Central Coast Council

love water
use it wisely

Central Coast Water Security Plan

Draft - November 2021

Acknowledgement of Country

We acknowledge and honour the history and ongoing fundamental contribution Aboriginal and Torres Strait Islanders play in shaping the Central Coast and its future.

Our vision

To provide a resilient and sustainable water future that seeks new opportunities, contributes to regional health and prosperity and is supported by the community.

About our communities

Roads
2,176km

Water and sewer pipelines and tunnels:
4,960km

Water and sewer assets:
$2.4B

Area:
1,680km2

Population
350,000

Aerage rainfall:
1,105mm

Average temperature:
23.2c

3 water treatment plants

8 wastewater treatment and recycling plants

3 dams

3 ocean oufalls

Gross Regional Product:
$15.52b

Aboriginal and Torres Strait Islanders:
3.8%

Businesses:
24,546

Local jobs:
121,679

Families:
41%

Persons with a disability:
6.4%

Born overseas:
14.6%

Tourism overnight visitors:
5.2m

Senior citizens:
20%

Administrator's message

The Central Coast is steadily growing in size. We expect that by 2050 our population will have grown by around 35%. As the Coast grows, so does the demand for water, however, our current water supply system only provides us with a limited supply of water – and it isn't enough for our growing population.

I'm sure you've heard it before, but it's true: water is a finite, precious resource. And we need to make sure we have plenty of it on the Central Coast, not just for now, but for future generations.

Council last planned for our region's long-term water security in 2007, when we developed WaterPlan 2050. Since then, there have been changes in our demand forecasts and we have gained a better understanding of rainfall and streamflow, our water infrastructure, the operating environment and approaches to long-term water planning. We have taken this new knowledge, and leveraged on WaterPlan 2050, to create the Central Coast Water Security Plan that is resilient to population growth and the impacts of future droughts.

When developing the CCWSP we worked closely with the Department of Planning, Industry and Environment and Hunter Water Corporation. I would like to acknowledge them both, as their assistance has been invaluable in ensuring the Central Coast and Lower Hunter regions have water strategies that can work side by side.

Most importantly, I'd like to give a big thank you to the Coast community – not only for letting us know your water values and preferences for this plan, but also for your ongoing efforts to conserve water. The more we conserve water, the longer we can hold off investing into new ways to supply the Coast with water.

However, water conservation isn't going to provide us with the water we need forever, and investing in new supplies of water is inevitable – so we have made sure that our plan can adapt to the uncertainties that lay ahead regarding water demand and climate.

I'm excited to see our CCWSP rolled out on the Coast. Piecing this plan together has been a journey; from having meaningful conversations with our community, to undertaking a multitude of investigations, modelling, analysis – all with the aim to develop an agile, efficient and collaborative plan and approach to water conservation.

We look forward to receiving your final input, comments and ideas for this plan, to ensure we provide the Central Coast with a resilient and sustainable water future – one that is supported by our community.

Mr Rik Hart
Administrator, Central Coast Council

Water Management Advisory Committee

The adoption of an effective plan is essential for the Central Coast to ensure the region's water supply needs are met over the short, medium and long-terms for both normal and drought conditions. The plan must reflect community values, be cost effective and sustainable for the future.

The plan must review and build on previous plans such as WaterPlan 2050 that was developed during the millennium drought. The new plan - Central Coast Water Security Plan – has reviewed and updated the region's supply and demand balance and developed a portfolio of actions based on new technologies, climate trends and community values.

The millennium drought changed the Central Coast as a community in valuing our water supply. The incredible fact is that in 2021 less water is being used across the Central Coast than in 2000, whilst providing water to over 45,000 more residents. This demonstrates the changing attitudes of the community towards water use and conservation.

The development of the Central Coast Water Security Plan has been a long journey with the community and other regional bodies. The community displayed engagement and interest in the Central Coast's water supply and provided extensive feedback during the consultation process, the quality and depth of engagement being unparalleled for water supply planning on the Central Coast. Collaboration was also undertaken with the New South Wales (NSW) Government who will review and approve the plan and Hunter Water who provided extensive modelling support.

The plan has adopted a portfolio approach comprising of a group of different options combined to provide diversity of water sources and demand management measures which will be resilient and adaptable in the face of changing circumstances, especially drought. Extensive and rigorous computer modelling was carried out to develop and assess portfolios which accommodate growth and drought response.

The plan is a "living plan" that addresses future uncertainties such as climate shocks or population growth. The plan has recognised the need for ongoing monitoring and evaluation and provides a pathway to manage the associated changes and trigger additional supply works in those events as required. This is important as the community and all levels of government need to know and support the steps that need to be undertaken and the triggers for them.

The Water Management Advisory Committee has overseen the process of developing this plan from inception in an open and transparent manner. The Water Management Advisory Committee supports the plan and is particularly impressed with the informed and collaborative process undertaken across water agencies and the community and the adoption of permanent water conservation measures that can further defer major capital works expenditure across all portfolios. The Committee was also impressed with the plan's strong support for climate independent options such as recycled water and carbon offset desalination to improve the diversity and sustainability of the water supply and the maintenance of the regional approach developed with Hunter Water during the millennium drought.

The Central Coast Water Security Plan is a commendable, robust plan that provides a balance between making the most of the existing infrastructure and water, while providing a portfolio of actions that will provide the Central Coast with a reliable water supply into the future.

Pam McCann & Daryl Mann
On behalf of the Water Management Advisory Committee

Mr John Asquith

Mr Ken Brookes

Mr Michael Redrup

Our Water Security Plan on a page

A drinking water plan for our growing community

Provides a resilient and sustainable water future that promotes regional health and prosperity, supported by the community

Why do we need a new plan?

As the Central Coast grows, so does the demand for water. However, our current infrastructure can only supply us with a limited amount of water, so we need to address ways to grow our supply, to meet our future demand. We need to plan for new supplies well in advance to allow for them to be developed in time, so we are ready to accelerate the plan if we experience shocks such as drought.

Our plan is:

Agile – it adapts to the future uncertainties of population and climate

Efficient – maximises water sources that are currently readily available to delay more costly, new water supply options

Collaborative – prepared with input from the community, Hunter Water Corporation and Department of Planning Industry and Environment

Cost effective – minimises the impacts upon the environment and bolsters the resilience of our water supply in a cost effective manner

What is an adaptive plan?

The plan will respond adaptively to future uncertainty, potential future droughts and climate change. Purified recycled water and desalination can be delayed or accelerated based on: dam storage, population growth, reduced rainfall, the performance of other supplies including from Hunter Water Corporation, new technologies, the cost and speed of delivery of new supplies and the future risks of restrictions and water security.

The pillars of the plan

Pillar 1: Conserve and use water efficiently

- maximise efficient water conservation measures

Pillar 2: Maximise existing water supplies to delay new water supplies

- fully utilise existing storage capacity in Mangrove Creek Dam and maximise on water transfers with Hunter Water Corporation
- sustainably extract and treat water from existing groundwater supplies
- utilise existing recycled water facilities to supply non-drinking water for irrigation and industry

Pillar 3: Develop new rainfall independent supplies for an adaptive future

- consult the community and regulators to further progress purified recycled water for drinking (PRW)
- provide new climate independent supplies of water through PRW and desalination
- deliver these new supplies adaptively

There are many groups who play a vital role: Council, NSW Government, government agencies and...YOU, the community.

Working together

Understanding our community values and preferences is a key part of our long-term planning. Your voice was heard — a representative sample of the Central Coast community contributed to this plan through a series of forums and online engagement.

What is your role?

Be active in water conservation and water efficiency. Have your say — contribute to the plan during public exhibition.

What is NSW Government's role

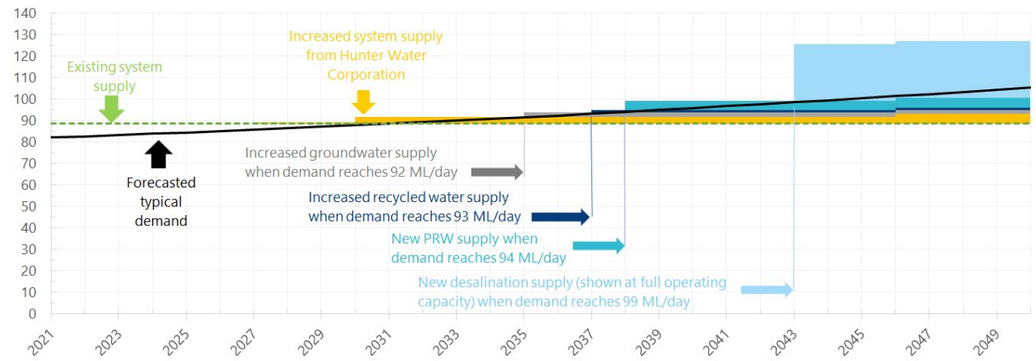
Ensures services are sustainable, affordable, and cost-effective. Water, sewer and stormwater prices are regulated by IPART, which is state-owned but independent.

What is Council's role?

Ensures community feedback from the plan's public exhibition period is taken on board, and then efficiently implement this plan — seeking funding where available for implementation.

Find out more:

yourvoiceourcoast.com/waterplan



*Note: the figure above shows 'indicative' timing of new supplies which are triggered based on increasing demand.

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Tables

1. Setting the scene

1.1. About our water supply system

The water supply system serves the region's population of more than 350,000 people, delivering water to more than 140,000 homes and businesses.

Figure 1 presents an overview of our water supply system. The drinking water system incorporates three dams, three weirs, three water treatment plants, over 50 reservoirs, and more than 2,000 kilometres of pipelines.

The region's drinking water is heavily reliant on water drawn from Mangrove Creek and Mooney Mooney Creek in Gosford, Ourimbah Creek and Wyong River in Wyong. Water harvested from Wyong River and Ourimbah Creek is pumped into Mardi Dam which is used for treatment and supply. Additional water is pumped using the Mardi to Mangrove pipeline to boost storage in Mangrove Creek Dam.

A two-way connection between the Central Coast and Hunter Water Corporation helps both organisations leverage on each region's water supply during drought and operational outages. Water transfers between the two regions operate on an agreed set of rules to ensure it is beneficial for both regions.

We also get some of our water supply from groundwater bore fields at Woy Woy and other minor groundwater sources, along with dispersed small scale stormwater harvesting schemes and recycled water schemes at our wastewater treatment plants.

Every day we deliver approximately 82 megalitres per day (ML/d) of drinking water to our homes and business.

Figure 1: Our water systems

1.2. Government's Integrated Water Cycle Management (IWCM) regulatory process

Local water utilities (LWUs) such as Central Coast Council are responsible for undertaking long-term town water planning. This involves looking at our priorities for our:

- water, wastewater and stormwater services
- existing and future infrastructure

We then review the:

- cost of these services
- revenue we earn from these services

This is all done as part of our IWCM Strategy – a 30-year plan that LWUs are required to develop. It identifies an integrated water, wastewater and stormwater system, providing the best value for money on the basis of social, environmental and economic considerations.

The Central Coast Water Security Plan (CCWSP) is a component of the IWCM Strategy. In developing the CCWSP, we followed the NSW Government's best practice management guidelines **(Figure 2).**

The process commences with the existing systems, defines future challenges, develops options and then assesses these options against a number of triple bottom line factors being social, environmental and financial.

Figure 2: NSW Government IWCM Best Practice and CCWSP process

Central Coast Water Security Plan goals and objectives

Our goals

Resilient
Provide a system that can adapt and respond to future uncertainties and will withstand system shocks while continuing to meet the needs of our community in a sustainable manner.

Social
Provide services that are supported by our community and promote its needs, health and wellbeing.

Environment
Protect and restore our ecosystems and biodiversity values.

Financial
Provide affordable and high-quality services that support the region's economic prosperity.

Leadership and strategy
Provide transparent, collaborative and integrated strategic planning.

Our objectives

- Provide water for regional growth.
- Provide time in decision-making to create and respond to future opportunities and emerging challenges.
- Provide a system that withstands system shocks and climatic variabilities whilst meeting community needs (frequency and duration of restrictions, risk of running out of water).
- Provide a resilient system (as measured against resilience qualities such as adaptability, flexibility, connectivity, diversity, robustness, etc).

- Implement a trusted and inclusive process which delivers agreed outcomes supported by the community.
- Improve our urban areas by collectively moving towards a 'water sensitive city' (see Water sensitive cities CRC Urban Water Transitions Framework).
- Reflect the true value of water through:
  - recognition of the values of traditional owners
  - meaningful engagement with broader social values on how water should be used
  - promotion of water as a valued resource.

- Environmental impacts will not exceed the capacity of the locally affected environment
- Deliver net positive environmental outcomes.

- Provide high quality and affordable services that are fit for purpose (selected measures are cost effective, and meet water quality guidelines and regulations).

- Provide leadership and strategic direction for collaborative, transparent and accountable decision-making.
- Provide services that meet community needs and support economic growth.
- Promote integration across internal and external planning processes to deliver positive societal outcomes.

Challenges in developing a Water Security Plan

An understanding of our water systems and its impacts upon the natural and social environments is advancing with significant drivers of change, challenging the way we plan our systems. Adaptability is the key as we balance affordable investments into new supplies while being prepared for future uncertainties.

It is the aim of this Water Security Plan to balance these challenges, to avoid over designing that will impact cost and under designing that will put at risk the water supply and our services.

