry, the system needs to be backed up by normal mains water supply in case the rainwater tank runs out of water.

What is the BASIX scheme?

The Building and Sustainability Index (BASIX) scheme is a sustainable planning measure to reduce water and energy use in new homes. Since July 2005, the BASIX scheme has applied to the whole of NSW. More information on the BASIX scheme is included in Chapter 4.

Under BASIX, new homes are required to achieve a mandatory 40 per cent reduction in potable water use compared to average water use before the BASIX scheme started. Rainwater tanks have proven to be a common choice in meeting BASIX requirements, with 97 per cent of all new houses in the Hunter using a rainwater tank as an alternative source of water supply.

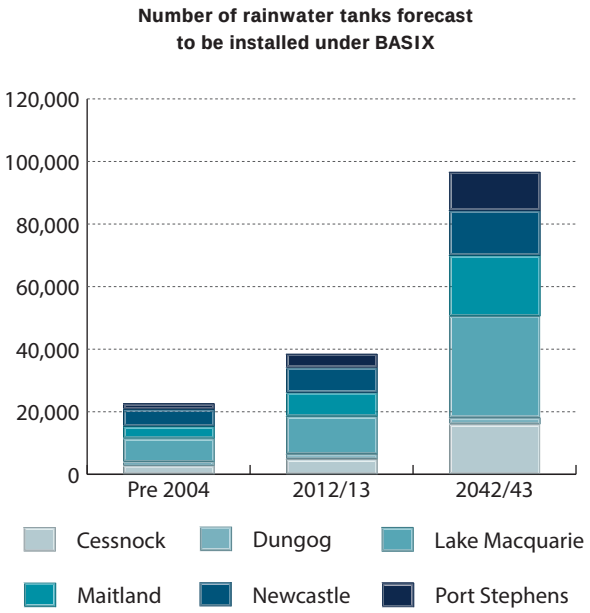
The effectiveness of rainwater tanks in the lower Hunter

A recent study into the role of rainwater tanks in the lower Hunter found that:

- From 2004 to 2013, the number of rainwater tanks in the region increased from around 22,600 to around 38,400.
- Rainwater tanks are estimated to have saved almost 1.2 billion litres of drinking water in 2012/13. This equates to around two per cent of the current total drinking water use.
- Over the next 30 years, it is expected that almost 60,000 more rainwater tanks will be installed in the lower Hunter region as a result of the BASIX scheme.
- By 2043, water savings from using rainwater instead of drinking water for suitable purposes are forecast to be around 3.4 billion litres a year, which represents around five per cent of the demand for drinking water.

The amount of drinking water savings achieved by rainwater tanks will normally be less in dry years when there is less rainfall to capture.

The graph below shows the estimated number of new rainwater tanks in each Council area in 2004 (before BASIX) and 2012/13, and the forecast for thirty years' time.



The effectiveness of rainwater tanks relies on a number of factors, including how well the rainwater capture and end-use connections are installed and maintained, and the owner's willingness and ability to use the system as intended, and to pay for repairs when needed.

The performance or 'functionality' of rainwater tanks is reduced by poor installation and inadequate maintenance, including blocked gutters and failed pumps. Although there is limited data on the performance of rainwater tanks, particularly for systems beyond a few years old, it has been estimated that around 60 per cent of rainwater tanks are fully functional.

The literature suggests that owners who voluntarily install a rainwater tank are often more motivated to use and maintain it compared with owners who had to install a rainwater tank to comply with BASIX. Better education about rainwater tank installation and maintenance could help to get the best performance from rainwater tanks. A trial program by Hunter Water and Lake Macquarie City Council in 2013/14 aims to better understand failures in rainwater tanks and educate participants on options to fix them.

Stormwater harvesting

Stormwater harvesting involves collecting stormwater from drains or creeks in urban areas, then storing and treating it for later use. Stormwater capture can provide significant quantities of non-drinking quality water that may be used for irrigating golf courses, sporting fields, parks and gardens, and for industrial purposes.

Stormwater can be stored in open dams and ponds or in enclosed tanks either above or below ground. Unless suitable storages already exist, this can be one of the most costly elements of a stormwater project.

Urban stormwater collects contaminants as it passes over roads and other surfaces, picking up chemicals and pathogens from the surrounding environment. Stormwater needs to be treated to a quality that suits how the water will be used (such as disinfection to kill pathogens) so that it meets public health and environmental guidelines. Stormwater use schemes generally need to be located near where the water will be used, and there can be significant costs to collect, treat and store the stormwater.

Water licences and approvals administered by the NSW Office of Water may be required for the construction and operation of stormwater harvesting schemes.

A range of stormwater harvesting case studies have been investigated for the *Lower Hunter Water Plan* in consultation with local councils. Although these opportunities were relatively expensive and did not

Although rainwater tanks and stormwater harvesting can reduce the overall water demand on the system, they may not be able to provide significant water savings during a drought.

provide a robust drought response measure for the broader community, use of stormwater to irrigate sporting fields and other council facilities can help maintain these important community assets.

There is also potential for industries to achieve significant water savings by harvesting and using stormwater on-site – as shown in the case study on stormwater use by the Newcastle Coal Infrastructure Group.

What would happen in a drought?

Rainwater tanks and stormwater harvesting schemes depend on rainfall, so their contribution in a drought depends on whether or not there is some localised rainfall that can be captured for use (sometimes called a 'green drought'). These schemes contribute to reducing the demand on drinking water supplies over the long term, but the lower Hunter still needs a contingency plan for a severe drought.

