



Draft Regional Water Strategy

Gwydir: Strategy
September 2020

Published by NSW Department of Planning, Industry and Environment

dpie.nsw.gov.au

Title: Draft Regional Water Strategy

Subtitle: Gwydir: Strategy

First published: September 2020

Department reference number: PUB20/303

More information: www.dpie.nsw.gov.au/gwydir-regional-water-strategy

Acknowledgments: The input and collaboration of these NSW Government agencies is acknowledged: WaterNSW, NSW Health, Office of Local Government, and Aboriginal Affairs NSW. The feedback of these groups on the Aboriginal Water Coalition is also acknowledged: NSW Aboriginal Land Council, NTSCORP, Murray Lower Darling Rivers Indigenous Nations and Northern Basin Aboriginal Nations.

The NSW Government acknowledges Aboriginal people as Australia's first people practicing the oldest living culture on earth and as the Traditional Owners and Custodians of the lands and waters.

We acknowledge that the people of the Gomeroi/Kamilaroi/Gamilaroi/Gamilaraay Nation hold a significant connection to the lands in which the Gwydir Regional Water Strategy falls upon.

The Gwydir Region holds areas of great spiritual, cultural and economic importance to Aboriginal people and the NSW Government recognises the connection of the water to the people of these nations.

We recognise the intrinsic connection of Traditional Owners to Country and acknowledge their contribution to the management of the Gwydir Regional Water Strategy area landscape and natural resources.

NSW Department of Planning, Industry and Environment understands the need for consultation and inclusion of Traditional Owner knowledge, values and uses in water quality planning to ensure we are working towards equality in objectives and outcomes.

NSW Department of Planning, Industry and Environment is committed to continue future relationships and building strong partnerships with Aboriginal people. We thank the Elders, representatives of the Gomeroi/Kamilaroi/Gamilaroi/Gamilaraay Nation and Aboriginal community members who provided their knowledge throughout the regional water strategy development process.

© State of New South Wales through Department of Planning, Industry and Environment 2020. You may copy, distribute, display, download and otherwise freely deal with this publication for any purpose, provided that you attribute the Department of Planning, Industry and Environment as the owner. However, you must obtain permission if you wish to charge others for access to the publication (other than at cost); include the publication in advertising or a product for sale; modify the publication; or republish the publication on a website. You may freely link to the publication on a departmental website.

Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2020) and may not be accurate, current or complete. The State of New South Wales (including the NSW Department of Planning, Industry and Environment), the author and the publisher take no responsibility, and will accept no liability, for the accuracy, currency, reliability or correctness of any information included in the document (including material provided by third parties). Readers should make their own inquiries and rely on their own advice when making decisions related to material contained in this publication.



Minister's foreword



The NSW Government made a commitment before the last election to undertake comprehensive modelling that would enhance the management of water, to improve water security and better prepare our communities for future droughts.

Water is our most precious resource—for our towns, industries and maintaining our natural and cultural assets.

Our water management and understanding has improved considerably in recent times—if you can't measure it you can't manage it.

Communities have participated in tough decisions that have returned just over 1000 gigalitres to natural river flows in the past decade through the Murray-Darling Basin.

The knowledge we have garnered in the development of these strategies will underpin future investments through a better understanding of optimum water management.

Engaging with our Aboriginal communities is vital given water is an essential part of their connection to Country and culture, and their cultural water holdings will be vital to creating local jobs into the future.

I appreciate the engagement by local government in the development of the draft strategies. Their continued partnership is very important to ensure the strategies respond to the needs of catchments and which may include many local government boundaries.

Australia is no stranger to extremes, we have always had to manage our water resources through floods and prolonged droughts.

In preparing these strategies, we've engaged leading academics at a number of universities. The Paleoclimate informed rainfall and evaporation modelling was largely undertaken by the University of Newcastle and Adelaide University to help understand and mitigate risk in the most extreme circumstances.

The climate modelling in this draft strategy is based on a deliberately conservative scenario which is intended to pressure test the effectiveness of these strategies in a worst-case scenario. They also do not account for changes in how we operate the system moving forward, where in reality we will respond actively to ongoing drought conditions to prolong the availability of water for critical human needs.

These climate scenarios will not necessarily eventuate, but they give us an idea of the possible climate risks and allow us to begin planning to mitigate these risks if they arise.

The recent drought has taught us a great deal about managing our water resources and we need to put these lessons to good use in preparing for future extreme weather events.

In short, the better evidence and information we now have means we can better plan for

the future to ensure this precious shared resource is managed to sustain secure regional lifestyles, create jobs, support industry and protect our precious natural environment.

There is no one size fits all policy to manage water in our regions, and I encourage all stakeholders to take part in giving us your views on how to improve these draft strategies to ensure our water management policies support the future of NSW.