Affordability

Aged assets

Water security

Climate change

Population growth

Increased resource efficiency

Increased governance and jurisdiction

Increased level of service expectation

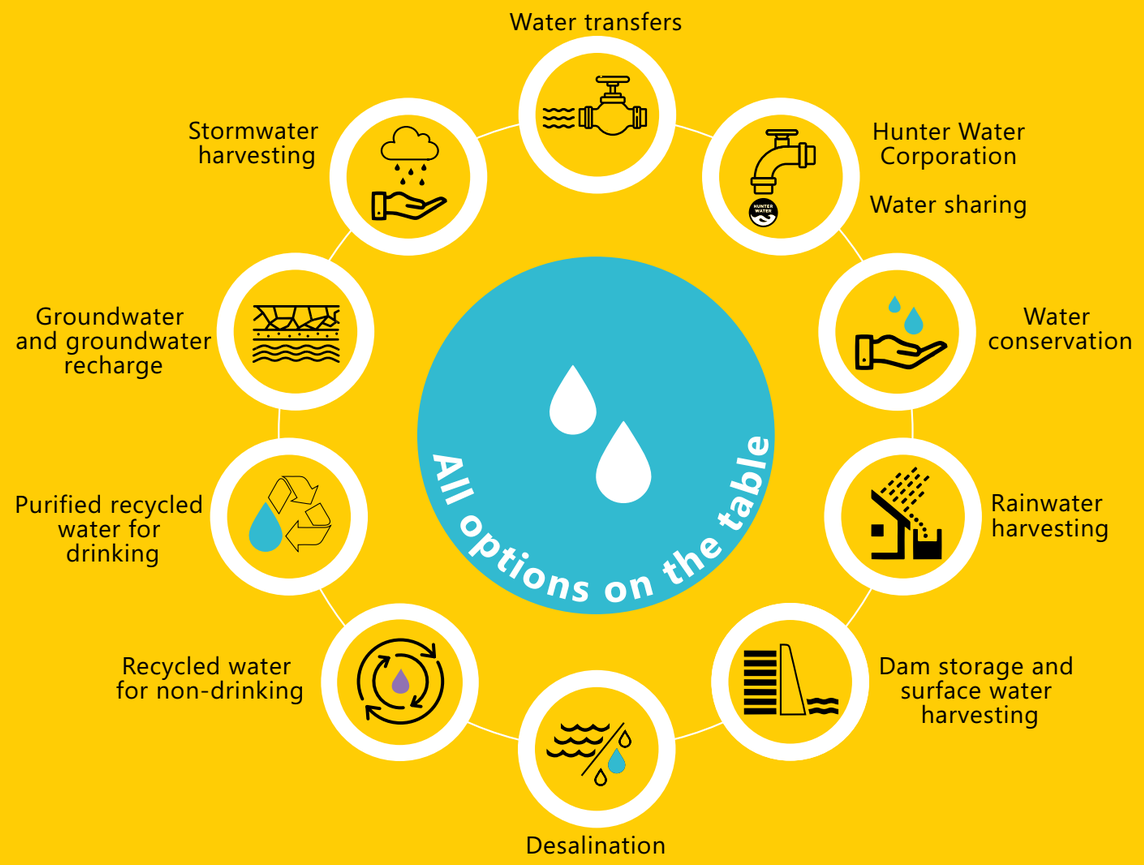
Increased regulatory compliance

CCWSP an adaptable plan for the future

All options on the table

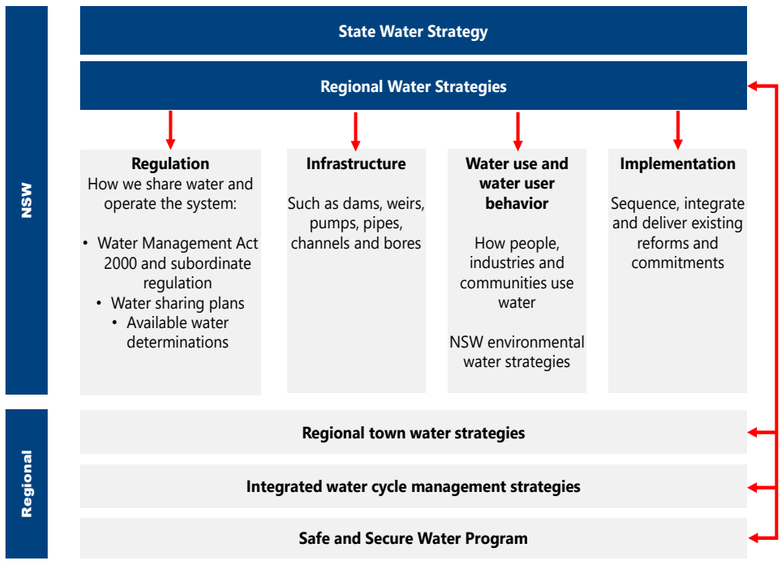
"Diversification is critical; good water industry planning means having all options on the table for consideration".

Water Services Association of Australia (WSAA).
All options on the table lessons from the journeys of others 2019



NSW Water Strategy

The Central Coast Water Security Plan aligns with a suite of long-term strategies being developed by the NSW Government **(Figure 3)** to maintain the resilience of the state's water services and resources over the coming decades.



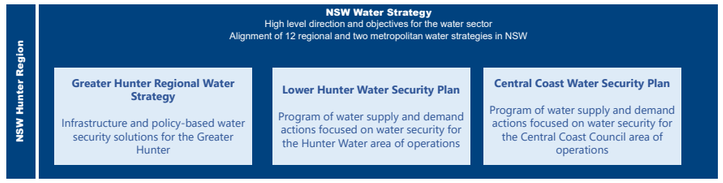


Figure 3: Interaction with NSW Water Strategy

The NSW Water Strategy is the first 20-year water strategy for all of NSW. It tackles the key challenges and opportunities for water management and service delivery across the whole of the state and sets the strategic direction for water service delivery and resource management in NSW over the long-term.

The NSW Water Strategy works in tandem with 12 regional water strategies and two metropolitan water strategies, the Greater Sydney Water Strategy and the Greater Hunter Water Strategy. The NSW Water Strategy sets overall state objectives, outcomes and priorities, while the regional and metropolitan strategies identify place-based solutions for each region. Together the suite of strategies ensures the resilience of the state's water services and resources over the coming decades.

Alignment with the Lower Hunter Water Security Plan

In preparing this plan we have also worked closely with Hunter Water Corporation as they develop the Lower Hunter Water Security Plan (LHWSP).

Central Coast collaborated with Hunter Water Corporation to develop a joint system model (tool and approach) to assess the options for sharing water between the two regions to achieve the optimum whole of system outcome for both regions.

1.3. Our Community Strategic Plan

Our Community Strategic Plan has three main statements which have been integral in the development of the Central Coast Water Security Plan:

Access equity and inclusion statement

The Central Coast community and Central Coast Council are committed to welcoming and nurturing all people who choose to live in or visit our region and to building a sense of place and belonging where work and play co-exist.

Aboriginal and Torres Straight Islander statement

The Central Coast community and Central Coast Council acknowledge our first peoples as the traditional custodians of our beautiful lands and waterways.

Sustainability statement

The values of the Central Coast community are strongly tied to our local natural environment, including our beaches, waterways, ridges, estuaries, lakes and valley floors. The parks, gardens and natural bushland contribute to the lifestyle, culture and beauty of the region.

Doing more with less – sustainability goals

The Integrated Water Cycle Management (IWCM) (allowing for all options to be on the table) and Central Coast Council Community Strategic Plan are strongly aligned and complementary with the principles of a circular economy.

Circular economy entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system. There are three driving themes:

- Design out waste and pollution
- Keep products and material in use
- Regenerate natural systems

1.4. Water supply on the Central Coast – where are we now?

WaterPlan 2050 and this Water Security Plan

This Water Security Plan replaces the previous plan WaterPlan 2050, which was adopted toward the end of the millennium drought in 2007.

Key features of WaterPlan 2050 were:

- Water conservation
- Enhance our existing water supply system
- Accessing additional sources of water

WaterPlan 2050 was an adaptive plan, designed to be flexible to adapt to future uncertainty. This plan has leveraged significantly on WaterPlan 2050 with this revision, and like the WaterPlan 2050, it is anticipated that this plan will be revisited within a 5 to 10 year period or if material change requires an update. Material change can be significant changes to the planning assumptions such as supply or demand changes, major cost revisions, or delays to certain options etc.

Current water use on the Central Coast

Over the past 20 years, the amount of water used by residents and businesses on the Central Coast has reduced, despite a population growth of nearly 50,000 people. This is due to improved water conservation, education and policy changes.

Figure 4 shows this consumption trend since 2002 for residential, non-residential and non-revenue water.

We use on average 82 ML/day and of that, 70% of this is delivered to our homes, 21% is delivered to businesses and the remaining 9% is lost through leaking pipes and maintenance activities within our network.

Water conservation and leakage

Prior to the development of WaterPlan 2050, residents of the Central Coast had experienced the millennium drought – something that influenced the projections of that plan. After its publication, we observed the community embed water conservation practices into their everyday lives.

Figure 5 presents typical patterns of consumption within the home.

Figure 6 demonstrates the benefits of conserving water, and the patterns of water usage since the millennium drought.

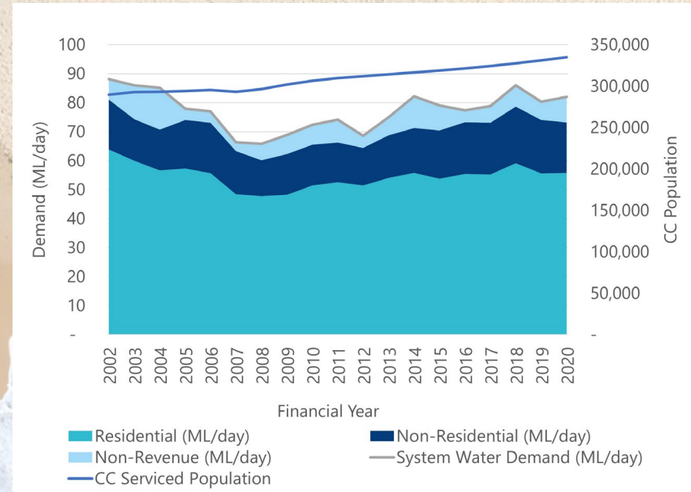


Figure 4: Historic drinking water demand on the Central Coast

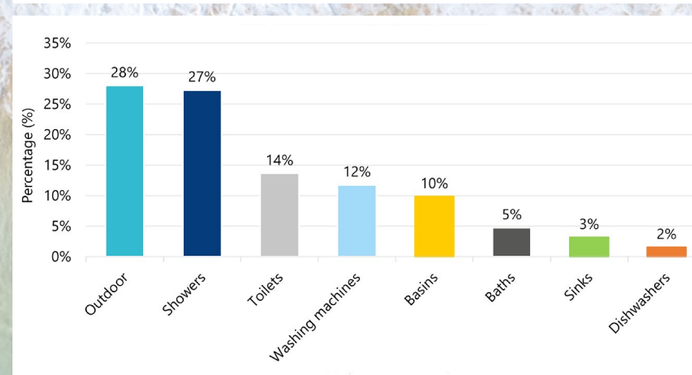


Figure 5: Typical patterns of consumption within the home

In 2002, an average person consumed (in their home) 218 litres per person per day (L/p/d). Compare that with 2020, which is 170 L/p/d, and we are using 48 L/p/d less.

This compares with Hunter Water region at 190 L/p/d and Sydney region at 182 L/p/d.

As a community, when we account for all the drinking water treated, used by businesses and within our homes, we consume approximately 245 L/p/d (including system losses).

Any fluctuations in these demands are typically due to influences such as rainfall, temperature and water demands outside of the home.

Leakage occurs in all water systems through the pipe joints, cracks, broken water mains and connections to customer homes. On a national basis, our leakage management is one of the best performing utilities in the country. **Figure 7** compares Central Coast leakage performance with other water utilities.

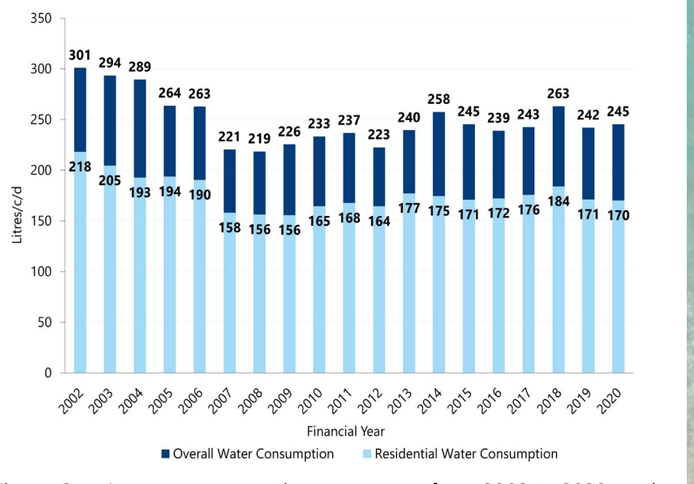


Figure 6: Average consumption per person from 2002 to 2020 on the Central Coast

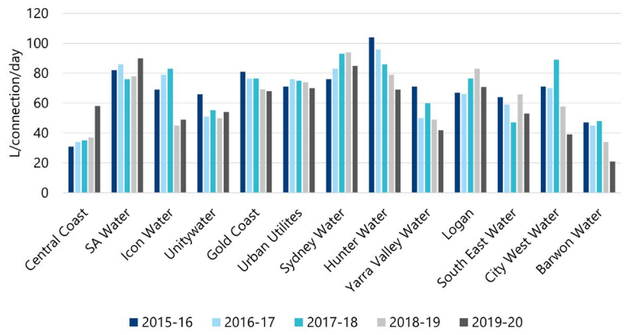


Figure 7: Central Coast system leakage performance (National Performance Report Bureau of Meteorology 2019-20)

Enhancing our existing water supply system

WaterPlan 2050 looked at ways that we could harness the river flows of Wyong River, and store it within Mangrove Creek Dam.