Stormwater capture projects have the potential to save water and provide other community benefits as part of an integrated approach to managing the urban water cycle. These may include maintaining green parks and playing fields and benefits in managing stormwater to reduce localised flooding. Investigations into their potential are encouraged in conjunction with water efficiency initiatives. However, they generally cannot deliver a robust drought response measure because of the significant lead times to implement a project and the benefits are likely to be localised.

During a drought, there may be more interest in opportunities for stormwater capture for uses such as watering sporting fields or for industrial purposes, with the potential for ongoing benefits. However, these projects are generally too uncertain for drought contingency planning because they depend entirely on rainfall.

Rainwater tanks come in a range of sizes and configurations

Case study - Stormwater use by Newcastle Coal Infrastructure Group

NCIG terminal on Kooragang Island

The Newcastle Coal Infrastructure Group (NCIG) owns and operates one of Australia's largest coal export terminals on Kooragang Island, with rail, coal storage and shiploading facilities and associated infrastructure.

Managing dust is a critical part of operations at the terminal. Dust is managed by wetting the coal stockpiles and unsealed surfaces on the site.

NCIG has reduced its use of drinking water by capturing and using stormwater on its site.

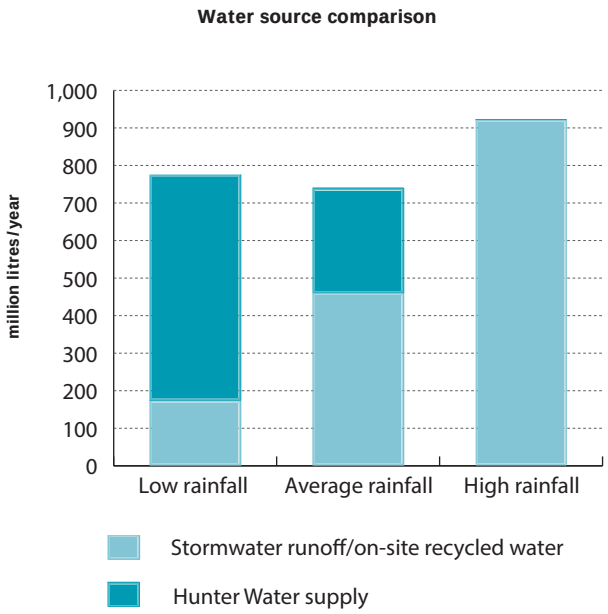
Stormwater is diverted by a series of drains across the site and stored in settlement ponds. The drains are lined to minimise the amount of water lost through the soil.

After settling in the first pond to remove particles and contaminants, water is pumped to a second storage pond for use in dust suppression, equipment washdown and landscape irrigation. The breakdown of water use is shown in the table below.

WATER DEMAND FOR:	LOW RAINFALL ML/YEAR	AVERAGE RAINFALL ML/YEAR	HIGH RAINFALL ML/YEAR
Dust suppression	686	650	615
Washdown and cleaning	88	88	88
Landscape irrigation	2	2	2
Total	**776**	**740**	**705**

Depending on rainfall, the volume of stormwater runoff and on-site recycled water used by the NCIG is estimated to range from 174 million litres a year when rainfall is low, up to 922 million litres a year when rainfall is high and more stormwater is captured. As illustrated in the graph below, this results in a significant reduction in the amount of water purchased from Hunter Water.

Stormwater being used for dust suppression



Looking to the future

- Rainwater tanks will continue to be installed in new homes under the BASIX scheme for new development. By 2043, rainwater tanks are expected to contribute to water supply savings of around 3.5 billion litres a year. The amount of water savings from rainwater tanks will depend on the balance between new developments using rainwater tanks or recycled water as alternative sources to meet BASIX requirements.
- Liaison with councils will continue in order to encourage the development of potential stormwater harvesting schemes as part of an integrated approach to water cycle management. Such schemes may be more feasible if sources of grant funding are available.
- Opportunities for stormwater harvesting and use by industrial customers will be encouraged in conjunction with water efficiency initiatives (refer Chapter 4).

'Rainwater tanks let the community contribute to the water solution'

COMMUNITY COMMENT
CONSULTATION WORKSHOP 2013


REJECTS
9
7
5
3
1

A contingency measure that doesn't depend on rain

Desalination is a process of producing fresh water by removing dissolved solids (primarily salts) from a water source such as seawater, estuarine water, treated wastewater or brackish groundwater. Desalination produces high quality water without relying on rainfall, so it is resilient to drought and climate change.

Use of portable desalination units, installed as late as possible if and when needed, is one way of diversifying the lower Hunter's water supply sources, and reducing the risk of running out of water in an extreme drought. The units would be removed when no longer required.

Temporary desalination facilities offer a flexible contingency measure at a relatively low expected cost compared with other measures, as they would only be installed in a very rare drought and as late as possible.

Why consider desalination?

As discussed earlier, the lower Hunter has sufficient water to meet its needs in average climate conditions for the medium term.

However, the region's reliance on rain-fed dams and groundwater supplies makes it vulnerable to severe drought. A contingency measure that doesn't rely on rain would help make the system more resilient to climate variability.

How does desalination work?

Desalination removes salt and other impurities from salty water to produce fresh water that can be used for drinking water supplies, or for industrial processes that need high quality water.

The two most widely used and commercially proven technologies for desalination are reverse osmosis and thermal distillation. Most desalination plants built recently in Australia use reverse osmosis, which uses less energy than thermal distillation.

Seawater is pumped into the desalination plant from the ocean and passes through two levels of initial filtration to remove most of the large and small particles and impurities. The filtered seawater then enters the reverse osmosis plant where it passes through special membranes that act like microscopic strainers. The pores in the membranes are so tiny that only fresh water flows through leaving behind bacteria, viruses, other impurities and salt.