Melinda Pavey
Minister for Water,
Property and Housing



Contents

Overview	10
Chapter 1: Context	20
1.1 Purpose of regional water strategies	22
1.2 Objectives of regional water strategies	24
1.3 What has informed the draft regional water strategies?	26
1.4 Building on existing commitments and reforms	29
1.5 Policy and planning context	30
Chapter 2: The Gwydir region, its opportunities and challenges	32
2.1 What we know about the Gwydir region's climate	36
2.2 The landscape and its water	46
2.3 People, industries and water use	66
Chapter 3: Options for the Gwydir Regional Water Strategy	80
3.1 Our vision for the Gwydir Regional Water Strategy	82
3.2 Identifying and developing the options	82
3.3 Which options will be progressed?	84
3.4 Gwydir: Long list of options	86
Chapter 4: Where to from here?	94
4.1 Finalising the strategy	95
4.2 Implementing the strategy	96
Attachments	98
Attachment 1 Targeted stakeholder engagement	99
Attachment 2 Glossary	110

Snapshot

The Gwydir region



24,800
population



26,000 km²
area



**Gomeroi
Nation**



Regional centre:
Moree



Smaller towns include:
Uralla, Bingara
and Wyallda



One main river: Gwydir
Branches into Mehi/
Moomin, Gwydir and
Carole Creek systems. Plus,
a number of unregulated
rivers and creeks



Major water storage:
Copeton Dam with a storage capacity
of 1,364 GL



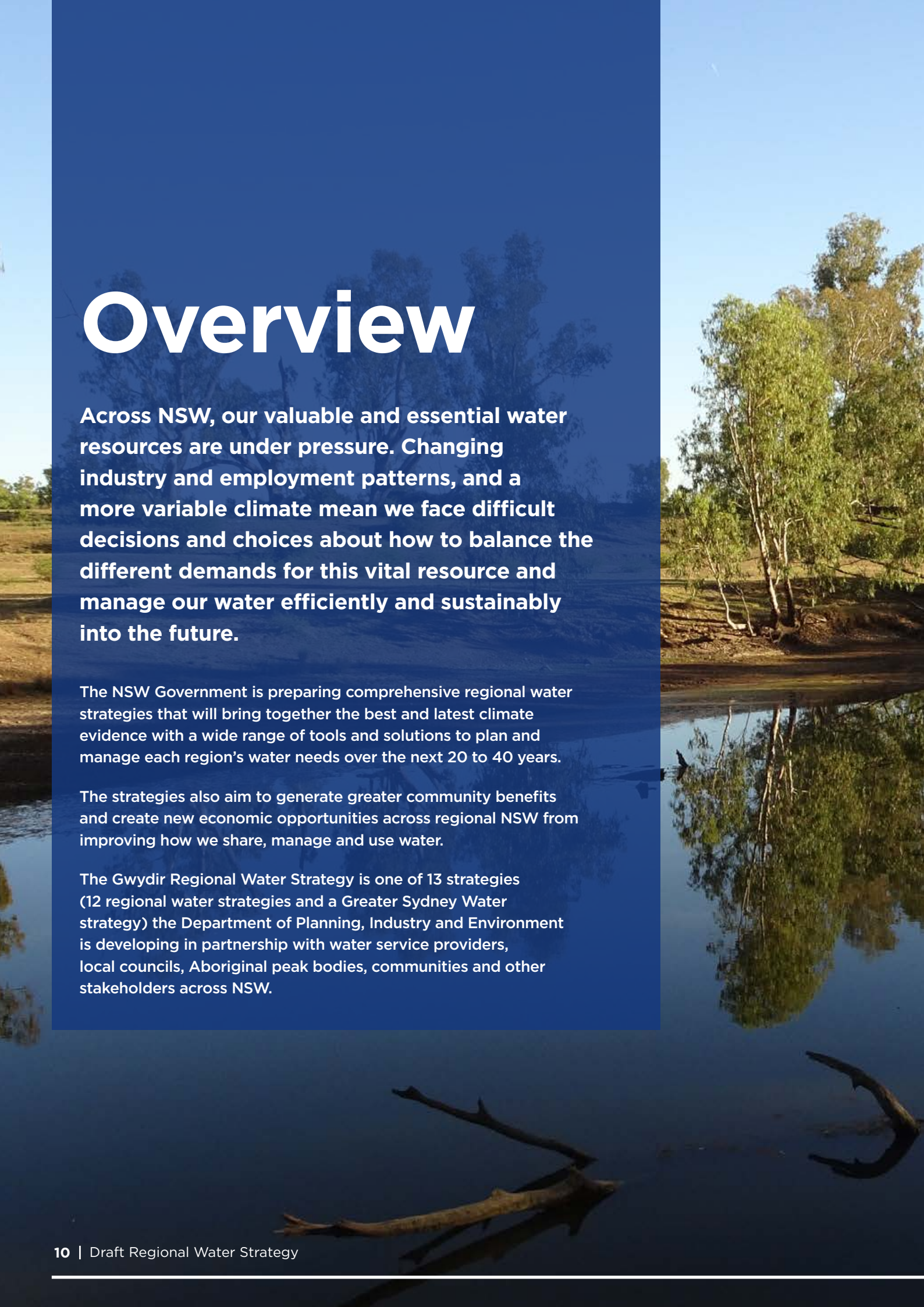
Key environmental assets:
Gwydir Wetlands
Internationally recognised and provides
habitat for rare, endangered and threatened
animal and plant species

Gross Regional Product:

\$1.34 billion







Overview

Across NSW, our valuable and essential water resources are under pressure. Changing industry and employment patterns, and a more variable climate mean we face difficult decisions and choices about how to balance the different demands for this vital resource and manage our water efficiently and sustainably into the future.

The NSW Government is preparing comprehensive regional water strategies that will bring together the best and latest climate evidence with a wide range of tools and solutions to plan and manage each region's water needs over the next 20 to 40 years.

The strategies also aim to generate greater community benefits and create new economic opportunities across regional NSW from improving how we share, manage and use water.

The Gwydir Regional Water Strategy is one of 13 strategies (12 regional water strategies and a Greater Sydney Water strategy) the Department of Planning, Industry and Environment is developing in partnership with water service providers, local councils, Aboriginal peak bodies, communities and other stakeholders across NSW.