Since then we have:

- installed a pipeline from Mardi Dam to Mangrove Creek Dam
- installed a new pumping station from Mardi Dam to Mangrove Creek Dam
- upgraded the weirs at Ourimbah Creek and Wyong River
- installed a new Lower Wyong River Pump Station.

However, up until recently, the maximum allowable storage level of Mangrove Creek Dam was only 80% of its full capacity – due to a previous change in dam safety rules, resulting in more conservative sizing of spillways to accommodate peak flood flows. This had resulted in the capacity restriction being implemented in mid 2011.

The good news is, methods for assessing dam safety have continued to evolve, allowing a detailed risk-based approach to be followed. In 2020 we engaged specialists to undertake a comprehensive assessment, supported by an independent peer review. Relevant monitoring actions are in place and future triggers for major works have been developed. The 80% capacity constraint has now been resolved and we are able to allow the operation of the dam to 100% capacity – without the need for the spillway upgrade.

Water sharing with Hunter Water

We have set up a water sharing agreement with Hunter Water Corporation (HWC) – allowing for up to 30 ML/d of drinking water to be shared between the regions. HWC's previously proposed Tillegra Dam would have presented additional water security for the Central Coast but was ruled out through a planning assessment process in 2010. HWC is preparing its Lower Hunter Water Security Plan that will present new water security options for its water supply system. Water sharing arrangements will be reviewed when new supplies are incorporated within either system in the future.

Groundwater

Council has three main groundwater bore-fields:

- Woy Woy
- Ourimbah (Bangalow)
- Mangrove Creek

The majority of bores were commissioned during the millennium drought as Council searched for new water supply sources. Since the end of the drought, Ourimbah and Mangrove Creek bore-fields have been decommissioned and Woy Woy has been operating in standby mode due to the availability of other surface water sources.

Existing rainwater tanks

Through development control plans, BASIX and subsidies from Council during the millennium drought, there are approximately 25,000 rainwater tanks in operation on the Coast, saving approximately 2 ML/d drinking water over the long-term.

Recycled water

Council currently produces a total of around 1.8 ML/day of recycled water (in addition to stormwater harvesting schemes) at the following sites for internal operations:

- Bateau Bay Wastewater Treatment Plant (WWTP)
- Toukley WWTP (Includes Magenta Shores)
- Kincumber WWTP
- Mannering Park WWTP
- Central Coast Stadium Reuse Scheme (Graham Park)
- Hylton Moore Park Reuse Scheme
- Terrigal Reuse Scheme

We also irrigate a number of parks and sporting fields on the Coast using recycled water.

Desalination

We identified the potential need for a drought response desalination plant during the millenium drought, when we developed a concept design for a 20 ML/day desalination plant at Toukley.

Since 2005, various studies prepared for the Statement of Environmental Effects (SEE) for a drought response desalination plant determined that construction adjacent to the Toukley Wastewater Treatment Plant was feasible, if it was required.

Water for the environment

In 2009, following investigations into environmental flows between Central Coast Council and Department of Water and Energy, a water sharing plan covering Wyong River, Ourimbah Creek and Mangrove Creek was adopted. The water sharing plan identified and endorsed more flow extraction from Wyong River and Ourimbah Creek when flows are high for use within our drinking water system.

The water sharing plan's rules considers the flow rate (categorised into flow classes) and combined storage level of our dams to determine the potential amount of water able to be harvested. For example, when Wyong River is in Flow Class B and total dam storage is less than 60%, Council is able to take 80% of the remaining riverflow (after environmental flows).

Together, the remaining flow classes, access limits, environmental flows and licence allocations govern the amount of water able to be harvested by Council across daily (total daily extraction limit) and yearly (financial year) time periods. There are no set flow class rules defined for Mangrove Creek or Mooney Mooney Creek.

The history of Australian droughts

There have been four major droughts in the past 120 years (as far back as our records go) with two of these occurring in the past two decades:

- Federation Drought (1895-1903) – 8 years
- Mid Century Drought (1937-1947) – 10 years
- Millennium Drought (2001-2010) – 10 years
- The Bushfire Drought 2017-2020 – 3 years

In addition to these multi-year droughts, there have been a number of short, intense droughts including the years 1914-1915, 1965-1967 and 1982-1983.

During a drought, there is less rainfall. This means that there is less water falling into our rivers – which in turn fill up our dams.

Figure 8 demonstrates the impact reduced rainfall has had onto our catchments and rivers. The figure also shows climate variability and wet periods between 1950 and 1990, and stark reduction in river flows since 1990. This is further demonstrated with the decline of storage levels **(Figure 9).**

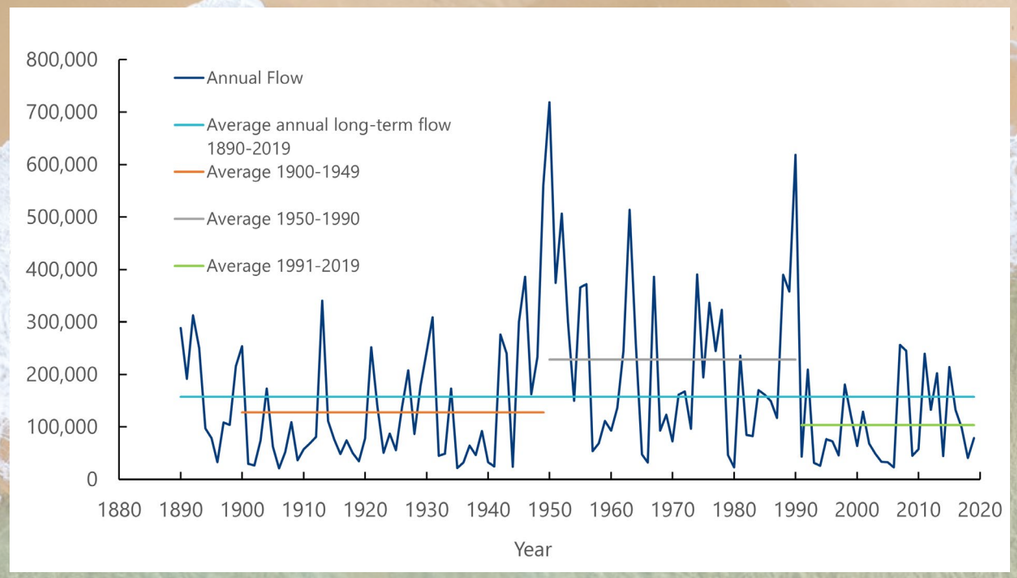


Figure 8: Historical Central Coast river flows

Figure 9 shows the historical water storage levels on the Central Coast – with water storage at Mangrove Creek Dam playing a dominant role. However, it is noted that the upgrades identified in WaterPlan 2050 (including Mardi to Mangrove pipeline) were not commissioned until 2012. These assets aim to maximise the capture of river flows when they are in surplus for storage within Mangrove Creek Dam for later use.

Increased population and reduced river flows across Australia has prompted significant consideration to climate independent supplies. Climate independent supplies are supplies that are more resilient to reduced rainfall, increased temperatures and evaporation. Table 1 compares Council's climate independent supplies with major centres within Australia.

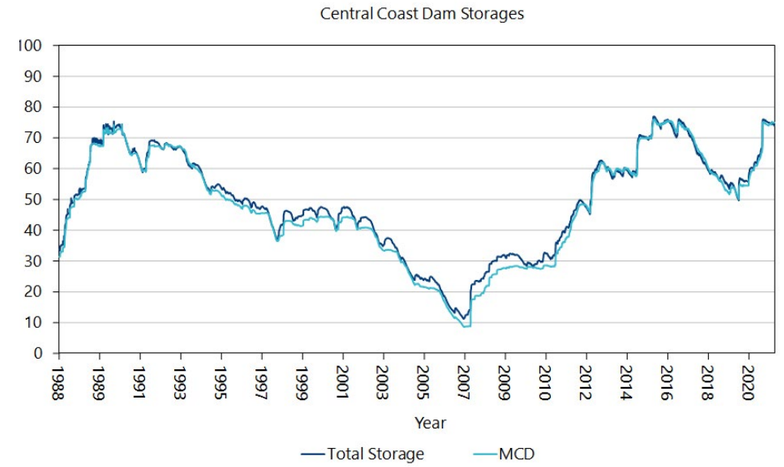


Figure 9: Historical storage level in Mangrove Creek Dam (MCD)

Table 1: Climate independent supplies in major centres across Australia

City	Desalination capacity as a % of demand	Recycling capacity as a % of demand	Total climate independent sources as a % of demand
Central Coast	0%	2.2%	2.2%
Adelaide	54%	15%	69%
Perth	66%	4%	70%
Melbourne	36%	11%	48%
Gold Coast	71%	12%	83%
Sydney	15%	7%	22%

Source NSW Water Strategy (except Central Coast Council)

2. The purpose of the CCWSP

2.1. Supporting growth on the Coast

The population of the Central Coast is changing.

The Coast has witnessed people moving between Greater Sydney, the Hunter region and Queensland and components of direct overseas migration.

This growth is in response to influential trends and existing policies such as:

- financial security and stability of the region
- housing availability and affordability
- migration policies
- inter-region transport policies and amenity
- lifestyle and education choices.

Figure 10 shows the historical migration pattern which typically trends at about 1% of the population per annum.

The global pandemic of COVID-19 (commenced early 2020 and is ongoing) presents additional uncertainty on future population growth, with interregional growth being positively affected and international migration negatively affected.

The provision of drinking water and wastewater services supports our growing community. Without these high-quality services people and businesses would go elsewhere.

Over the next 30 years we could see a further 121,000 people residing within the Central Coast area – with approximately 52,000 new homes. **Figure 11** shows the expected population growth between 2016 and 2051 will largely be in the northern area of the Central Coast.

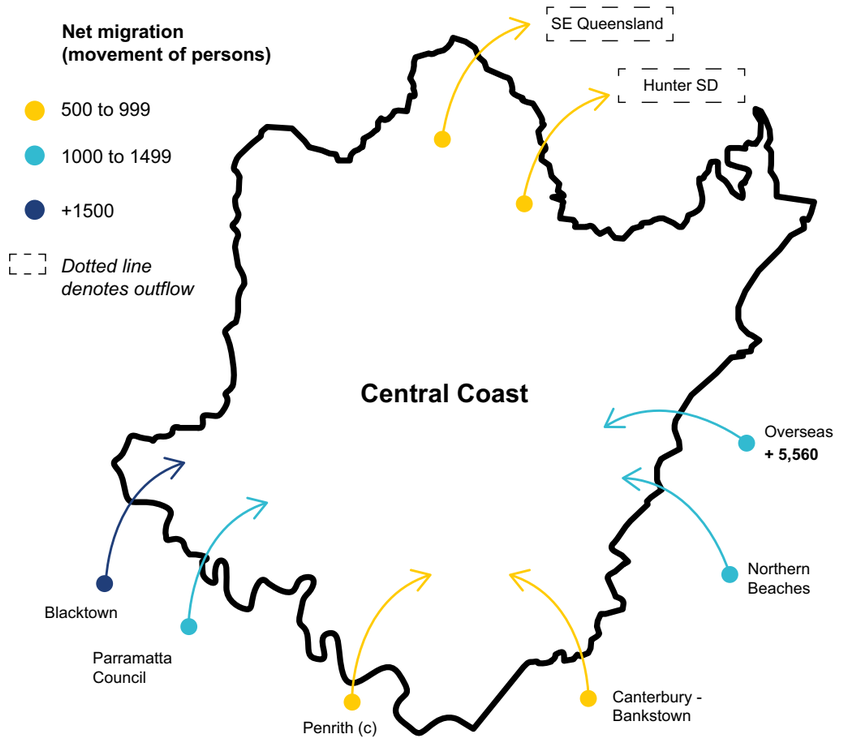


Figure 10: Population migration patterns on the Central Coast
(Source - .ID (informed decisions) March 2018)

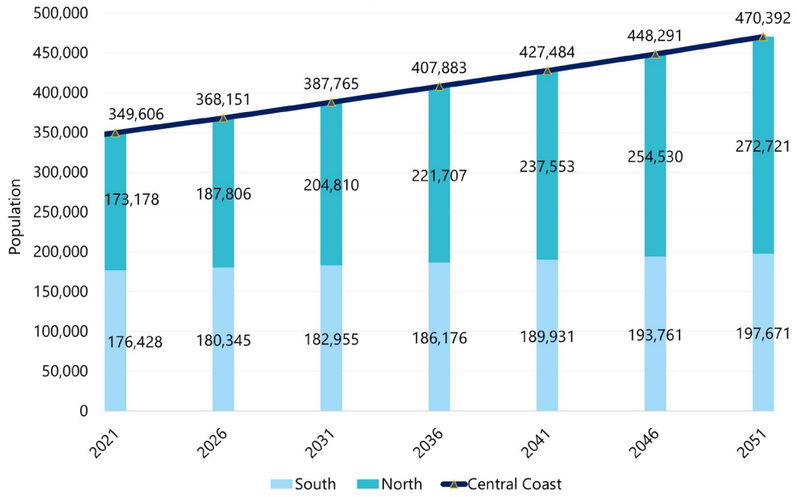


Figure 11: Forecast of population to 2051 on the Central Coast

2.2. Understanding how our water supplies will perform with historical and climate change scenarios

We know our climate is changing, but we are also learning more about underlying climate variability. A range of climate drivers influence rainfall and streamflow patterns in south-eastern Australia, as discussed in the NSW Water Strategy (DPIE, 2021).