Around 40 per cent of the water that goes through the desalination plant comes out as fresh drinking water. The remainder is pumped back into the ocean as brine. Since it is more salty than normal seawater, special diffusers are often used to make sure it mixes quickly and thoroughly back into the sea to minimise any impact on the marine environment.

Reverse osmosis is proven technology that is also used to produce recycled water from wastewater. The major industrial recycled water schemes at Eraring Power Station and the new Kooragang Industrial Water Scheme (discussed in Chapter 6) both include reverse osmosis as part of the process to produce recycled water.

Research is continuing to improve desalination technology, including research into:

- improving energy efficiency
- reducing membrane fouling
- solar thermal distillation
- using ocean wave energy to generate clean electricity and drive the reverse osmosis process
- new developments in nanotechnology.

Permanent desalination facilities in cities around Australia

Since 2005, most of the coastal capital cities in Australia – including Sydney – have experienced severe drought and constructed desalination plants to improve their water security. These desalination plants provide an 'insurance policy' that ensures these cities will not run out of water, which would cause major social and economic disruption.

The reasons these major cities have invested in permanent seawater desalination plants include:

- a shift in climate, with Perth in particular experiencing a long-term reduction in rainfall and other coastal cities experiencing more variability in rainfall and longer droughts
- desalination plants don't depend on rainfall and can be sized to make a significant difference to the reliability of water supplies
- they can be integrated into existing water supply networks without too much difficulty, and can contribute to a diverse, resilient urban water system
- most of Australia's major cities are located on the coast so they can readily access seawater as a new source of supply.

In Perth, the desalination plants operate continuously as part of the regular water supply system. Some other cities, including Sydney, Melbourne and the Gold Coast, now have their desalination plants in 'shut down' mode. They will be turned on again if storage levels drop below certain trigger levels.

The Central Coast has planning approval for a 20 million litre a day permanent desalination plant at Toukley. The plant will not be built unless required in a severe drought.

Desalination would only need to operate in the lower Hunter in an extreme drought, and it would be very costly to construct a large-scale, permanent desalination plant for such rare occasions. However, desalination technology could be used as a contingency measure on a much smaller scale using portable units on a temporary basis.

What are the benefits of temporary desalination units?

Modelling has demonstrated that temporary, portable desalination units are able to provide enough water as a short-term solution to supplement the lower Hunter's drinking water supplies in periods of extreme drought, improving our drought security at a relatively low cost compared with other potential supply measures.

Investigations for the *Lower Hunter Water Plan* have identified that small, land-based, temporary units could provide a flexible supply in a severe drought. Small desalination plants can fit into several shipping containers or be skid-mounted to make them easier to transport and install.

Initial investigations suggest that portable desalination units, each producing around one to three million litres of treated water a day, could be installed at one or more sites. The modelling assumed a total of nine million litres a day of water could be supplied from temporary desalination units, with the number and configuration scaled up or down depending on needs at the time. This flexibility is one of the benefits of portable desalination units.

Portable desalination would only be deployed when needed in a severe drought. The units would be shut down, removed, and the sites rehabilitated when no longer required. Some infrastructure (such as pipelines below ground) might remain after the plant is removed.

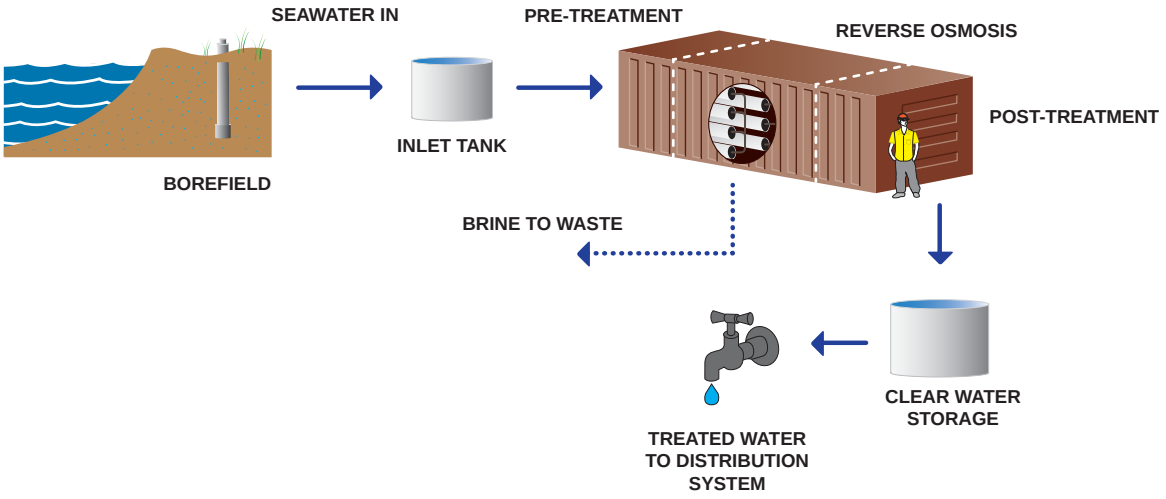
During the most recent drought, the Central Coast obtained planning approval to install several temporary desalination units. However the drought eased so they did not need to proceed with purchasing and installing the units. This means there is recent local experience to draw on in designing and procuring portable desalination units.

Portable desalination units are available in Australia and overseas. Examples of their use include drinking water supplies for naval and cruise ships, desalinating mine water, as well as providing emergency drinking water supplies after natural disasters such as Hurricane Katrina (see box below).