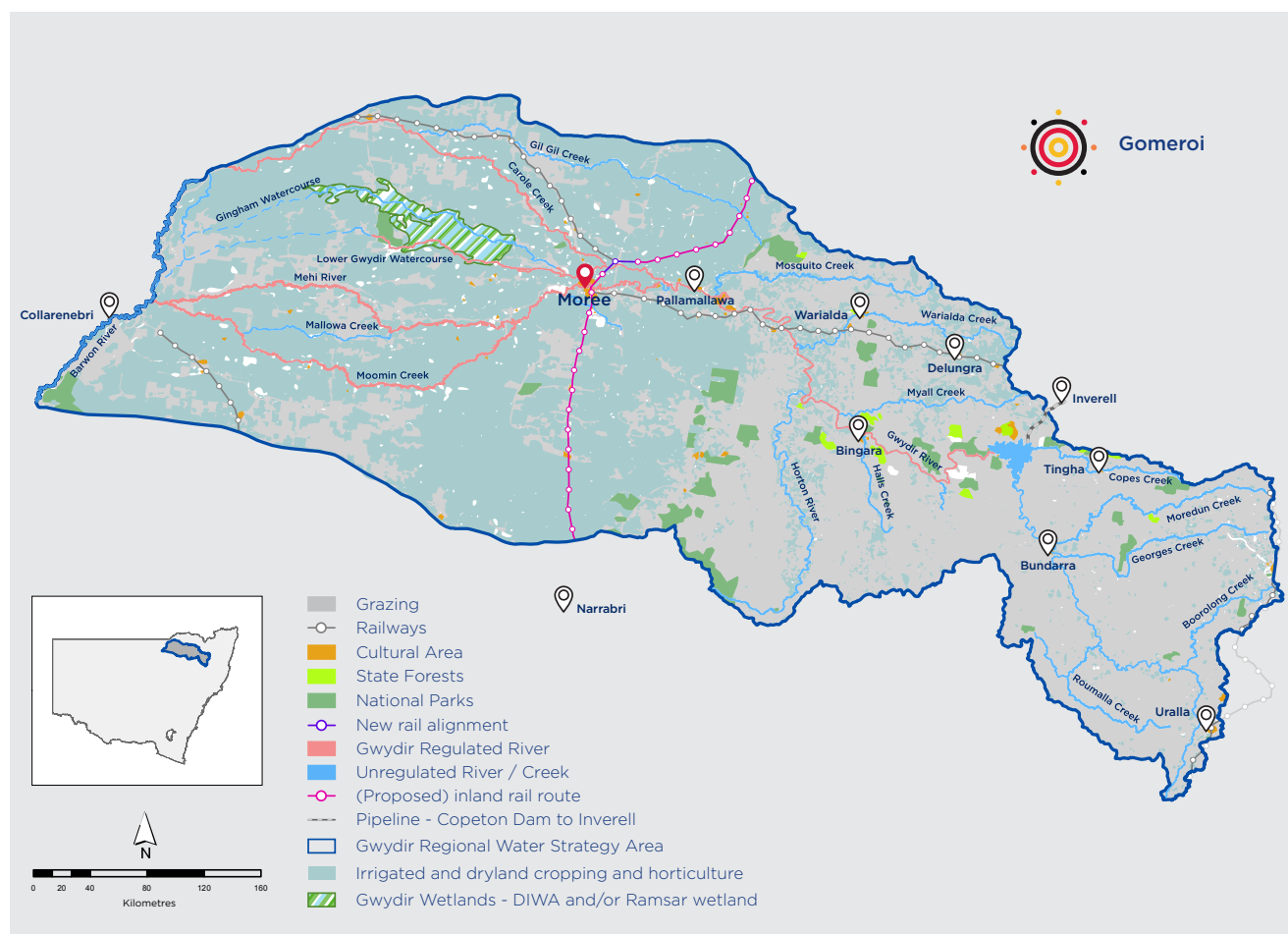
The Gwydir region

The Gwydir region (Figure 1) is located in northern NSW, bounded by the Border Rivers region to the north, the western slopes of the Great Dividing Range to the east, the Namoi catchment to the south and the Barwon River to the west. It covers more than 26,000 km² and is located within the traditional lands of the Gomerioi Nation.

The region's population is around 25,000. Moree is the largest town and an important employment and services hub for outlying areas. There are also smaller towns in the region with populations ranging from around 300 to 2,500 people, including Uralla, Bingara, Warialda, Tingha and Delungra.

The Gwydir region supports various industries, with the most significant economic contribution coming from the agricultural industry, which employs almost half the region's workforce. Tourism also contributes to the regional economy and is expected to continue to expand, as are enabling industries such as transport, freight and logistics. Service industries such as health and education are growing in importance. The Moree Special Activation Precinct, Inland Rail Project, upgrades to the Newell Highway and the new Moree Intermodal Project will encourage further industry development and regional growth.

Figure 1. Map of the Gwydir region



Water in the Gwydir region

Water is a significant feature of the Gwydir region's environment, with its interconnected systems of rivers, creeks, groundwater aquifers and wetlands. Water supports the region's population and its liveability, protects and conserves ecological assets and Aboriginal cultural heritage, and underpins key industries and local employment.

Since 2017, the region has been experiencing widespread drought conditions. At the end of 2019, below average rainfall conditions had persisted for nearly three years. These conditions placed the region's water resources—and the communities, industries and ecosystems that rely on them—under considerable stress. The drought reinforced the Gwydir economy's reliance on access to water and that water in rural landscapes contributes to mental wellbeing and community cohesion.