Climate analysis from the past 120 years will not tell us how vulnerable we will be to future extreme droughts. This makes water planning difficult.

In the last decade we have seen a raft of climate records broken – being the hottest decade on record, 2019 being the second hottest year ever recorded, and ocean temperatures the highest we've seen.

Correlation with ice cores in Antarctica suggest droughts can last for decades (highlighted as red shading) – as per **Figure 12**.

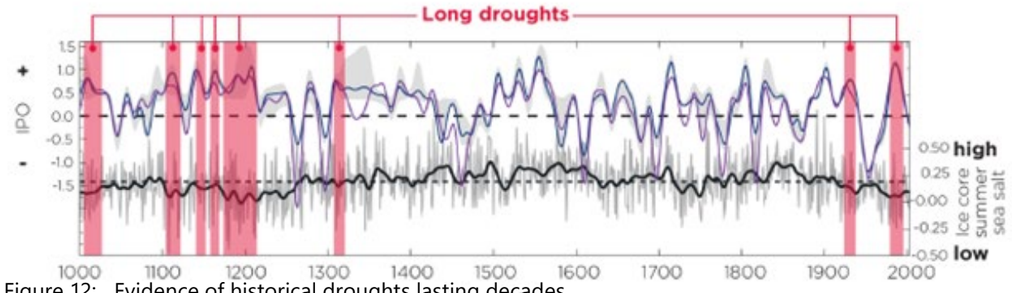
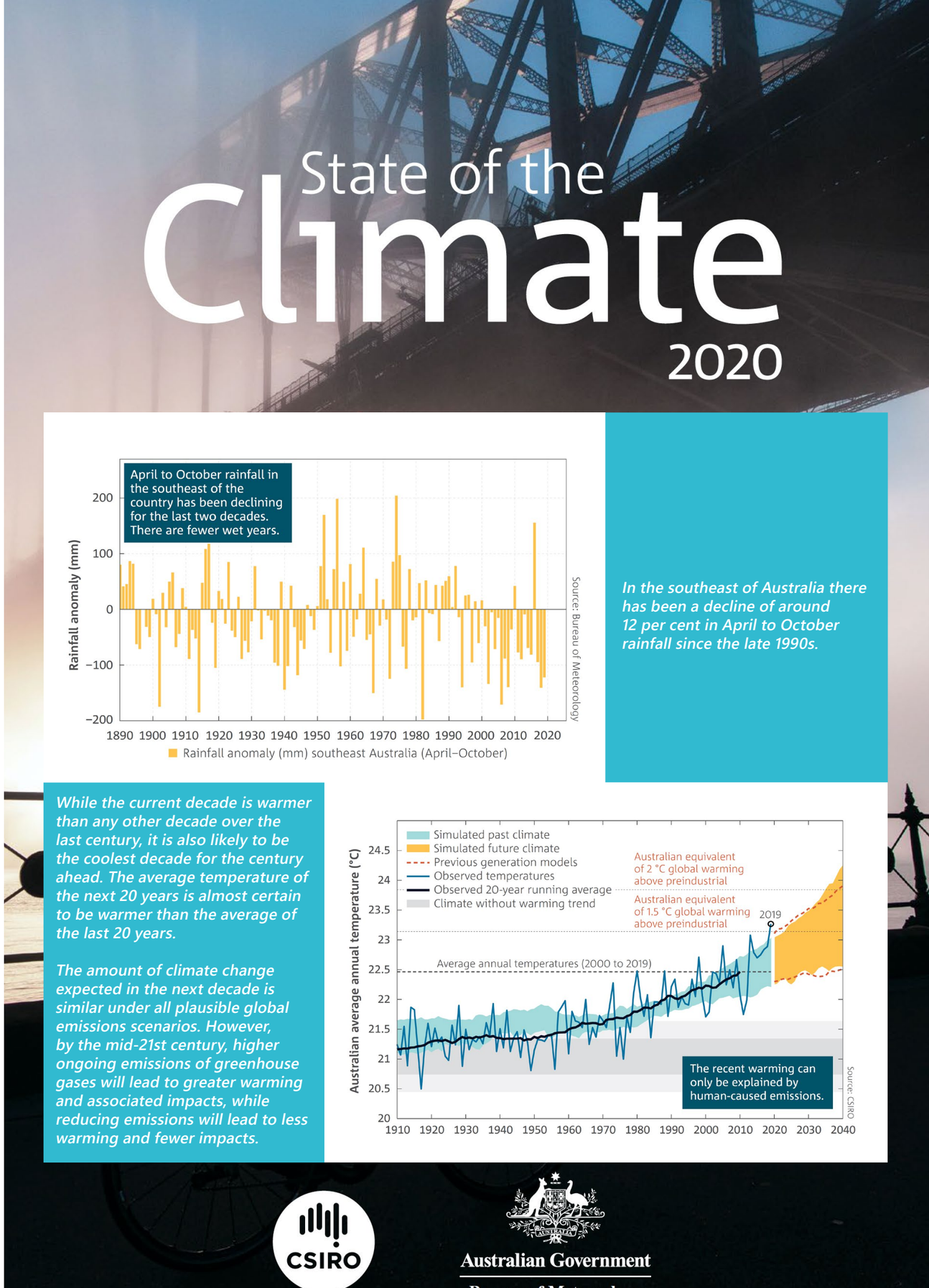


Figure 12: Evidence of historical droughts lasting decades (Vance et. al., 2015)



Hydrological modelling

The NSW Government has invested in new modelling methods and sets of data to develop a better understanding of both historical climate variability and likely future climate conditions.

We now understand that there have been droughts far longer and more severe than those observed during the last 120 years. Palaeo data reconstructed from before instrumental records began, using sources such as tree rings, cave deposits and coral growth and ice cores **(Figure 12)** also indicates that we could also see higher temperatures and less rainfall in the future (State of the Climate 2020).

Past and future climate risks have been considered in the development of the Central Coast Water Security Plan.

2.3. Planning for drought

While our models and global understanding of climate trends are improving, we are not yet at the stage of accurately predicting the weather beyond one week with further uncertainty when we forecast years ahead.

The global conditions impacting Australian rainfall are strongly influenced by climate drivers such as El Niño, La Niña, the Indian Ocean Dipole and the Southern Annular Mode. These systems change rapidly (within a matter of months), which means lower or higher than average rainfall can occur at any time for extended durations.

This plan also involves a drought response, developed to implement alternate water supplies quickly in the case of a drought emergency. Timing is crucial, and if we see a drought unfolding, we want to ensure that we are ready to call on additional climate independent water supplies, such as desalination to provide water to the community.

To balance this uncertainty and ensure that we continue to provide essential services during extreme drought, we have also included in the plan for water restrictions to be in place.

We asked the community about how they felt about water restrictions. Almost all felt that **"restrictions are an essential way of slowing water use during times of drought."**

Our drought response considers both demand side and supply side measures.

Through the hydrological modelling and statistical analysis, we have balanced potential under and over investments and risk in response to extended drought. The measures adopted mean:

- restrictions beyond Water Wise Rules will not be in place for more than 5% of the time
- our drought infrastructure response should not be triggered more than 1 in every 50 years.

Table 2 presents the planned demand side restriction levels through drought when water becomes more scarce, and the indicative storage levels when they will be implemented.

Supply side drought measures

Should the drought response be triggered, we have taken a conservative approach by assuming the observed climate record with the lowest historical inflows and repeating that cycle. This provides the minimum time we have to implement supply responses.

The suitable drought supply responses are further discussed later in this report but include:

- Porter's Creek to Wyong River Transfer Scheme (2 ML/d)
- potential temporary desalination (3-5 ML/d)
- desalination of up to 30 ML/d.

The actual timing to commence delivery of the above climate independent supplies depend on the lead time to construct them before reaching a critical storage level of 15% (**Figure 13).**

Considerations to trigger the drought response measures would also assess:

- the prevailing rate of depletion during the future drought
- the prevailing demand for drinking water and the effectiveness of water restrictions
- availability of key water supply assets
- current climate outlook

The drought response will be further defined as we refine this plan which may also include PRW and further assessment if temporary desalination can be avoided with the proposed permanent site at Toukley.

Table 2: Demand side drought measures — water use restrictions

Restriction level	Percentage of Mangrove Creek Dam when restrictions are triggered to be on	Percentage of Mangrove Creek Dam when restrictions are triggered to be off	Anticipated water savings of climate corrected average day demand
Level 1	50%	55%	5%
Level 2	40%	42%	10%
Level 3	35%	37%	15%
Level 4	30%	32%	19%
Level 5	25%	27%	23%

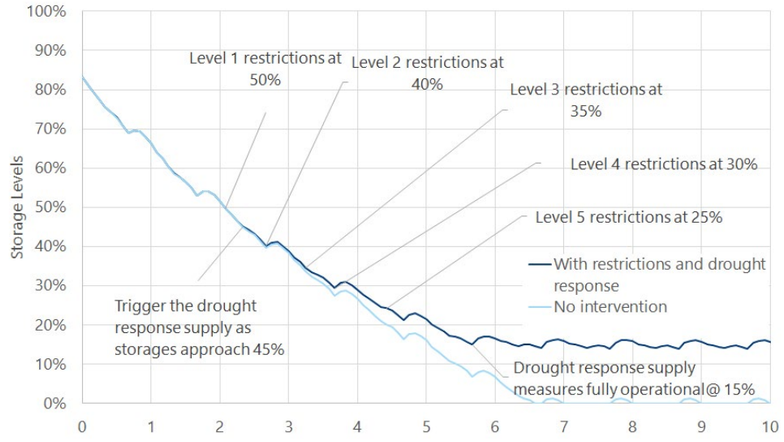


Figure 13: Indicative triggers and implementation durations for Central Coast drought response

2.4. Balancing supply and demand

Accounting for the expected population growth, current consumption patterns and future water efficiency through programs like WELS and BASIX, we have projected the future water demand and compared this to the available water supply (without any new supplies) **(Figure 14)**.

The figure also includes a forecast under climate change scenarios that affect both the existing supply and the demand forecast providing upper and lower boundaries around the average.

Without accounting for uncertainty, we have forecasted that we would need to supply an average of 106 ML/d of drinking water by 2050, an increase of 17 ML/d from our current supply.

Together, the amount of river flow and additional supplies make up the total water supply. As we identify and deliver more supply the available water for the community increases.

Allowing for uncertainty of population growth and water conservation, we have upper and lower bands of forecasted demand at 2051 of +/- 5% around the average forecast.

We have also considered climate change scenarios at 2050 which:

- under a dry outcome – has the impact of reduced river flows and increased water demand as temperatures rise
- under a wet outcome – has the impact of increased river flows and increased water demand as temperatures rise.

When supply is greater than demand we have increased resilience to system shocks such as drought. However when supply is less than demand, we are more likely to trigger water restrictions and the construction of major drought response supplies.

These uncertainties require the plan to be flexible. The timing of new supplies can be triggered between the upper and lower bounds of supply and demand but more likely to be based on averages. This means that we need to be prepared to provide new supplies earlier than anticipated if we have higher than expected demand or lower than expected supply.

When it comes to extended droughts, supply may be significantly less than that required to meet the expected demand and may require further interventions.

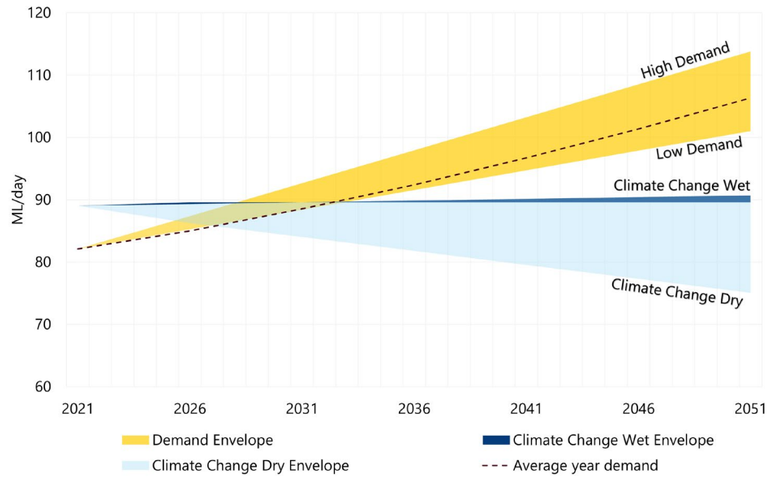


Figure 14: Supply and demand forecasts with boundaries of uncertainty (note the y axis starts at 60 ML/d)

To manage this uncertainty our plan needs to be adaptable to change – which means we may accelerate supply options or delay supply options subject to the conditions at that time.