In 2005, the United States Navy set up a portable desalination unit in response to Hurricane Katrina. It delivered safe drinking water to Gulf Coast residents being treated at a hospital in Biloxi, Mississippi. The device was trucked in and set up on the shores of the Gulf of Mexico, approximately four blocks from the hospital. It desalted and purified about 100,000 gallons (380,000 litres) of water per day from the turbid Gulf of Mexico, replacing the daily caravan of 18 tankers needed to keep the hospital running.

www.greenbang.com/us-navy-aims-for-more-energy-efficient-desalination_11885.html

Schematic showing temporary, portable desalination units



What would be the main elements of a temporary desalination plant?

The main elements of a temporary desalination plant would include:

- an intake for saltwater, from a beach or estuary (this could include a number of bores and pumps buried in sand dunes, where the beach sand would act as a natural filter)
- preliminary treatment to remove sediment and organic material in order to protect the membranes from fouling
- reverse osmosis units to desalinate the water
- addition of minerals to improve the taste, along with disinfection and fluoridation
- pipes to connect to the water supply network for delivery to customers
- water and chemical storage tanks.

Environmental considerations

Further investigations are required to identify suitable sites for temporary desalination in the lower Hunter and undertake the necessary technical and environmental assessments. The sites would need access to seawater, sufficient power supply, and the water supply distribution system.

From a preliminary review, co-locating the units on an existing wastewater treatment plant site near the coast might be feasible. Other options include open space areas near the coast, but these could have short-term visual and noise impacts, and public access would need to be restricted until the units were removed.

Some of the key environmental factors relevant to temporary desalination are outlined below:

- Portable desalination units have a relatively small footprint and use less energy compared with permanent, full-scale desalination plants.
- Potential for environmental, social, cultural heritage, noise and aesthetic impacts would need to be minimised in selecting suitable sites.
- It has been estimated that the energy used to desalinate the amount of water used in an average house is about the same as the energy used each day by a refrigerator[3].
- Seawater could be extracted using bores in the sand dunes, with less potential to affect marine life than an ocean intake, while also providing a natural filter.
- If co-located with an existing wastewater treatment plant, the brine (or concentrated seawater) waste could be dispersed in the ocean, with the potential to be blended and discharged through an existing effluent diffuser system.
- The potential for short-term visual and noise impacts from the plant and any above-ground pipelines would be temporary, ending when the units were removed and the sites rehabilitated.

3. Water Services Association of Australia, Seawater Desalination Information Pack Two, 2013

What would happen in a drought?

Having the capacity to deploy temporary desalination units in a severe drought would provide a new, diversified source of water supply that would only be constructed if other measures in the *Lower Hunter Water Plan* had already been deployed, and storage levels continued to drop to very low levels (refer graphs in Chapter 9).

In order to delay a decision to proceed with construction of temporary desalination until the latest time possible in a drought, some 'readiness' activities will be undertaken to reduce lead times.

The first steps to progress in the short term include:

- further investigations to develop a short-list of suitable sites and assess their feasibility from an operational, environmental and planning approval perspective
- proceeding with environmental and other technical investigations
- undertaking a more detailed assessment of procurement options, including evaluating potential suppliers and comparing opportunities for purchase or hire of desalination units
- developing and implementing a water quality monitoring program for the preferred sites.

Further action may not be required until storage levels fall in a drought. The assumptions for the hydrologic and economic modelling undertaken in developing the *Lower Hunter Water Plan* included the following key triggers:

- when storage levels drop to around 65 per cent, work on design, environmental assessments and seeking planning and other approvals would be triggered
- when storage levels drop to around 35 per cent, installation would be triggered (by this time, drought restrictions would already include a total ban on outdoor water use[4])
- if storage levels continued to drop, operation would start at or below 30 per cent (the actual level would depend on the construction time and how quickly storages were falling at the time – the modelling assumed that the units would be producing water no later than 15 per cent storage level)
- when storage levels recover, operation would cease at around 35 per cent (on the rise)
- the units would remain on-site until the risk of continued drought was past, with decommissioning and site rehabilitation at around 50 per cent or higher.

The modelling for developing the *Lower Hunter Water Plan* included sensitivity analysis on triggering installation at higher storage levels (45 or 55 per cent), in order to explore the benefits for improved drought security. Trigger levels will need to be flexible as part of an adaptive management approach. For example, they will need to take into consideration the results of monitoring and evaluation of how the other demand and supply measures perform, as these will affect the supply-demand balance and the actual rate that storage levels fall in a real drought. This flexibility is one of the benefits of temporary desalination units.

As a contingency measure that does not depend on rainfall, small-scale, temporary desalination units could supplement water supplies during a very severe drought. The units would only be installed in a rare event, and would be removed when no longer required.

4. Under the proposed drought restrictions, a total ban on outdoor uses by household customers would have been implemented when storage levels reduced to 40 per cent (refer Chapter 5).

Looking to the future

- The Metropolitan Water Directorate and Hunter Water will continue working together on:
  - feasibility studies to identify a short-list of suitable sites for temporary, portable desalination units
  - a review of procurement options
  - a water quality monitoring program for preferred sites.
- Ongoing research into potential improvements in desalination technology will be monitored, so that the proposed approach to a temporary plant can be adapted based on the latest knowledge and improvements in energy efficiency.
- Liaison between the Central Coast and lower Hunter regions will continue to explore opportunities for information-sharing and cooperation, noting that both regions have identified desalination as a contingency drought measure.

'Temporary desalination is a good insurance plan option in severe drought.'