The region has one main river, the Gwydir River, which begins northwest of Uralla and flows west for 480 km, joined by over 30 tributaries. The river spreads out into various smaller rivers and creeks as it reaches the Gwydir floodplain, which stretches west from Moree. Near Moree, the river branches out into three separate systems: the Mehi River, Lower Gwydir River and Carole Creek.

The region is home to the Gwydir Wetlands, which are among the most extensive semi-permanent wetlands in NSW and include four sites listed under the international Ramsar Convention. Together, the whole Ramsar site covers 823 hectares. It is part of a wider area of wetlands that has been reduced due to land use change and river regulation.¹ The wetlands also include archaeological sites of cultural significance to the Gomeroi people.

Copeton Dam, the region's main public water storage, is located on the Gwydir River in the upper reaches of the valley. The dam has a relatively small catchment area and needs large rainfall events to significantly increase the amount of water in storage. Many water users in the region, including towns, industry and environmental water holders, rely on surface water delivered from Copeton Dam. Most water is extracted below Biniguy, facilitated by a network of weirs and regulators on the Gwydir River and its effluent systems.²

Inflow in Copeton Dam was well below average in 2018 and 2019.³ Between February 2018 and February 2020 there was 54 GL of inflow into Copeton Dam. This is the second lowest 24-month inflow volume on record. The lowest was 53 GL in the 24-months to January 1920.⁴ Although Copeton Dam was built during the 1970s, we can calculate inflows prior to its construction.

Unregulated rivers and groundwater from alluvial, artesian, and fractured and porous rock aquifers are also important water resources for towns, industry and water-dependent ecosystems in the region.

Floodplain harvesting is also significant in the Gwydir region. More than one third of all surface water taken comes from water diverted from the floodplain. Significant growth in floodplain harvesting infrastructure over the last 20 years means that the amount of surface water now being taken is estimated to be greater than the limit set in the region's surface water sharing plans. Licensing and managing floodplain harvesting within legal limits will provide business security and certainty while enhancing downstream environmental and cultural outcomes.

1. Office of Environment and Heritage 2018, *Gwydir Long Term Water Plan, Part A: Gwydir catchment, Draft for exhibition*, Sydney, NSW
2. Green D, Burrell M, Petrovic J and Moss P 2011, *Water resources and management overview—Gwydir catchment*, NSW Office of Water, Sydney
3. Bureau of Meteorology 2019, *Special climate statement 70 update – drought conditions in Australia and impact on water resources in the Murray-Darling Basin*, Canberra
4. www.industry.nsw.gov.au/water/allocations-availability/allocations/statements

Private on-farm water storages scattered across the region can be used to store water from these sources in addition to rainfall runoff. These storages help to buffer the region from annual rainfall variability and periods of reduced supply from Copeton Dam. For example, after a flood event, the water captured can at times be used to support the following growing season. Some of these storages also allow for block releases from Copeton Dam to help extend water supplies during drought, however they suffer large evaporative losses.

The region's main industry and biggest water user is agriculture. Predominant agricultural land uses include cotton and grains production that provide export industries for the region, while oil seeds, olives, pecan nuts, and intensive livestock contribute significantly to the local and national economy. Agricultural supporting industries operate extensively across the Gwydir region and there are opportunities for establishing value-adding agribusiness.

Tourism relies on the availability and quality of water, with major visitor attractions including Copeton Dam (a popular sport and recreational destination), sections of the Gwydir and Mehi rivers (which host boating, swimming, fishing, camping and bushwalking) and an artesian water complex located in Moree (which attracts more than 300,000 visitors each year, 250,000 of whom travel from outside the local area). During the recent drought, Moree Water Park, which reuses the spent artesian spa water, was able to remain a major tourism attraction, helping to maintain the town's local businesses.

Aboriginal people in the region also rely on water for their health, wellbeing and connection to Country. They value maintaining connectivity to land and water, and the region's rivers are considered 'classrooms' for maintaining the continuity of Aboriginal culture. Aboriginal people seek more opportunities to manage water using their cultural knowledge and to create improved economic opportunities.

Definitions

We are using the following definitions in the regional water strategies:

Water security in the context of regional water strategies refers to the acceptable chance of not having town water supplies fail. This requires community and government to have a shared understanding of what is a 'fail event' (for example, no drinking water or unacceptable water quality) and the level of acceptability they will pay for.

Water reliability refers to how often an outcome is achieved. It is often considered to be the likelihood, in percentage of years, of receiving full water allocations by the end of a water year for a licence category.

For example, a 60% reliability means that in 60% of years a licence holder can expect to receive 100% of their licensed entitlement by the end of the water year. Other measures of volumetric reliability could also be used: for example, the percentage allocation a licence holder could expect to receive at a particular time of the year as a long-term average. Reliability may also refer to how often an acceptable water quality is available. A reliable water supply gives some clarity to water users and helps them plan to meet their water needs.

Resilient regional centres means water users are able to withstand extreme events, such as drought and flood, and/or adapt and respond to changes caused by extreme events.

Future climate risks

The NSW Government has invested in new climate datasets and improved modelling that provide a more sophisticated understanding of historic climate variability in the Gwydir region, as well as potential future climate risks over the next 40-plus years. This means that we can move from making decisions based on a single 'worst-case' recorded drought scenarios to a much more comprehensive understanding of natural variability and potential extreme events.

We can now better plan for plausible future climate scenarios, better understand the climate risks faced by water users and the environment across NSW (such as the likely frequency, duration and severity of droughts and floods) and better manage our water resources over the medium and long-term to mitigate these risks.