2.5. Water quality challenges

Climate change not only affects the amount of water available but the quality of the water available. Bushfires can also impact on the availability of water supply assets and water quality can be negatively impacted when post bushfire streamflows enter the dam storages or require increased treatment.

Changing water supply catchment characteristics

As rainfall is reduced, and temperatures increase, the ecosystems of our catchments will also change. Our water treatment process is designed to manage the typical variations in water quality that come from the catchments, however modifications to these processes may be required to accommodate the changing climate conditions and impacts of increased urbanisation.

To manage water quality and ensure development within the catchment has a neutral or beneficial effect (NorBE) to water quality, Council is drafting the following plans to meet these challenges:

- consolidated development control plan to manage development within the water supply catchments
- water supply catchment management plan.

Muddiness and organic matter within our source water

Turbidity, or muddiness of water, is caused by the presence of suspended sediments and organic matter in the water column. This can be caused by:

- higher temperatures leading to bush fires preceding heavy rain
- lower average flows and higher intensity flows leading to land and river erosion.

Turbidity can affect taste, odour and organic matter. Organic matter also reacts with chlorine to produce unwanted chemical by-products and act as a shield to pathogens as particles can harbour bacteria and viruses.

The water sharing plan *(The Water Sharing Plan for the Central Coast Unregulated Water Sources 2009)* has reduced the extraction of low flows in Wyong River while allowing greater extraction of high flows from the river. However, these high flows are typically lower quality water and have resulted in the requirement for significant upgrades to Mardi Water Treatment Plant which are currently underway.

Higher temperatures leading to algae growth within dams

On the Central Coast we have choices in where we can source our water which improves system resilience and our ability to respond to algae outbreaks.

Certain species of algae can be toxic (such as Blue-green algae). It can cause taste and odour problems in our drinking water and can block our water filters at our treatment plants.

Freshwater algal blooms occur when there is a combination of suitable environmental conditions including:

- nutrients
- temperature
- light
- turbidity and stable conditions.

The major nutrient sources contributing to algae growth are phosphorus and nitrogen, which enter our water ways from:

- runoff and erosion from fertilised agricultural areas
- erosion from river banks, river beds, land clearing
- sewage effluent.

As temperatures increase so does the risk of algae blooms. Typically, these occur in the warmer months. With the expected increase in temperature, it is reasonable to expect more frequent algae problems.

Council's algae management plan aims to reduce and manage the formation of potentially toxic algae through regular monitoring and sampling of the water in each of our Dams and available river flows prior to harvesting. Investigations into existing innovations and technologies are required to reduce and eliminate problematic algae from our dams.

3. Developing the plan

How we've developed the Central Coast Water Security Plan

2018

Catchment hydrology modelling

Joint headworks model development with HWC

Joint option investigations with LHWSP

Demand forecast

2019

Define project scope and goals

Continue joint option investigations with LHWSP

2020

Shortlist supply and demand option types
Continue investigations

Continue CCWSP option development

Community consultation on values

2021

Assess portfolios against objectives and future states

Develop and shortlist portfolios

Community consultation on water options

From 2022

Community consultation on portfolios

Recommend a portfolio and finalise the draft plan

Seek community input on the draft plan

Submit the draft plan to DPIE for review

Release and implement the final plan

Working throughout with our stakeholders and government partners

Ongoing learning with our community

3.1. Options development

WaterPlan 2050 options

We developed a list of options based on the following process.

We balanced our investigations to inform the options selection, with the expectation that if that option was to proceed, further investigations would be required for a comprehensive delivery of that option.

Potential options identified in WaterPlan 2050 were revisited

A long-list of 52 options

Additional options from WaterPlan 2050 were added to the "all options on the table" list to develop a long-list including options being considered within the Lower Hunter Water Sharing Plan.

Options were defined at a very high level

Preliminary 35 shortlisted options

A suite of criteria were developed and through an internal workshop, a preliminary shortlist of the options was developed for further investigation.

Engineering judgement using a range of criteria with subject matter specialists were used to further reduce the options

10 final options were shortlisted

Specialists were engaged to further develop the options in terms of costs, feasibility, indicative capacities and typical delivery timeframes.

Based on this advice the final shortlist was prepared.

Feasible final list of options providing costs, lead time and capacity

5 Portfolios

'No regrets' options were selected that used existing assets at modest costs while deferring the need for new supplies.

A diverse selection of portfolios were selected

The collection of options forming the portfolio provided similar scale of supply.

Supply, timing and costs of the selection of options were considered when developing the sequencing of delivery of the options.

Summaries of the final shortlisted options are presented within **Figure 15** and the portfolios within **Figure 16.**

Planning our water future

As the Central Coast grows, so does the demand for water.

Our current water infrastructure can only supply us with a limited amount of water. We need to figure out how we can grow our water supply, so we have enough for future demand levels.

Below are the ten final shortlisted options that we then analysed as part of our decision making tool. No single option provides sufficient water supply required for the future, therefore we need to implement a combination of options.

Dam enlargement

We looked at enlarging the existing Mangrove Creek Dam.

Store either an additional:	40 billion litres of water	80 billion litres of water
Build cost	$134M	$259M
Operate cost	$0.7M p.a.	$1.3M p.a.
Levelised cost*	$5.96/kL	$6.33/kL
Environment		
Cultural/social		
Timeframe		
Water production		
Relies on rain?	yes	

Desalination

Desalination plants remove salts from seawater to create drinking water.

We looked at constructing one at the existing Toukley Wastewater Treatment Plant.

We also allowed for carbon offsets to account for the carbon created through the electricity requirements.

The options are:	20 million litres of water per day#	30 million litres of water per day#
Build cost	$206M	$230M
Operate cost	$12M p.a.	$16M p.a.
Levelised cost*	$4.59/kL	$3.66/kL
Environment		
Cultural/social		
Timeframe		
Water production		
Relies on rain?	no	

Groundwater

Groundwater can be found in fractured rock or layers of sand and gravel. It would be pumped out and treated for our drinking water.

We looked to produce a further 2 million litres of water per day with a peak of 5 million litres of water per day.

Build cost	$0.5M
Operate cost	$0.4M p.a.
Levelised cost*	$0.66/kL
Environment	
Cultural/social	
Timeframe	
Water production	
Relies on rain?	yes

Purified recycled water (drinking)

We looked at purified recycled water – which would treat our wastewater through advanced treatment to make it safe and suitable to be stored in Mardi Dam for our drinking water.

We looked to produce 4.5 million litres of water per day with a peak of 6 million litres per day.

Build cost	$48M
Operate cost	$1.5M p.a.
Levelised cost*	$3.49/kL
Environment	
Cultural/social	
Timeframe	
Water production	
Relies on rain?	no

Rainwater tank scheme

We considered a rainwater tank program to significantly subsidise the supply of rainwater tanks to around 45,000 existing homes.

We looked at saving approximately 3.5 million litres of water per day of drinking water.

Build cost	$224M
Operate cost	$2.24M p.a.
Levelised cost*	$12.82/kL
Environment	
Cultural/social	
Timeframe	
Water production	
Relies on rain?	yes

Recycled water (non-drinking)

We already treat some wastewater to bring it to a standard for non-drinking uses.

We considered expanding the existing recycled water distribution and increase use by our major recycled water customers.

We looked at saving approximately 1.0 million litres of water per day of drinking water.

Build cost	$6.6M
Operate cost	$0.2M p.a.
Levelised cost*	$1.84/kL
Environment	
Cultural/social	
Timeframe	
Water production	
Relies on rain?	no

Water sharing between regions

We considered our current water sharing with Hunter Water by upgrading existing water sharing assets and providing additional storage at Mangrove Creek Dam. This particular option is only feasible if we proceed with enlarging the dam. There maybe other water sharing opportunities emerge from the Lower Hunter Water Security Plan. The combination of dam enlargement and inter region transfer would provide approximately 18.5 million litres of water per day on average.

Build cost	$357M ^
Operate cost	$2.6M p.a.
Levelised cost*[1]	$5.02/kL
Environment	
Cultural/social	
Timeframe	
Water production	
Relies on rain?	yes

Water transfers

We considered the construction of a pipeline that would transfer water from the Lower Mangrove Creek Weir into Mangrove Creek Dam – which would effectively increase the catchment area of the existing dam. This would provide approximately 2 million litres of water per day on average.

Build cost	$108M
Operate cost	$0.7M
Levelised cost*	$14.38/kL
Environment	
Cultural/social	
Timeframe	
Water production	
Relies on rain?	yes

Risk / impact
Low
Medium
High

– **The levelised cost considers how much it costs to build and operate the asset, providing you with a cost per unit of water produced.*

^ Included with dam enlargement of 80 billion litres of water

 # These are full capacities of desalination. Allowing for plant downtime and system constraints, supply will be less.

Figure 15: Shortlisted options

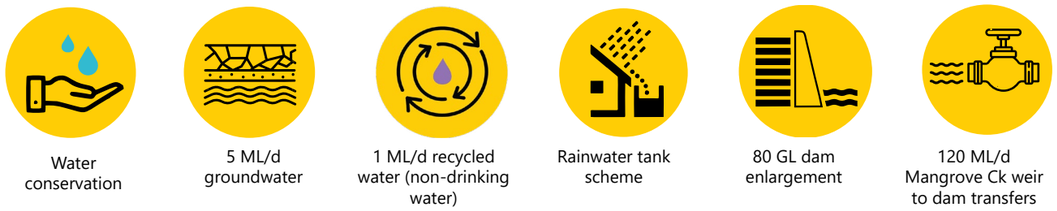
The collection of options and the indicative sequencing in which the options would be implemented formed a portfolio.

The following five portfolios were analysed with water conservation as a central common pillar to all the portfolios.

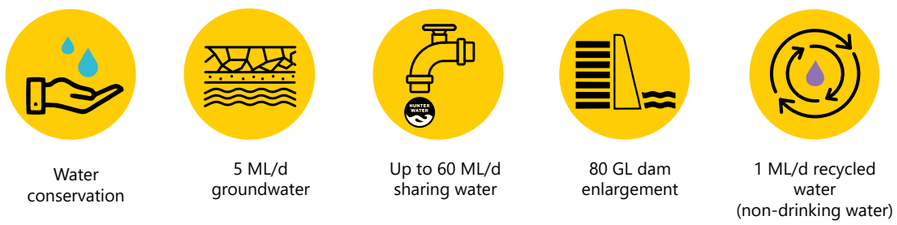
1. Climate independent (staged desalination capacity)

2. Climate independent (upfront capacity)

3. Surface water (traditional sources)



4. Enhanced water sharing with Hunter Water Corporation



5. Traditional transitioning to climate independent

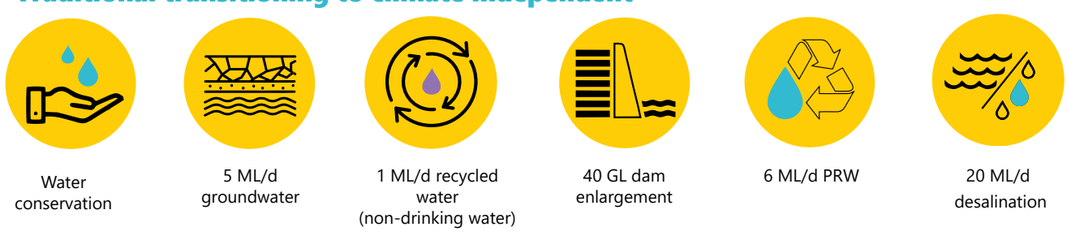


Figure 16: Final portfolios
(numbers quoted are maximum capacities, actual supply will be less)

3.2. Your Voice Our Coast

Accessibility, equity and inclusion is one of the key statements of our Community Strategic Plan. So we reached out to our community to capture their voice in values and preferences when developing this Plan.

How you connected

- 2,238 visits to the YVOC website
- More than 7,500 social media users reached generating 35 likes, comments and shares
- The fact-sheets on the water supply and demand options were downloaded 442 times
- 308 surveys completed
- Over 11,000 stakeholders were kept up-to-date through Council-wide e-newsletters
- 116 people participated in a series of three live video forums over a five month period
- 230 stakeholders were kept up- to-date through project update e-newsletters
- Digital advertisements were seen 268k times, with 339 clicks to the project page

The community said

We value our water supply to be:

- reliable
- sensitive to the environment
- cost effective

We want our future options to:

- conserve water
- reuse water
- be climate independent

We support:

- a water efficiency program
- sustainable groundwater as a supply source
- maximising recycled water for non-drinking
- developing purified recycled water for drinking
- developing desalination for climate independence

3.3. Supply system modelling

The individual options and portfolio of options were simulated within the developed supply system modelling. This provided an understanding of the available water supply provided in relationship with operating rules and what the climate was doing to our demands and storages. The supply analysis was an important feature that informed the cost benefit analysis. The CCWSP has utilised an updated approach to determine our supply scheme yield (compared to WaterPlan 2050), similar to the approach followed for the LHWSP.