COMMUNITY COMMENT
CONSULTATION WORKSHOP 2013

Implementing the plan

The *Lower Hunter Water Plan* has been developed to make sure the people of the lower Hunter have enough water to meet their needs in the medium term, including being able to withstand a drought much more severe than previously experienced in the region.

The plan includes actions to supply, save and substitute water that are already in place or under way, as well as additional measures to respond to droughts if and when they occur.

The *Lower Hunter Water Plan* is a balanced, adaptable plan that recognises the importance of managing water in an integrated way to deliver diverse water supplies that are fit-for-purpose, and make best use of water at different stages of the urban water cycle.

It is important that we invest in new supplies only when they are needed, to avoid 'gold plating' the system. Deferring investment until it is needed means that the people of the lower Hunter are not paying for unnecessary infrastructure, and limited finances can be used for more immediate needs.

The plan will be reviewed regularly to respond to new information, technologies, and changes to climatic conditions. A formal *Monitoring, Evaluation, Reporting and Improvement Plan* will be used to evaluate performance of the portfolio of measures over time, including during a drought. This will allow it to be adapted in 'real time' to ensure the plan continues to achieve its objectives, and the measures can be adjusted to respond to any variations from the key planning assumptions.

How the plan will be implemented for different climate scenarios

Because this *Lower Hunter Water Plan* has a strong focus on actions to maintain the region's water supplies through a drought, it has to be able to respond differently depending on the climate we experience in future years.

To illustrate the different responses, the figures overleaf show water storage levels and the contribution of the different measures in three different climate scenarios - typical years, a moderate drought, and an extreme drought.

The examples demonstrate how measures are activated as storage levels fall. In most climate scenarios, the drought response measures are not needed. Although the chance of a severe drought is low, the consequences for households and businesses would be substantial without the portfolio of measures in the *Lower Hunter Water Plan*.

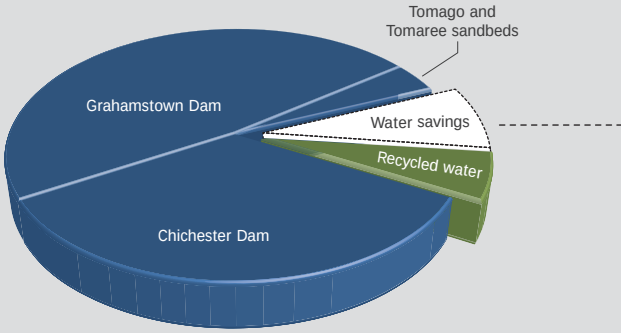
For all scenarios:

- Water Wise Rules will be implemented at the start of the *Lower Hunter Water Plan*
- modifications to the water supply network between the Central Coast and the lower Hunter will proceed, increasing the capacity to transfer water north as required under the existing water transfer agreement
- further investigations and 'readiness activities' for temporary desalination, to enable a quick response if needed in an extreme drought.

‘Typical’ climate conditions

This scenario shows lower Hunter water storage levels staying above 70 per cent full, which occurs most of the time.

The pie chart illustrates how the mix of measures contributes to the supply-demand balance in this example, demonstrating that programs to improve water efficiency and recycle water save a considerable volume of water. In typical years, no drought response measures need to be triggered.

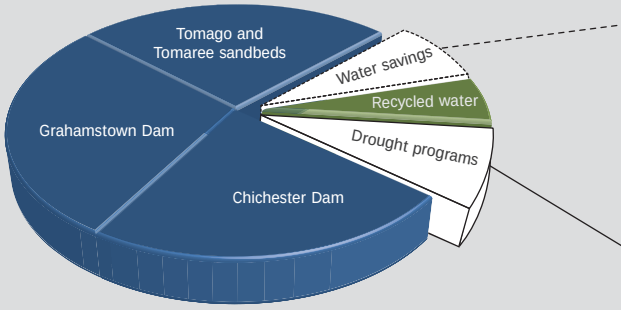


Note: Pie chart shows the volumes saved or supplied over the 10 year period

Moderate drought

This scenario represents a moderate to severe drought, similar to the drought in the lower Hunter during the 1980s, the worst drought since records began. In this drought scenario, water storage levels fall to almost 40 per cent, triggering additional water efficiency and loss minimisation programs, two levels of drought restrictions and transfers of water from the Central Coast.

In both the moderate and extreme scenarios, drought restrictions and water efficiency programs reduce water use from the storages, to help slow depletion. The contribution of the drought programs increases as the drought worsens. The graphs also illustrate that more water is likely to be used from Tomago sandbeds in a drought.



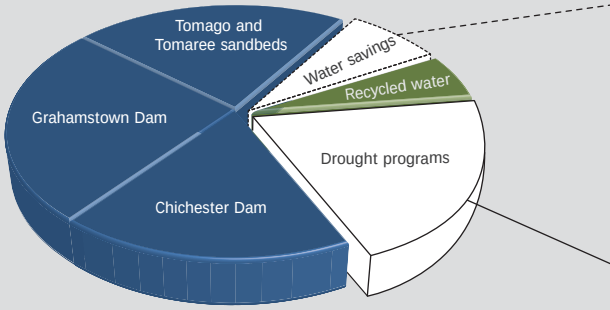
Note: Pie chart shows the annual volume supplied or saved over the drought period, years 2 to 6

Extreme drought

The drought depicted in this scenario is extremely rare, about twice as severe as the worst drought recorded in the lower Hunter. A drought of this severity would trigger all the measures in the *Lower Hunter Water Plan* portfolio.