At the same time, this new evidence allows us to look beyond these risks to plan for a better future in which more efficient and innovative water management can support diversity, growth and opportunity in our regional towns, communities and industries.

This new information is the basis for preparing robust new water strategies for our regions and also offers fresh evidence for examining our existing water policies, operational rules and management plans.

The new climate data and updated hydrological modelling developed for this draft regional water strategy suggest that the Gwydir region will continue to experience extended periods that are dominated by wet and dry conditions and there is a risk of:

- prolonged droughts that receive less total rainfall than those in the observed record for the Gwydir region (such as the WWII Drought)

- more frequent short, sharp droughts, similar to the most recent drought
- less frequent, but higher magnitude large flow events.

These events could become more severe due to likely changes in climate across north west NSW. These changes include higher temperatures and changes to the seasonality of rainfall in the near and long-term. It also means that our rivers and creeks may not flow as regularly as they do now. Droughts that occur in closer succession and hotter, drier conditions may mean catchments require higher rainfall to generate runoff into rivers and creeks.

Making choices for the future

Like most regions across Australia, the Gwydir region faces choices and challenges in balancing different water uses as climatic conditions change. However, the region's communities and primary producers are used to variable annual rainfall and river flows, and past droughts have led to government and industry investment in private and public water storages, groundwater bores and water use efficiency improvements. This has put the Gwydir in a good position to deal with greater climate variability and tackle future challenges, which include:

- providing reliable and safe water supplies for small towns and Aboriginal communities that rely mainly on unregulated rivers and creeks
- maintaining domestic water availability during extended dry periods for around 40% of the region's population who source their drinking and domestic water from unregulated rivers, groundwater aquifers, farm dams and rainwater tanks
- sustaining and improving productivity in the region's agricultural industries

- regulating floodplain harvesting and making sure that adequate water reaches downstream users and is available to protect the environment, including the Gwydir Wetlands
- improving waterway connectivity with the Barwon River.

To meet these challenges, we may need to rethink the types of industries suited to different parts of the region and make better use of technology to reduce water demand and use water more efficiently in agriculture and other important industries—while catering to the growth that will be stimulated by the Moree Special Activation Precinct. We also need to find ways to better manage groundwater and make more use of recycled wastewater and stormwater (acknowledging that in 2018/19, 74.25% of total wastewater collected by Moree Plains Shire Council and 15% by Gwydir Shire Council was recycled).

In particular, we need to make decisions now about how best to give the region's centres water security into the future and provide access to water for new commercial uses. Improved water security reliability will also be critical to attracting people, businesses and jobs to the Gwydir region and leveraging opportunities from new investment in the area.

We also need to review the existing water allocation process, drought operating rules and the efficiency of water trade and water pricing to make sure we enhance water resilience across the region in the future.

Any solutions we adopt will need to improve outcomes in the significant wetlands and other important environmental assets that are present along the length of the Gwydir catchment, and deliver benefits to communities that rely on these assets remaining healthy and productive.



A new, comprehensive water strategy for the Gwydir region

The Gwydir Regional Water Strategy will guide how we address future water resource challenges, make the right policy and infrastructure choices and open up new opportunities for the region.

The strategy will bring together all the tools we have—policy, planning, regulatory, educational, technology and infrastructure solutions—in an integrated package that is based on the best evidence, responds to the region’s water uses and delivers the right amount of water for the right purpose at the right times.

The strategy will aim to provide choices to better use, share, store and deliver water to avoid having to ride the highs and lows of water availability. It will cover the whole Gwydir region and all water types, and it will change how we manage water in the future.

In line with the objectives we have set for all regional water strategies, the Gwydir strategy has a strong focus on working closely with communities to provide healthy, reliable and resilient water resources that:

- deliver and manage water for local communities
- enable economic prosperity

- recognise and protect Aboriginal water rights, interests and access to water
- protect and enhance the environment
- are affordable.

The final strategy will set out clear and accountable actions for the NSW Government, local councils and industries to tackle the challenges facing the Gwydir region and maximise opportunities arising from the growing agricultural sector, other emerging and expanding industries, and new investments in transport and community infrastructure.