3.4. Cost benefit

A cost benefit analysis compared the portfolios to determine the best outcome for the community using a number of measures based on funding and pricing principles set out by NSW Treasury guidelines, such as the:

- lowest cost of the portfolios
- cost of restrictions
- cost of triggering the drought response
- balance and understanding of costs and how they integrate with HWC for options that contribute to common supply.

3.5. Selecting the preferred portfolio

To find out what was the best portfolio for the Central Coast, we developed a multi-criteria analysis (MCA) tool.

The tool took the vision and objectives of the Water Security Plan and aligned them with the United Nations Sustainability Goals, which are consistent with our Community Strategic Plan.

We then identified criteria and measures, and put each of them into one of the following three categories:

- community
- benefits
- costs.

This was so we could then score each of the water supply and demand options, and the five portfolios, against these categories. The level of influence of the categories are presented within **Table 3.**

In broad terms, when looking at the water options and portfolios, we considered the following:

- the social and environmental impacts of water supply options
- the broader social costs of water restrictions and inability to meet water demands
- alignment of community values with the water supply options and portfolios
- the costs to construct and operate the options
- implementation timeline for the options
- likelihood and cost of triggering drought response investments
- flexibility of the options in scale and time
- reliability and drought performance
- system resilience benefits
- complexity and risks.

Table 3: Criteria level of influence of each category for portfolios within the MCA

Category	Criteria	Level of influence for each category (%)
Community	Representative community support	22.5%
Benefits	Supply contribution	29%
	Resilience	
	Flexibility	
	Circular economy principles	
	Net nutrient discharge savings	
Financial cost	Levelised costs for options, LRMC for portfolios	26%
	Cost of restrictions – portfolio only	
Non-financial cost	Biodiversity impacts	22.5%
	Heritage	
	Net carbon emissions	

Our multi-criteria analysis balanced all of the information we had from our investigations, modelling and analysis, with the feedback we received from the community, to develop an overall Water Security Plan that is affordable, efficient, resilient to future changes and both meets the needs of, and is supported by, the community **(Figure 17).**

Options were assessed individually and then collectively as portfolios. The final scores of the options and portfolios are presented within **Figure 17** and **Figure 18.** The higher the column the more benefit it provides, or less negative impact it has.

Sensitivity checking was carried out on the analysis based on the following criteria, however this did not change the overall ranking:

- Overall weightings were removed to determine if there was any inherent bias being introduced.
- Financial scores were removed to determine whether cost was influencing the selection.
- Only costs were assessed to determine if just a cost decision would change the outcome.

The analysis has provided strong support for:

- climate-independence
- avoidance of biodiversity and heritage impacts.

This is characterised by Portfolio 1 (P1) and Portfolio 2 (P2) as the preferred portfolios.

Surface water options also scored poorly (typically higher social and environmental impacts with lower levels of resilience and flexibility) and this is reflected within the lower scores of portfolios 3 (P3), Portfolio 4 (P4) and Portfolio 5 (P5).

Community

- The community's support is P1 and P2 – with P2 marginally exceeding P1.
- P3 has medium levels of support.
- P4 is the least supported by the community.

Benefits

- P1 and P2 provide the highest overall benefits across all the criteria.
- P3 has lower support and lowest in removing nutrients from waterways, flexibility and resilience.
- P4 has the lowest overall benefits across the portfolio options but scores well in how much water it can supply.
- P5, while scoring marginally better than P3 in benefits, still significantly lags P1 and P2.

Costs (financial and non-financial) (higher score = lower cost)

- P1 and P2 provides the highest overall cost score.
- P3 has the lowest score for Long Run Marginal Cost (LRMC) and second lowest for cost of restrictions but scores well in carbon emissions.
- P4 has the highest score for cost of restrictions, scores well in carbon emissions but the lowest score for biodiversity and heritage impacts.
- P5 scores well in LRMC, cost of restrictions and carbon emissions, slightly trailing P1 and P2.

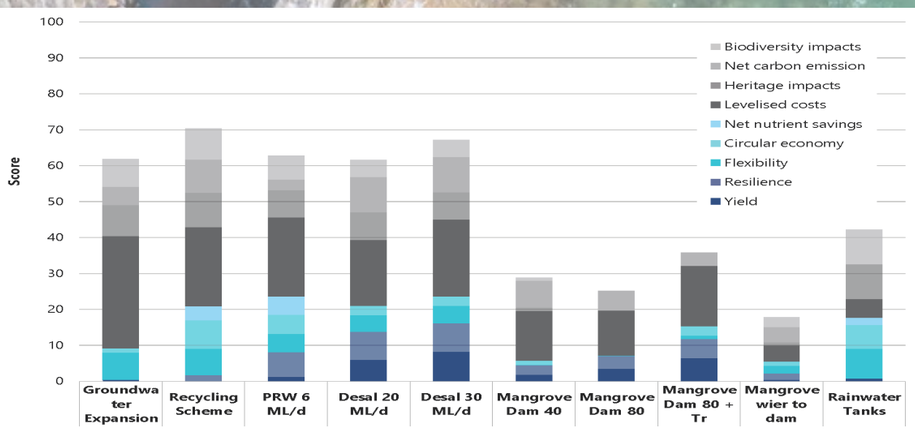


Figure 17: MCA options scores
(the higher the score the better the option performs)

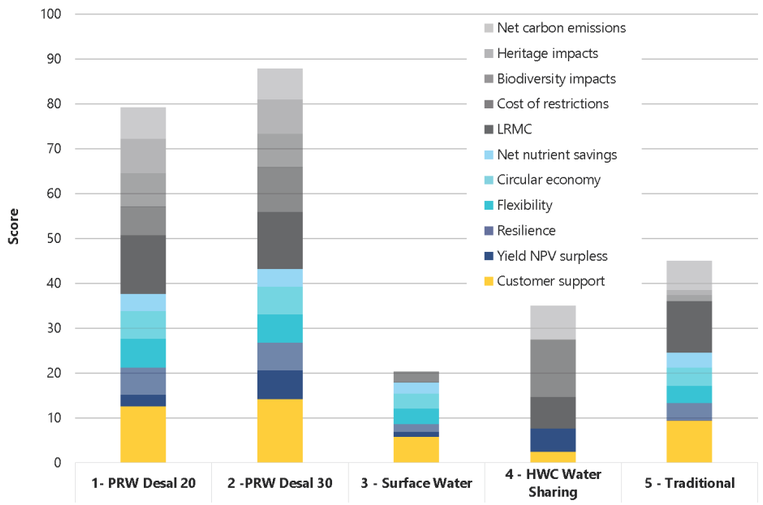


Figure 18: MCA portfolio scores
(the higher the score the better the portfolio performs)

3.6. Summary of the evaluation process

The phase	The analysis	The outcome
Options development	The detailed options assessment developed the following characteristics for each of the options: – technical – regulatory – financial – social – sustainable.	– **Over 50 options were assessed with 10 making the final list** – **Provided capital and operating costs, capacities, lead time and social and environmental impacts.**
Supply system modelling	The scale of the supply assessment was based on: – in restrictions, no more than 5% of the time – probability of triggering drought response is no more than 1: 50 years.	– **Options — estimate of water supply** – **Portfolio — estimate of water supply.**
Community engagement	The community was engaged to capture: – values – preferences.	– **Options and portfolio support.**
Cost benefit analysis	Cost benefits analysis determined the lowest cost, considering: – triggers for new supplies – capital and operating costs – cost of restrictions – biodiversity offset costs	– **Least cost portfolio assessment** – **Indicative options timing and long run marginal costs (LRMC)** – **Cost of restrictions.**
Multi-criteria analysis	MCA balanced competing drivers: – social and cultural impacts – environmental impacts – financial impacts.	– **Options and portfolio assessment** – **Preferred portfolio.**

4. Our plan for the future

4.1. Wrapping up WaterPlan 2050

WaterPlan 2050 final actions

The great work that is being implemented from WaterPlan 2050 has now started to maximise the available water we have within our rivers and store this water for later use.

The following are the final wrap up actions to complete WaterPlan 2050:

- **Mangrove Creek Dam:** Following the recent dam safety assessment, Mangrove Creek Dam will return to full operation, deferring the need for a new spillway. This is the final piece in maximising the available surface water while it is in abundance and storing this water within Mangrove Creek Dam for later use for drinking water.

- **Mooney Water Pump Station:** By rolling out an upgrade at this pump station, we can now increase its capacity from 43 ML/d to 60 ML/d.

- **Somersby Water Treatment Plant:** We are planning to enhance the operations of this treatment plant so we can better treat water from both Mangrove Creek Weir and Mooney Dam simultaneously. The benefits of increasing Mooney Water Pumping Station capacity and enhancing Somersby Water Treatment Plant are to:
  - increase the utilisation of available water at Mooney Dam
  - maximise daily production of drinking water at Somersby Water Treatment Plant
  - improve resilience of our water supply to the southern parts of the Central Coast.

- **Porters Creek Emergency Stormwater Harvesting Scheme:**
  The existing Porters Creek Stormwater Harvesting Scheme is limited as a sustained water supply, with challenges associated with an urban catchment. As a result, it is only considered suitable as an emergency drought management response. A water extraction licence is required and additional studies to ascertain the local impacts on the ecosystems and catchment risks are required. At times of need during drought this scheme is expected to contribute an average daily volume of 2ML/d of water to supplement supplies.

Benefits finalising WaterPlan 2050 actions:

- feasible and easy to implement
- low capital and operating cost per unit of supply due to previous expenditure
- ability to increase utilisation of assets that already exist
- low impacts to the community and environment
- maximises the sustainable amount of water extracted from the environment for consumption
- improves operational flexibility and resilience
- adds to our overall drought resiliency for shorter droughts
- defers the timing of future new supplies
- adds to HWC's resiliency through the water sharing plan.

Enhance our water sharing rules

Central Coast Council and Hunter Water Corporation (HWC) have an existing pipeline connecting the two regions. The pipeline can transfer water in either direction according to established water sharing rules.

The system offers mutual benefits to both systems to build shared drought security by maximising the storage of available water across the two regions. There are also operational benefits by increasing the resilience of the system to impacts of any local water issues or incidents.

Investments that HWC make in new supplies may also contribute to the overall supply for the Central Coast and vice versa.

Existing water sharing arrangements will be continued and enhanced where possible to ensure both regions are best placed to respond to drought, day to day needs, meet future growth requirements and adapt to climate change.

4.2. The preferred portfolio of supply options

The two preferred portfolios and sequencing are presented within **Figure 19**. All portfolios incorporate water conservation as an ongoing cost-effective initiative. Groundwater and recycled water make best use of existing facilities and new supplies of purified recycled water and desalination follow. The portfolios differ only with desalination. The scale of the treatment processes for desalination in portfolio 1 is staged where as within portfolio 2 desalination capacity is built in one go. The key elements of the preferred portfolios are detailed below.

1. Climate independent (staged desalination capacity)

2. Climate independent (upfront capacity)

Figure 19: Preferred portfolios and sequencing (numbers quoted are maximum capacities, actual supply will be less).

4.2.1 Pillar 1: Conserve and use water efficiently

Water conservation

Water conservation and efficiency is a cornerstone of our Water Security Plan. Since the millennium drought, the Central Coast community has responded to the principle to reduce waste.

We can still do more. Currently each person within the home uses 170 litres of water, per person per day.

Council's Live to 150 initiative is one of many web-based water education initiatives available which encourage the community to conserve water through a voluntary residential water conservation target of 150 litres of water per person per day.

We aim to achieve this target through our ongoing education programs and increased use of water efficient appliances. Future water efficiency initiatives will be guided by a state-wide Water Efficiency Framework and program being led by the NSW Water Strategy.

Alongside this we will consider outcomes of the NSW Government's review of the Economic Level of Water Conservation and will apply the recommended methodology to guide investments in water conservation, including leakage reduction, pressure management and community education.

This tool will guide our efforts in future leakage, pressure management and education campaigns.

We expect to:

- continue to invest in reducing leaks from the water distribution system
- continue to use the Love Water website and program to encourage long-term behavioural change
- support customers to find and repair leaks
- expand the schools' program to help students save water at school and at home
- work with major and large water customers, councils and businesses on water efficiency management plans and alternative water supply projects
- consider rebates to encourage water efficient appliances within the community.

Benefits of water conservation

- a reduction in the amount of water extracted from the environment for consumption
- a reduction in the amount of water that is treated and pumped around the system
- a reduction in our energy footprint in treating and transporting drinking water and wastewater
- a deferral in the timing of future new supplies.

4.2.2 Pillar 2: Maximise existing water supplies to delay new water supplies

No regret actions

Our no regret options align with the principles of a circular economy to:

- keep resources in use for as long as possible
- extract the maximum value from them while in use
- recover and regenerate products and materials at the end of each service life.

Accordingly, the following 'no regrets' actions not only maximise on investments of the past but also defer new investments.

Sustainably maximise our groundwater use

Groundwater can be a replenishable and sustainable source of water. Extracting water for drinking water historically has been more expensive than using our surface water supplies. Because of this, our groundwater operations were minimised. By better utilising this existing supply allows us to defer the construction of newer, higher cost supplies of drinking water.