In the early stages of the drought, additional water efficiency programs would be triggered to help households and businesses save more water, and Hunter Water would expand its loss minimisation programs. Drought restrictions and transfers of water from the Central Coast would also be triggered. The drought restrictions would become stricter as storage levels continue to fall, including a ban on outdoor water use once storage levels drop to 40 per cent. A water use target could be introduced to encourage households to further reduce indoor use.

As the drought continues, water transfers from the Central Coast are likely to stop as their storages also drop. The contingency measure of installing small, portable, temporary desalination units would be triggered to supplement supplies with a source that does not depend on rainfall.



Note: Pie chart shows the annual volume supplied or saved over the drought period, years 2 to 6

KEY

Ⓐ Water Wise Rules start

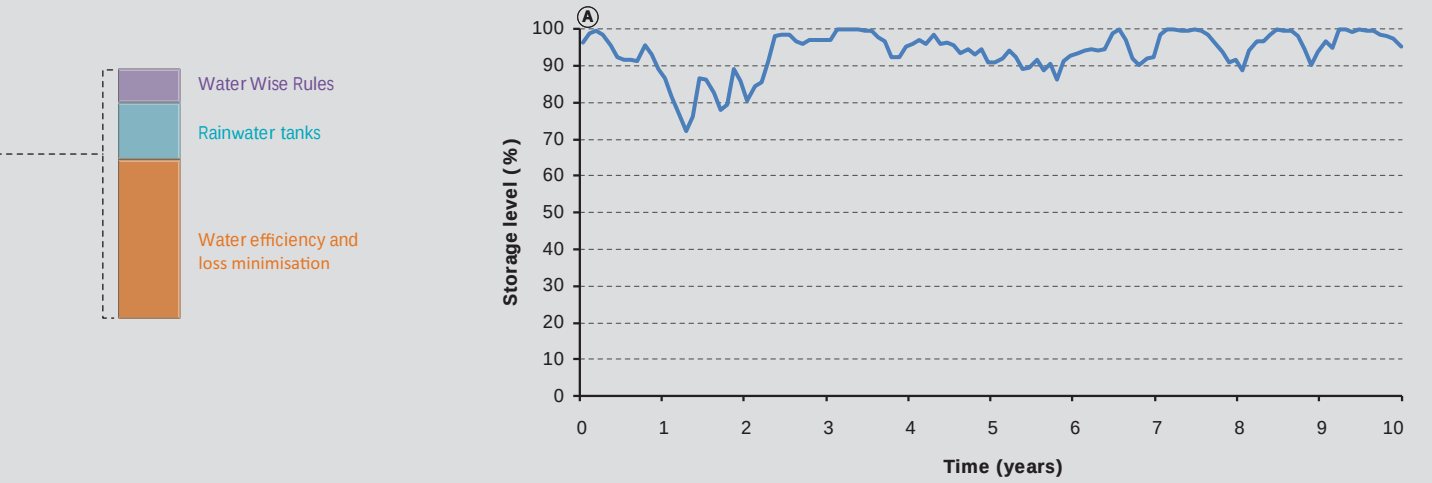
Ⓑ Leak detection and pressure management drought programs start
Non-residential water efficiency drought programs start

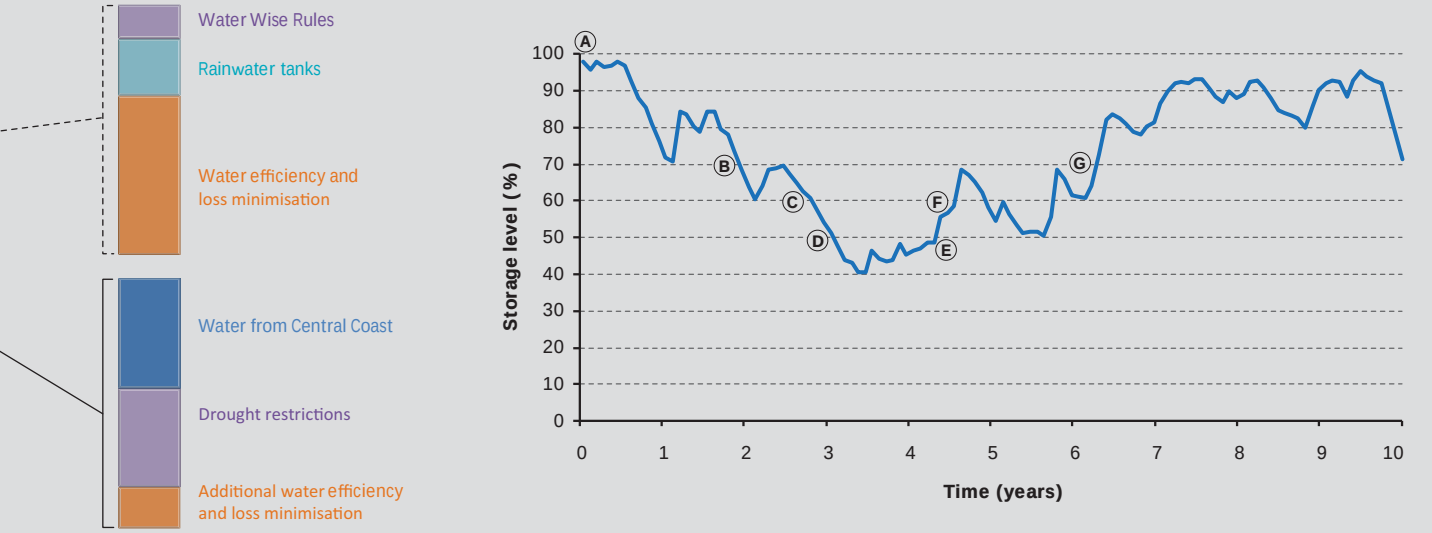
Ⓒ Residential water efficiency drought programs start
Level 1 drought restrictions start
Water transfers from the Central Coast start