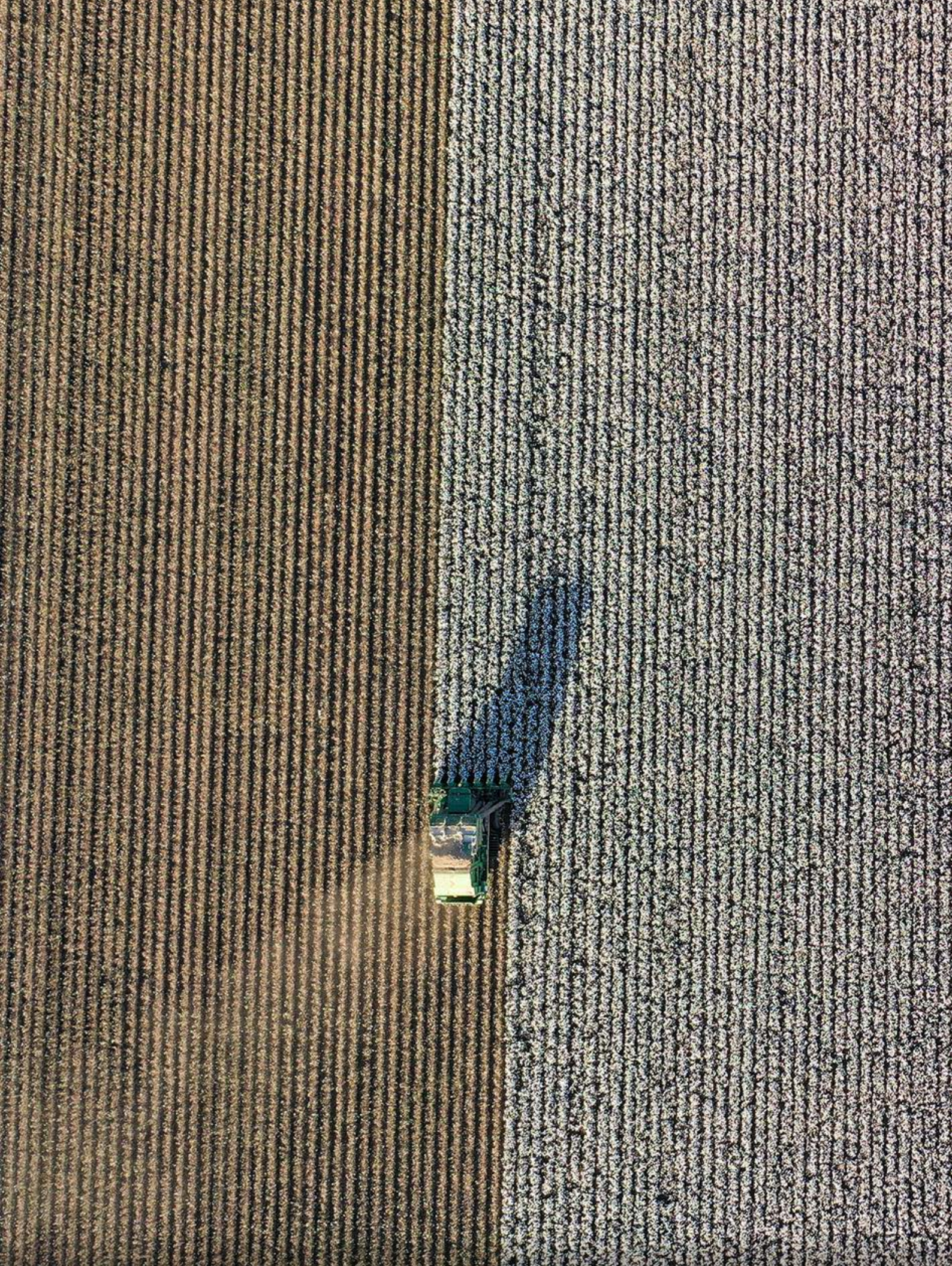
The strategy will build on current and planned investments and commitments to deliver further critical actions that will help to secure a strong and prosperous future for the region.

To reinforce the significant water reform program undertaken by the NSW Government over the last three years, the final strategy will also help to improve the sequencing and integration of these reforms across the Gwydir region to ensure they are implemented effectively.

The Department of Planning, Industry and Environment will develop an implementation plan that identifies actions and timeframes.

Our vision for the strategy

Our vision for the Gwydir Regional Water Strategy is to support the delivery of healthy, reliable and resilient water resources for a liveable and prosperous region. To achieve this, we need to position the region so there is the right amount of water of the right quality delivered in the right way for people, Aboriginal communities, towns, industries and the environment.



The options

A long list of potential options is presented as part of this draft strategy.

These options build on the NSW Government's current and planned investment in water infrastructure in the region. They also complement and build on state-wide reforms to introduce non-urban water metering, improve compliance with water sharing rules and bring floodplain harvesting into the licensing system.

Infrastructure options identified through the strategy will also benefit from the NSW Government's move to streamline the approvals process for drought-related projects. Other options, such as policy solutions, will be designed in partnership with communities.

To identify and develop appropriate options for the draft strategy, we have drawn from a range of sources including previous studies, community engagement, experiences in the Millennium Drought and existing government programs. We have aligned our approach with regional development and land use strategies to ensure that all options can be integrated and sequenced with state-wide and local plans.

The options cover actions, projects, reforms and investments that focus on:

- **maintaining and diversifying water supplies**, including new pipelines, refurbishing existing water storage and regulation infrastructure, and reuse, recycling and stormwater projects
- **protecting and enhancing natural systems**, including better protection for native and threatened aquatic species, the removal of floodplain structures that impede the delivery of water to priority ecological assets and improved water flows to the Gwydir Wetlands
- **supporting water use and delivery efficiency and conservation**, such as water efficiency measures and water market reviews
- **strengthening community preparedness for climate extremes**, such as reviewing drought operation rules, allocation processes and improving data collection and education programs
- **improving the recognition of Aboriginal people's water rights, interests and access to water**, such as reviewing cultural water access licences, ensuring greater involvement of Aboriginal people in water management and Aboriginal regional water advisory committees.