Our approach to recommissioning and enhancing our groundwater use includes:

- restoring the existing groundwater systems at Woy Woy, Ourimbah and Mangrove Creek
- monitoring the performance and impact on extraction for long-term sustainable practice.

We have also identified potential new groundwater sources that will be further investigated. It is expected that groundwater enhancement will contribute to a further 2 ML/d of supply over the long-term.

Maximise our recycled water use

Recycled water involves using highly treated wastewater from our treatment plants to use for non-drinking purposes such as:

- industrial processes
- irrigation of greenspace
- residential use (toilet flushing, garden watering, clothes washing)
- agricultural use
- day-to-day use at our treatment plants.

Increasing the level of recycled water (for non-drinking purposes) forms an important part of our program of actions as it reduces demand on drinking water supplies.

Our approach to increasing the level of recycled water includes:

- restoring our existing recycled water facilities at our treatment plants
- working with past and existing customers to better understand barriers to use more recycled water
- improving institutional arrangements and removing barriers to delivering recycled water and integrated water management solutions and liveability outcomes
- working with industrial customers to increase the supply of recycled water for industry schemes (using a combination of recycled water and stormwater harvesting)
- delivering local recycled water schemes for irrigation at local sporting fields
- working with developers to explore viable opportunities for recycling in new residential developments.

The program is estimated to reduce demand on current drinking water, increasing supplies by additional 1.0 ML/d, an increase of 55% on current levels.

Benefits of groundwater and recycled water actions:

- provides a climate independent supply of water for open space irrigation to improve liveability outcomes during drought
- reduces the amount of water extracted from the environment for consumption
- reduces the amount of treated wastewater we discharge to the ocean
- reduces the amount of water that is treated and pumped around the system
- reduces our energy footprint in treating and transporting drinking water
- defers the timing of future new supplies.

4.2.3 Pillar 3 - Develop new rainfall independent supplies for an adaptive future

Purified recycled water at Wyong South WWTP

All water is recycled through the natural water cycle.

PRW purifies or treats wastewater to a level that makes it safe and suitable to go back into the drinking water supply.

Such schemes are already part of the water supply mix in over 35 cities around the world, including Australia.

Many towns and cities discharge treated wastewater into rivers and creeks, with further downstream extraction for drinking water supply.

PRW provides a reliable, climate independent source of water and is often lower in cost and more energy efficient than other climate independent options like desalination. It also reduces the water taken from the environment by reusing wastewater and reduces nutrient discharges to waterways.

The results of the online deliberative forums and public consultation indicated that the Central Coast community showed support for purified recycled water for drinking as a future water supply option.

Our approach in developing this option has four main actions:

1. **Enhance our common understanding of PRW within the community:** We will work with NSW Government, Hunter Water Corporation, Sydney Water and the Water Services Association of Australia (WSAA) to further inform our community of assurances, processes and benefits of PRW.
2. **Work with our regulators to develop confidence in PRW:** We will work with NSW Health to develop a comprehensive Human Health Risk Assessment compliance and monitoring program to ensure Human Health is protected in accordance with the Australian Guidelines for Water Recycling framework and the water produced meets the Australian Drinking Water Guidelines (ADWG) for all new sources of water.
3. **Construct PRW facilities at Wyong South Wastewater Treatment Plant (WWTP):** We will develop our plans for PRW at Wyong South WWTP in a staged approach. This means we will:
    - complete a thorough drinking water risk management assessment of source water and treatment process at Wyong South to ascertain the risk management actions and treatment process required to protect public health
    - action the finding of the risk assessment to develop the treatment plant concept in the following phases:
        - develop a demonstration plant at Wyong South (this water will not be used within our drinking water system at this stage). This demonstration plant will develop:
            - regulatory compliance
            - required engineering and operational approach for full operations
            - a demonstration of the facility to demonstrate to the community understanding of this option through tours, engagement and education.
        - develop a full operational plant at Wyong South with an estimated potential production capacity up to 12 ML/d of purified recycled water for use within our drinking water system. It is envisaged at this stage that PRW will be delivered to Wyong River, upstream of the water supply weir. The water would be mixed with surface water from Wyong River and then be pumped to Mardi Dam where it would be mixed with surface water from Ourimbah Creek and Mangrove Creek Dam. Subject to the development of this program there are options to put it directly into Mardi Dam, Mardi Water Treatment Plant or directly into the water supply network which would improve the overall efficiency.
    - Water will only be provided to customers after satisfying a rigorous testing and monitoring regime to ensure it meets the ADWG.
4. **Subject to 1-3 consider expanding PRW to other Wastewater Treatment Plants:**
    - We will monitor the performance of the PRW program for rigorous consideration in expanding this program to other facilities.

Initially we have assumed that approximately 6 ML/d of purified recycled water will be produced from Wyong South WWTP and transferred to Mardi Dam, via the Wyong River.

The proposed location of the advanced water treatment plant for PRW is at Wyong South WWTP **(Figure 20).**

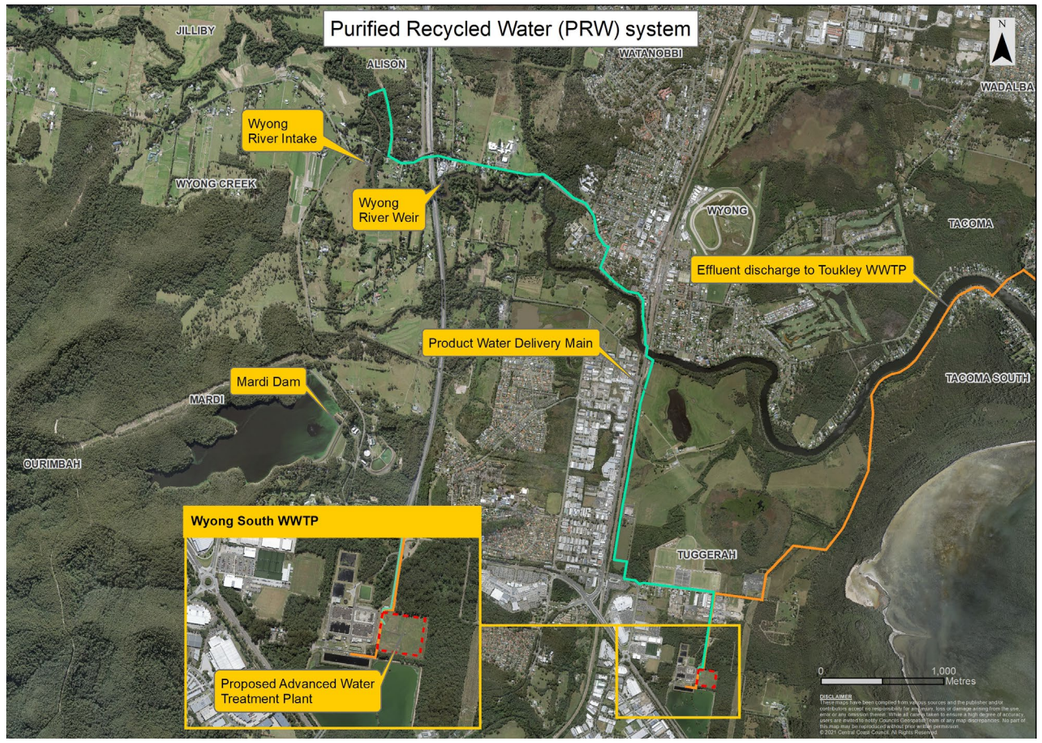


Figure 20: Location of the proposed PRW advanced water treatment plant

Benefits of purified recycled water:

- reduces the amount of water extracted from the environment for consumption
- reduces the amount of treated wastewater we discharge to the ocean
- enhances our drought response and resilience of the system by providing additional climate independent supply.

Desalination at Toukley WWTP

Desalination is an accepted and established technology for drinking water across the world. Technology approaches continue to be innovative with enhanced membrane technology and energy recovery. Membranes have very small holes that prevent salts and other organics being passed through the membrane. To force water through this membrane requires very high pressures which is why desalination requires a lot of electricity.

Additionally, the by-product that the membranes catch is washed from the membranes and diluted with seawater before it is diluted again with wastewater prior to discharge back to the ocean. There are multiple environmental studies across the world that have demonstrated minimal environmental impact from this discharge.

As innovation improves and energy costs reduce, manufacturing drinking water from our abundant ocean becomes more cost effective.

We have proposed to construct an expandable desalination plant adjacent to the existing Toukley WWTP. To implement this, we will:

- plan upstream and downstream infrastructure as a one off allowing for future expansion of up to 40 ML/d
- define a revised seawater intake facility, that will extract sea water from over 1 km offshore and transfer this water to the plant at Toukley
- amend the development consent for a 20 ML/d plant up to a 40 ML/day plant taking into account the revised intake structure
- develop the concept design for a 20 ML/d desalination plant with rapid expansion to 30 ML/d should it be required for drought and an ultimate capacity of 40 ML/d
- secure carbon offsetting to compensate for the high carbon intensive electricity use
- carry out a delivery risk assessment to ascertain critical path activities and manage the risk of long lead time activities in policy and construction and operation to enable rapid delivery if required for drought
- develop cost effective operating rules for the desalination plant to maximise the efficient operation of the total system and retain the required resiliency this plan brings
- consider temporary desalination as a contingent drought response if there are delays in procuring the Toukley plant or if additional measures are required to ensure security of supply to the southern edges of the supply scheme during drought. Temporary desalination would provide up to 5 ML/d and be located within the southern part of the Central Coast.

Benefits of desalination

- reduces the reliance on water extracted from our rivers for consumption
- dilutes wastewater discharges through the existing WWTP ocean outfall
- provides operational flexibility and aligns with our drought management plan
- enhances our drought response and resilience of the system by providing additional climate independent supply.

The proposed location of the desalination plant is at Toukley WWTP **(Figure 21).**

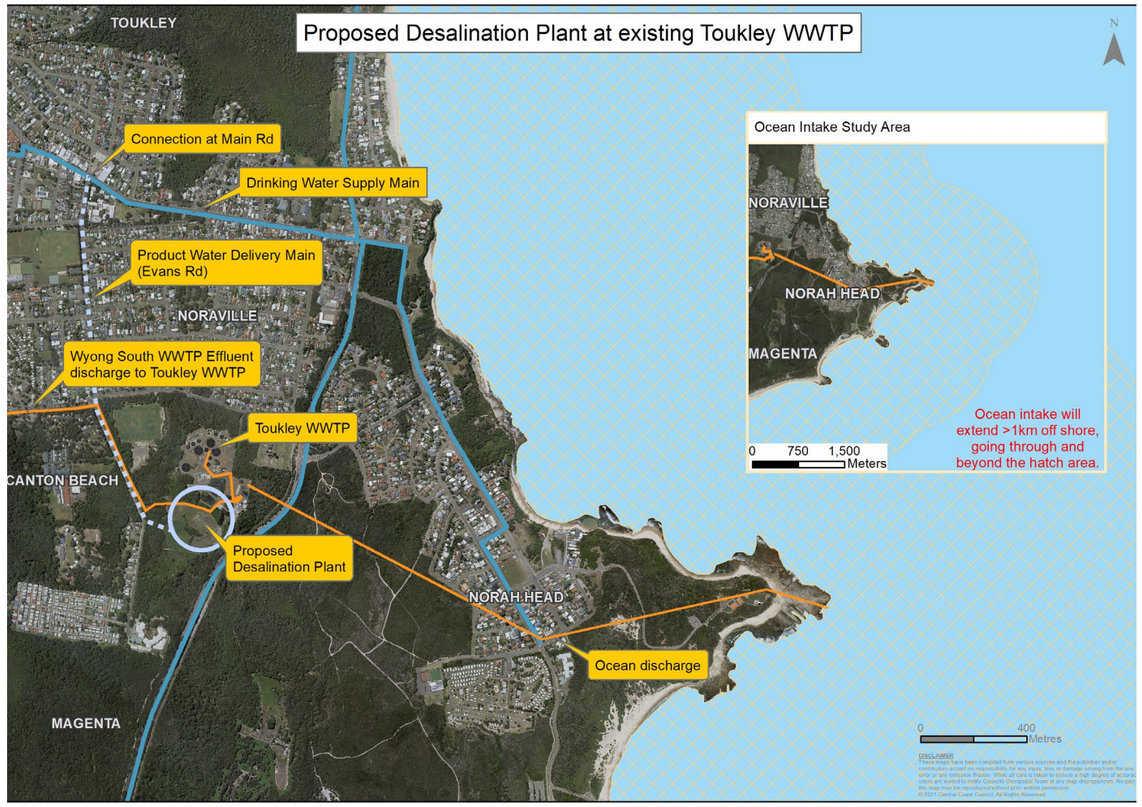


Figure 21: Location of the proposed desalination plant

4.3. Indicative timing and adaptive implementation planning

Our plan is adaptive which means the plan will respond to future uncertainty including future droughts.

The plan has been prepared with the best information at this time, is based on current legislation and has made assumptions as to what the future may entail.

Based on these assumptions, **Figure 22** provides an indication of the timing when future supply options are likely required. The timings are also reliant on a contribution of supply that may be available if HWC invest in additional supply options. The suggested supply indicated is dependant upon those plans proceeding in time and scale.
For more detail regarding HWC investments refer to the Lower Hunter Water Security Plan 2021.