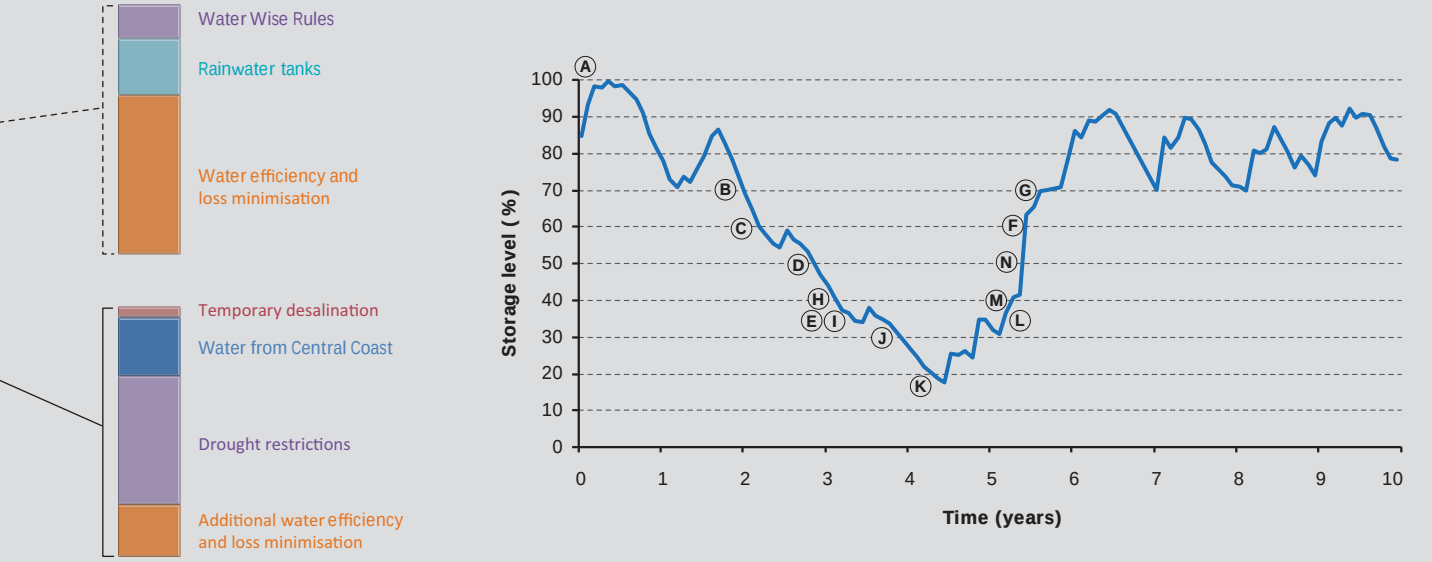
Ⓓ Level 2 drought restrictions start

Ⓔ Water transfers from the Central Coast stop

Ⓕ Level 2 drought restrictions eased to Level 1
Residential and non-residential water efficiency drought programs stop







Ⓖ Level 1 drought restrictions lifted
Leak detection and pressure management drought programs stop

Ⓗ Level 3 drought restrictions start

Ⓘ Construction of temporary desalination facilities starts

Ⓙ Level 4 drought restrictions start

Ⓚ Temporary desalination facilities turn on

Ⓛ Temporary desalination facilities turn off

Ⓜ Level 4 drought restrictions eased to Level 3

Ⓝ Level 3 drought restrictions eased to Level 2

Actions at a glance

The *Lower Hunter Water Plan* includes actions to supply, save and substitute water that are already in place or underway, as well as additional measures to respond to droughts when they occur.

The measures included in the plan will reduce the amount of water required to serve the lower Hunter's needs, make better use of existing storages and provide extra supply as a contingency in extreme droughts. Some measures will apply all the time, to reduce demand or substitute supply, while others will only be activated as storage levels fall during droughts. The key elements of the plan are summarised below.

MEASURE	CONTINUING ACTIONS[5]	DROUGHT RESPONSE
Surface water	Chichester and Grahamstown Dams will continue to provide most of the region's water needs each year. Modifications to the water supply network will enable more water to be transferred from the Central Coast to the lower Hunter, as required by the existing transfer agreement. The modelling of transfers to and from the Central Coast will be refined as a tool for optimising transfer arrangements. The NSW Office of Water will continue reviewing water sharing plans and implement related refinements of environmental flow rules through amendments to water licences and approvals.	Water transfers between the lower Hunter and Central Coast systems during droughts in either region will make better use of existing storages and improve drought resilience in both regions.
Groundwater	Groundwater from the Tomago and Tomaree sandbeds will continue to be an important source of water supply for the lower Hunter region. Investigations into the feasibility of new groundwater sources that might boost supplies in a drought will continue, focusing on the Lower Hunter Alluvial groundwater source in the short term.	The amount of water supplied from Tomago sandbeds generally increases in a drought.
Water efficiency	Hunter Water will continue to support water efficiency measures under its existing programs that assist households and businesses to save water. The national Water Efficiency Labelling and Standards (WELS) scheme and the NSW scheme to improve water and energy efficiency through the Building and Sustainability Index (BASIX) will continue to deliver improvements in water efficiency. Together, ongoing residential and non-residential water efficiency improvements are expected to save around 4.5 billion litres of water each year by 2034. Programs to detect leaks and manage pressure in Hunter Water's system are expected to save around 1.7 billion litres a year by 2034.	Additional water efficiency programs for both households and businesses will be activated in drought to help reduce demand as water storages fall. Hunter Water will also invest more in active leak detection and pressure management programs to reduce losses from the water supply system.