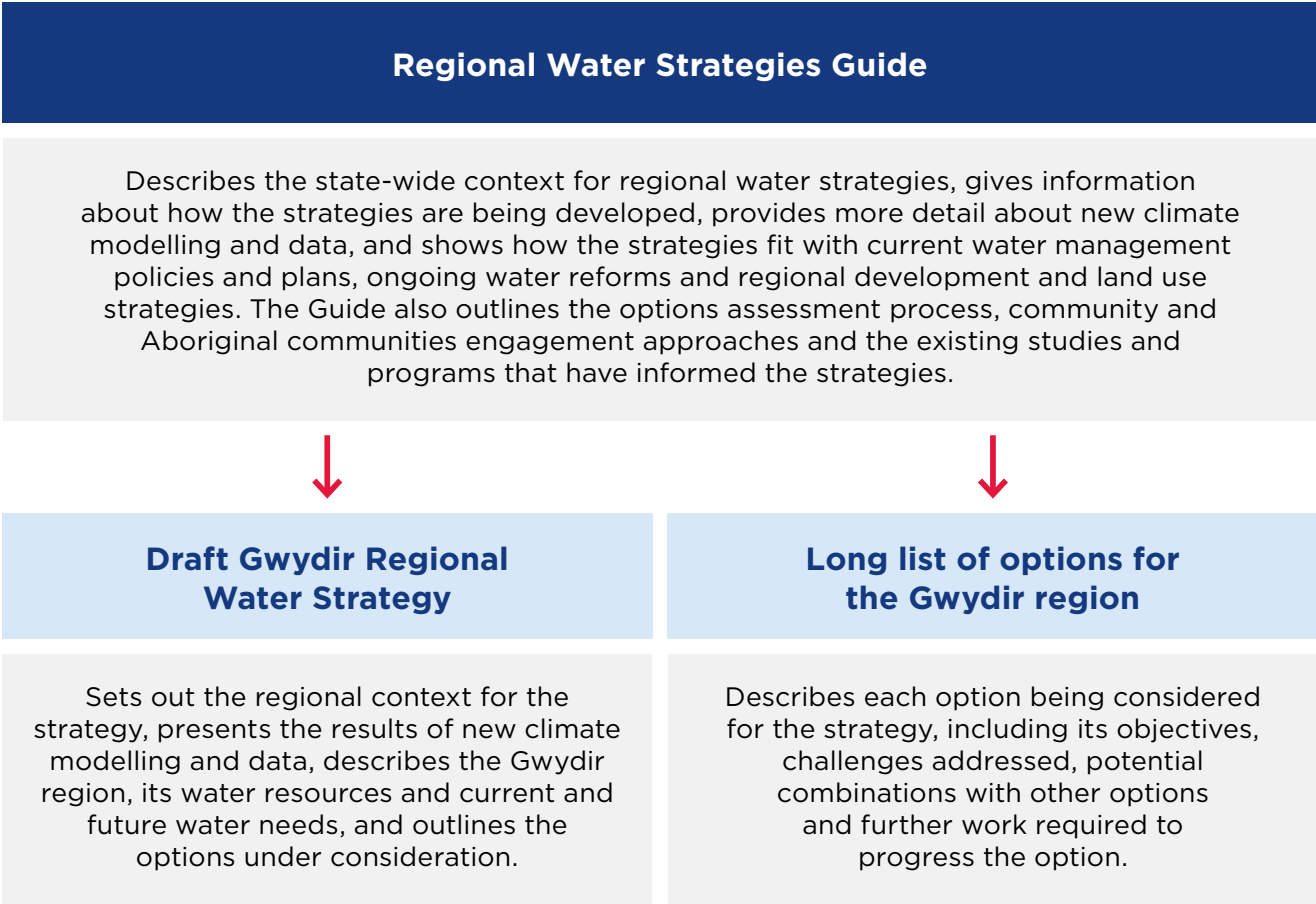
This strategy considers how government and local water utilities can adopt a more integrated approach to managing surface water and groundwater. It also acknowledges that connectivity and end of system flows are important for Aboriginal people and the environment, and we received strong feedback from Aboriginal people that we should consider options to enable flows to the end of the system to occur more frequently.

Many of the options are interrelated. This means that to get the most benefit out of these options—and make the best use of the region’s water resources—they may need to be combined into packages.

Not all options will be progressed, and many have not been costed. Following feedback on the draft strategy, we will conduct an evidence-based assessment to identify the best actions for the Gwydir region. These will form the final, comprehensive Gwydir Regional Water Strategy.

The Draft Gwydir Regional Water Strategy is accompanied by a more detailed description of the long list of options and an overarching explanatory guide that outlines the broader context for the development of regional water strategies across NSW (Figure 2).

Figure 2. Draft Gwydir Regional Water Strategy



Chapter 1

Context

Snapshot

We are preparing comprehensive regional water strategies across NSW, bringing together the best and latest climate evidence with a wide range of tools and solutions to plan and manage each region's water needs over the next 20 to 40 years.

- The strategies will aim to understand how much water a region will need to meet future demand, identify the challenges and choices involved in meeting needs and set out the actions we can take to manage risks to water security and reliability.
- Through better strategic planning the NSW Government aims to support safe and secure water for towns and communities, support regional industries, boost economic prosperity and safeguard and enhance the environment. The strategies will also recognise and protect Aboriginal water rights, interests and access to water.
- The Gwydir Regional Water Strategy is one of 13 strategies (12 regional water strategies and a Greater Sydney Water Strategy) the Department of Planning, Industry and Environment is developing in partnership with water service providers, local councils and Aboriginal peak bodies. The final strategies will also be informed by communities and other stakeholders across NSW.

New climate data and modelling, plans, studies and investments have also influenced the direction of the Gwydir Regional Water Strategy.

- A significant amount of work since the Millennium Drought, including drought assessment studies and the Gwydir Incident Response Guide, has improved our understanding of the risks affecting water resource management in the Gwydir region. Community engagement over the last few years has also given insights into the best way to prepare for future droughts and floods in the region.
- The NSW Government has invested in new climate datasets and improved modelling to provide a more robust and sophisticated understanding of future risks to water availability in the Gwydir region.
- The regional water strategies will build on existing NSW Government commitments to improve water security, resilience and reliability across regional NSW, including investment in water infrastructure, the repair of water and sewerage systems in Aboriginal communities, a range of state-wide water reforms and a new streamlined approval process for drought-related projects. Specifically, NSW Government Safe and Secure Water Program is a \$1 billion dedicated fund to strengthening and improving town water schemes in regional NSW.
- The strategy also aligns with existing policies and plans that are improving the management of water resources across NSW, as well as being integrated with strategic and local land use planning.