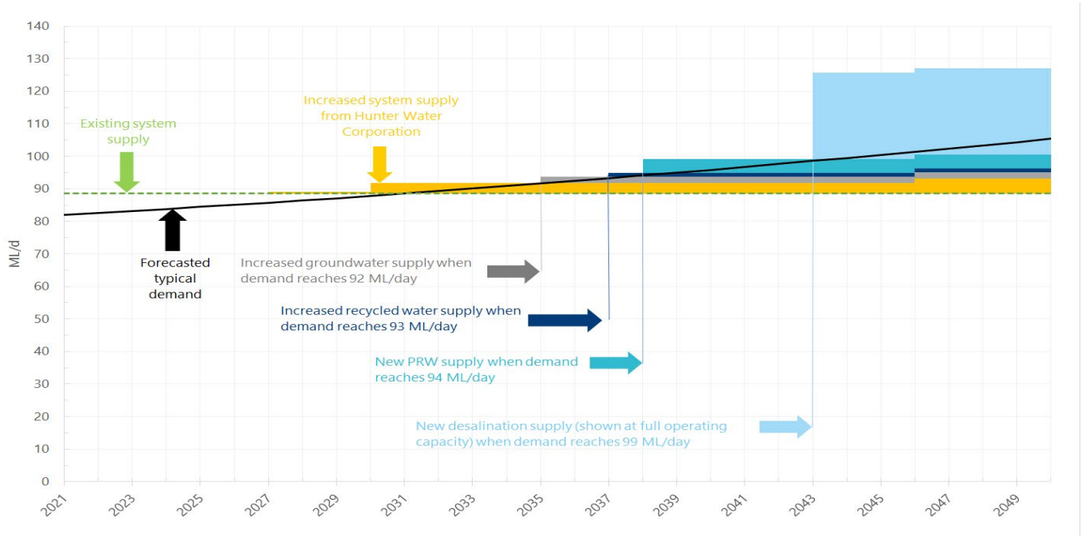


Figure 22: Indicative timing of new supplies

Uncertainties with this forecast

There are uncertainties which may affect these indicative timings.

Forecasted systems supply uncertainty

The analysis of existing system capacity is estimated using the historic measured climate from the past 120 years based on probability. We know that the climate is changing and to the extent this happens is uncertain. **Figure 14** (from earlier in this report) provides an indication the potential impact of climate change on supply, showing significant bias towards the future providing a less climate dependant supply.

Uncertainty of new supply options

We have discussed earlier the assumptions that contribute to the forecast of demand:

- population
- water conservation
- climate sensitive demand.

If any of the assumptions change, then the demand forecast will change making the estimated higher or lower. **Figure 14** provides an indication on sensitivity of these forecasts and the potential impact of climate change on demands.

Imbalance of supply and demand

If supply is higher than the demand we expected, or the demand is lower, then we will be able to push back the indicative timing of these new supplies. If supply is lower than expected or demand is higher, then we will have to bring forward the indicative timing of new supplies.

New supply options uncertainty

Further investigations into how much we can extract over the long-term from groundwater is required. We have been conservative regarding how much we can expect but the investigations may reveal more or less additional supply.

This will affect the timing of subsequent options.

Recycled water is dependent upon the take up from customers willing to use this water. Traditionally this has been patchy (not only within the Central Coast but more broadly across Australia). If the customers that can use suitable recycled water from the existing recycled water treatment plants do not shift from a drinking water supply to a recycled water supply, then the benefit of this options will not be realised. This will affect timing of subsequent options.

Contributions of supply from investment made by Hunter Water Corporation within the Lower Hunter Water Security Plan (LHWSP)

Through the existing water sharing agreement we have made potential contributions to our supply from investments made in new supplies within the Hunter Water Corporation system. As with the CCWSP there are uncertainties within the LHWSP that may affect the timing requirements within this plan. We will continue to work closely with Hunter Water Corporation and vice-versa to monitor both plans for the broader good of the community.

Further investigations for purified recycled water (PRW) and desalination

PRW is an emerging opportunity that is being considered by most major utilities within Australia. It's a proven technology and has been demonstrated to be cost effective. While the community is open to this option further investigations are required as the water industry develops this approach more broadly. As this option progresses there are further opportunities within the Wyong South WWTP and at other Central Coast plants to enhance recycling through advanced treatment and increase production above the scale of supply allowed for within this plan. Variations on our assumptions can have the effect of either delaying or accelerating the next major options of desalination.

PRW and desalination are also climate independent supplies that are incorporated within our drought response. These are new major infrastructure options that require some long lead times to deliver. As drought can happen at any time, we need to ensure that we are ready to implement these drought options should we need to. PRW has additional community and regulatory requirements and therefore will take even longer. Desalination is an established technology. This may require advancing parts of the infrastructure required so that we can quickly implement desalination rapidly.

We need to be plan ready

Due to these uncertainties we need to be plan ready.

This requires further investigations to improve the assumptions and tools used for forecasting, further reduce risks regarding delivery pathways for major augmentations, develop near term investment triggers, seek approvals for these investments in advance of their need, and undertake ongoing monitoring of the plan to ensure it is agile to the circumstances unfolding.

4.4. Implementing the plan (short/medium/long-term actions)

Further work is required to support this strategy and manage uncertainty. The following is an indicative implementation plan to deliver the Central Coast Water Security Plan (CCWSP).

This CCWSP is an agile adaptive plan that is subject to change as information comes to light, research is undertaken, and understanding is improved.

The following delivery plan assumes that the recent IPART submission is supported and funded.

Planning for investments will require ongoing engagement with the NSW Government and evaluation by IPART to ensure they are cost effective. Additionally, it is anticipated that Infrastructure New South Wales (NSW) gateways for large investments would be administered.

The delivery plan has been broken down into near, mid and far term within the following stages of delivery:

- planning and policy
- concept and procurement
- delivery and commissioning
- performance monitoring.

Option / stage	Action - Near term 0–2 year	Actions - mid term 2–5 years	Action - Greater than 5 years
Ongoing refinement of this CCWSP			
Planning and policy	• Continue to work with traditional owners to incorporate their voice into this plan. • Continue to work with the NSW Government and Hunter Water Corporation (HWC) to understand future opportunities to improve water security, including optimising watersharing agreements and further alignment of regional water supply models. • Further enhance the hydrological modelling tools developed for this plan for use within periodic operational modelling and incorporation of new information.	• Monitor the advancement of the LHWSP and determine how those actions benefit the Central Coast and modify the Water Sharing agreement as required. • Further enhance the hydrological modelling tools developed for this plan for use within periodic operational modelling and incorporation of new information.	• Refresh this Water Security Plan.
Performance monitoring	• Develop ongoing monitoring and evaluation process with the Department of Planning, Industry and Environment (DPIE). • Re-forecast demand projections based upon revised population growth from the 2021 census. • Incorporate any amendments to the Water Plan rules and initiatives from HWC. • Incorporate into the forecasting tools and refine projections and triggers for required works.	• Re-forecast demand projections based upon revised population growth from the 2021 census. • Incorporate any amendments to the Water Plan rules and initiatives from HWC. • Incorporate into the forecasting tools and refine projections and triggers for required works.	
Water conservation			
Planning and policy	• Apply government's revised ELWC model to guide ongoing water conservation programs such as a leakage and pressure management program within defined costs and benefits and implement that program. • Participate in the NSW Water Strategy's Water Efficiency Framework and implement programs accordingly on the Central Coast. This may include an education and engagement program, a potential water fix program targeting residential and non-residential high water use customers and a subsidy program to swap out old washing machines and toilets for more efficient appliances. • Participate in the NSW Water Strategy action to review state-wide water restrictions with the aim of improving alignment and harmonisation while considering local Central Coast conditions and community feedback.	• On an annual basis, based upon the revised ELWC model, recharter the water conservation program.	• Same as 2–5 years ongoing.
Concept and procurement	• Align the billing information systems to extract water consumptions for best practice active leak detection. • Refine the pressure management plan.		
Delivery and commissioning	• Deliver an enhanced active leak detection program. • Deliver a refined pressure management program.	• Ongoing active leak detection program. • Ongoing pressure management program. • Ongoing education and engagement program. • Ongoing water fix program. • Potentially deliver a water fix program.	• Same as 2–5 years ongoing.
Performance monitoring	• Refine and reassess the benefits and cost from the water conservation program within the refined ELWC tool for continuous and ongoing adjustment.	• Same as 0–2 years ongoing.	• Same as 2–5 years ongoing.
Surface water			
Planning and policy	• Porters Creek Transfer Scheme application (including supporting studies) for a water supply works approval and extraction licence for the scheme. • Update Water Management Risk Framework to incorporate Porters Creek.	• Undertake supporting studies and pursue previously identified increases to the annual extraction limit for Ourimbah Creek. • Undertake Porters Creek readiness assessment for a water supply works approval and extraction licence for the scheme including any amendments to the Wyong River extraction rules.	
Concept and procurement	• Develop the concept design and planning approvals for Porters Creek pumping station upgrade and procurement plan.	• Prepare concept design and cost estimates for alternative pumping arrangements from Wyong River to Mardi WTP or Mangrove Creek Dam, bypassing Mardi Dam.	
Delivery and commissioning	• Commence delivery to upgrade Mooney Pumping Station.	• Finalise construction of Mooney Water Pump Station upgrade to 60ML/d • Upgrade Somersby water treatment plant to allow enhanced river extraction at Mangrove Creek Weir and Mooney Dam concurrently.	
Performance monitoring	• Review and reassess the risk based water quality extraction triggers for Wyong River and Ourimbah Creek.		

Option / stage	Action - Near term 0–2 year	Actions - mid term 2–5 years	Action - Greater than 5 years
Groundwater			
Planning and policy	• Investigate the sustainable yield for groundwater at Woy Woy and the feasibility of further groundwater extraction elsewhere.		
Concept and procurement	• Prepare concept designs for required upgrades and refurbishment to realise additional supply yield. Update cost estimates.	• Develop the concept design for enhanced groundwater extraction and investigations into new potential groundwater bores.	
Delivery and commissioning			• Re-commission the Groundwater as determined by the revisit of triggers within the WSP. • Commission any new groundwater bores where the feasibility has supported the investment.
Performance monitoring			• Ongoing performance of groundwater extraction on the Groundwater for an ongoing sustainable yield.
Recycled water (for non-drinking purposes)			
Planning and policy	• Update regulatory approvals for existing recycled water schemes. • Develop a customer engagement strategy to understand barriers and entice exisiting and new customer to utlise the available recylced water.	• Ongoing customer engagement.	• Same as 2–5 years ongoing.
Concept and procurement	• Subject to the customer engagement process, prioritise the investment to re-commissioning the existing recycled water schemes and associated works.	• Ongoing recommissioning of the existing recycled water schemes and associated works.	• Same as 2–5 years ongoing.
Delivery and commissioning	• Commence delivery of the prioritised recycled water schemes.	• Ongoing delivery of the prioritised recycled water schemes.	• Same as 2–5 years ongoing.
Performance monitoring	• Monitor the performance and cost effectiveness of the recycled water schemes.	• Same as 0–2 years ongoing.	• Same as 2–5 years ongoings.
Purified recycled water (for drinking purposes)			
Planning and policy	• Develop a community engagement plan aligned with Sydney Water Corporation (SWC) and HWC to educate the community on the opportunities and risks of purified recycled water. • Observe from our neighbors the progress and lessons in delivering PRW and incorporate this into CCWSP. • Assess delivery timeframe risks to incorporate into the agile delivery plan. • Assess the feasibility of additional PRW elsewhere in the system.	• Work with NSW Health to develop a water management risk framework for PRW at Wyong South.	• Determine the delivery timeframe for full operation.
Concept and procurement		• Subject to the delivery risk assessment and SWC and HWC progress, develop the concept design for PRW at Wyong South considering a demonstration plant through to delivery.	• Develop the final concept design and procurement plan.
Delivery and commissioning			• Subject to lessons learned progress a pilot demonstration plant to be plan ready for the full PRW plant production. • Commission the full plant as determined by the revisit of triggers within the CCWSP.
Performance monitoring		• Monitor performance against the ADWG and feed into the water management risk framework.	• Ongoing performance management for compliance and as per the Water Management Risk Framework plan.
Desalination			
Planning and policy	• Determine the required environmental approval gateway. • Undertake distribution network modelling to confirm required operational changes to support the desalination plant and to confirm the need for temporary desalination in the southern area. • Assess delivery timeframe risks to incorporate into the agile delivery plan.		
Concept and procurement	• Subject to the delivery risk assessment - undertake concept design of the revised intake works and increased plant capacity including a cost benefit analysis for staged options for main plant. • Based on the delivery risk assessment and required approval gateways, consid-er the delivery of relevant early works to mitigate potential delays in delivery and defer commencement of future major works for as long as practicable.	• Develop the detail power supply concept for the plant. • Develop a procurement plan for the intake structure and protective works on the Norah Head Ocean Outfall Tunnel.	• Develop the final concept design and procurement plan.
Delivery and commissioning		• Subject to the delivery risk assessment and approval gateways, deliver any required early works (e.g. geotechnical work) to maximise deferral of future major works.	• Commission the full plant as determined by the revisit of triggers within the WSP.
Performance monitoring			• Ongoing performance management for compliance and as per the Water Management Risk Framework plan.

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