Demand management	Water Wise Rules to help conserve water every day will be introduced as an immediate priority under the *Lower Hunter Water Plan*. These common sense actions are estimated to save around one billion litres of water each year.	Water restrictions will be applied as storage levels fall to reduce both household and business demand and keep as much water in the storages as possible. Restrictions are a quick and effective response to drought. When in place, restrictions will be actively supported by education and awareness campaigns, and enforced through compliance activities.
Recycled water	The Kooragang Industrial Water Scheme will be able to deliver over three billion litres a year of recycled water to industrial users, starting in late 2014. This will bring the total amount of recycled water to nearly eight billion litres each year. Dual reticulation schemes in new developments at Chisholm and Gillieston Heights will provide recycled water to about 1000 properties as development proceeds. Private sector suppliers are likely to play a bigger role in providing water supply, wastewater and recycled water services to new developments, particularly in areas remote from urban centres.	In a drought, additional recycling opportunities may become more viable for customers seeking an alternate supply that does not depend on rainfall.
Rainwater and stormwater use	Rainwater tanks will continue to reduce drinking water use in new developments. If the current trend continues, rainwater tanks are expected to save around 3.4 billion litres of water each year by 2043. Councils and businesses may identify new opportunities to use stormwater as part of integrated water cycle management into the future.	There may be more interest in opportunities for stormwater harvesting for industrial uses or watering of sporting fields in a drought, although their dependence on rainfall makes them less reliable in a drought.
Temporary desalination	To enable a quick response in drought, 'readiness activities' will include site selection studies, technical and environmental investigations, and a review of procurement options. Ongoing research into potential improvements in desalination technology will be monitored.	Temporary desalination plants provide an emergency drought response for a very extreme drought. By planning in advance, the units can be built quickly if and when needed, and they would be removed when no longer required.

5. The 'continuing actions' in the table include actions that relate to both the longer-term supply-demand balance and investment in activities to prepare for drought.

Monitoring and evaluation

Monitoring and evaluation are essential tools for the implementation and ongoing improvement of the *Lower Hunter Water Plan*. This will involve collaboration with key stakeholders in the systematic collection of information, using existing monitoring systems where suitable. Through this process, the best available information will be used to assess if the plan is meeting its objectives and to make timely decisions on how best to adapt the plan to incorporate the latest knowledge, experience and technology in a process of continuous improvement.

This adaptive management approach is illustrated in the figure below, showing how the evaluation process can trigger adjustments to the plan prior to a major review.

Monitoring and evaluation in the adaptive management cycle[6]

Monitoring and evaluating the *Lower Hunter Water Plan* will involve assessing:

- the plan's effectiveness and efficiency in delivering on its objectives
- whether actions identified in the plan have been implemented in a timely manner
- key assumptions underpinning the plan, including factors considered in sensitivity analyses on demand forecasts and supply modelling
- the actual supply and demand balance compared with the plan's forecasts
- how the measures in the plan perform if a drought is experienced in the region, including whether the measures deliver the expected water savings and/or supply
- whether the measures in the plan continue to be appropriate and relevant in view of potential changes in the supply-demand balance or regulatory regime, advances in technology, and other developments
- appropriate triggers for review of the *Lower Hunter Water Plan.*

6. Adapted from www.cmar.csiro.au/research/mse/ accessed October 2013

A detailed *Monitoring, Evaluation, Reporting and Improvement Plan* is being developed to guide and support implementation of the *Lower Hunter Water Plan* and provide a basis for reviewing and improving the plan. As outlined in Chapter 1, actions to monitor and evaluate the plan and guide an adaptive approach to implementing or adjusting the measures in the plan and developing future plans include:

- monitoring population projections and changes in water demand
- monitoring and reviewing ongoing climate change research to better understand the implications for the lower Hunter's water supplies
- monitoring research into new technology and innovative water management practices
- liaising with the NSW Office of Water on implementing changes to environmental flow rules for the region's river systems in accordance with water sharing plans
- investigating long term water supply and demand options for future plans
- continuing the partnership with the community for future water plans.

Looking to the future

A structured monitoring and evaluation process will support periodic reviews of the *Lower Hunter Water Plan* to ensure it can adapt to changing circumstances and meet the ongoing needs of the lower Hunter community, providing water security during drought and reliable water supplies for business and population growth.


Mix of water supply and demand measures
BASIX
WHOLE OF GOVERNMENT APPROACH
Consultation
A balanced and adaptable plan
Detailed investigations
Engineering and costing
Demand forecasting
Collaborative process
Responding to extreme drought
Flexibility
CONTINGENCY PLANNING
Whole-of-water-cycle
Integrated approach
REDUCING DEMAND
Investigating new technologies
Environmental Flow Rules
Variable climate patterns
SAFE, HIGH QUALITY WATER
WELS
Planning for drought
Water security
Implications of climate change
BEST PRACTICE WATER MANAGEMENT
National Urban Water Planning Principles
Protecting ecosystems
Building portfolios
Multi-criteria analysis on options
Cost effectiveness analysis
Community Engagement In Water Planning
Decision support framework
Present value cost
Balancing supply and demand
Implementation lead times
Choice modelling
Hydrological modelling
Economic analysis
Water conservation and efficiency
New opportunities
Water that is fit-for-purpose
Providing for population and business growth

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Notes