1.1 Purpose of regional water strategies

Regional water strategies bring together the most up-to-date information and evidence with a wide range of tools and solutions to plan and manage a region's medium and long-term water needs.

The strategies look out over the next 20 to 40 years and determine the challenges and choices involved in meeting the region's future water needs and the actions we can take to manage risks to water availability and secure healthier, more resilient water sources.

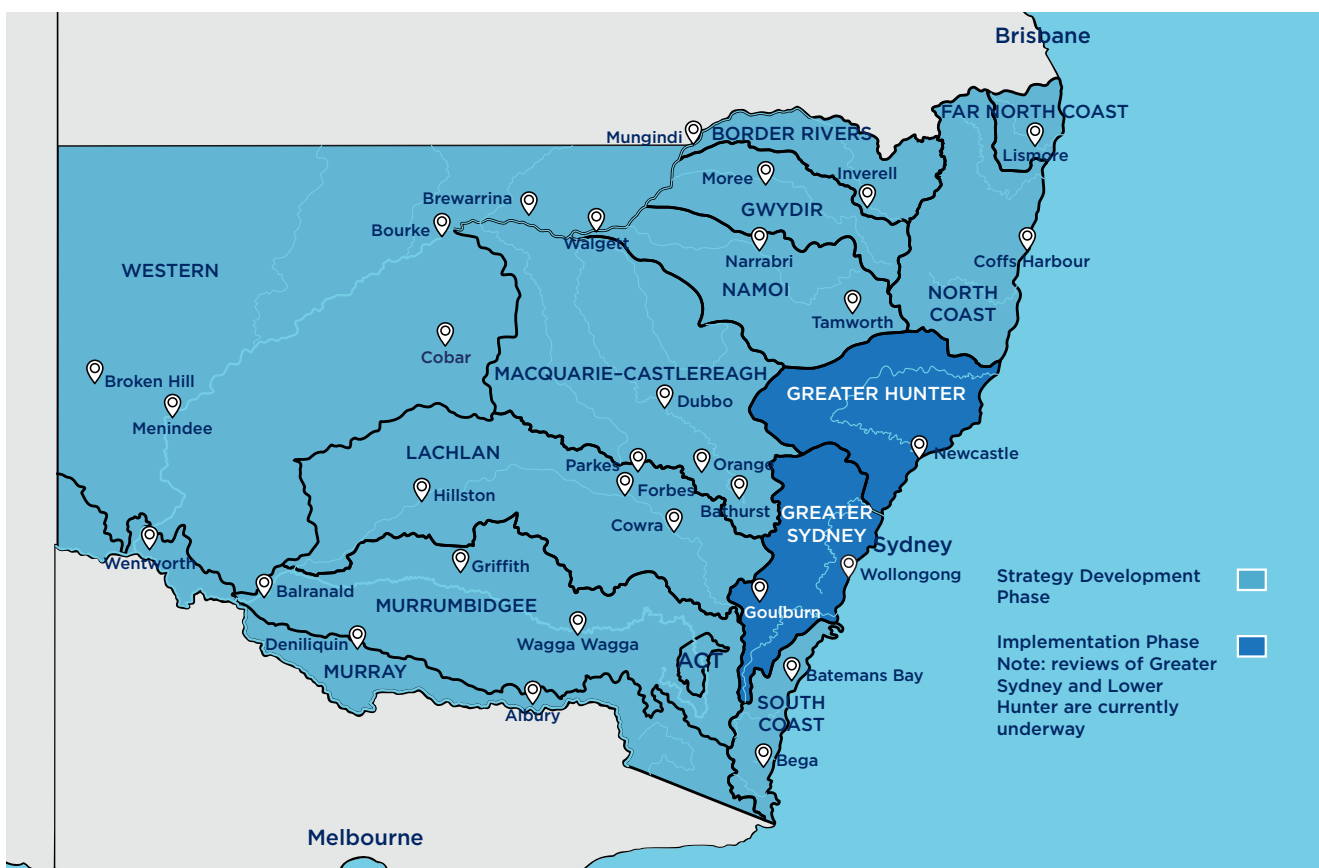
The strategies also explore new solutions to tackling these issues with the potential to add value to the way we manage water, generate

greater community-wide benefits and create new economic opportunities for each region.

With improved strategic planning around water, the NSW Government aims to achieve more resilient water resources for towns, communities, industries, Aboriginal people and the environment.

The Gwydir Regional Water Strategy is one of 13 strategies (12 regional water strategies and a Greater Sydney Water Strategy) the Department of Planning, Industry and Environment is developing in partnership with water service providers, local councils, Aboriginal peak bodies, communities and other stakeholders across NSW (Figure 3).

Figure 3. Map of NSW regional water strategy regions





1.2 Objectives of regional water strategies

Regional water strategies will set out a long-term 'roadmap' of actions to deliver five objectives. Options selected for inclusion in the final strategy for each region will need

to address at least one of these objectives. Our aim is for each strategy to have a comprehensive, balanced package of options that delivers on all of the objectives (Figure 4).

Figure 4. Regional water strategies: objectives



During extreme events, such as the current drought, our focus is on securing basic landholder rights and essential town water supplies. Outside of these extreme events, we have greater flexibility to deliver across all of the objectives, including providing water for the environment.

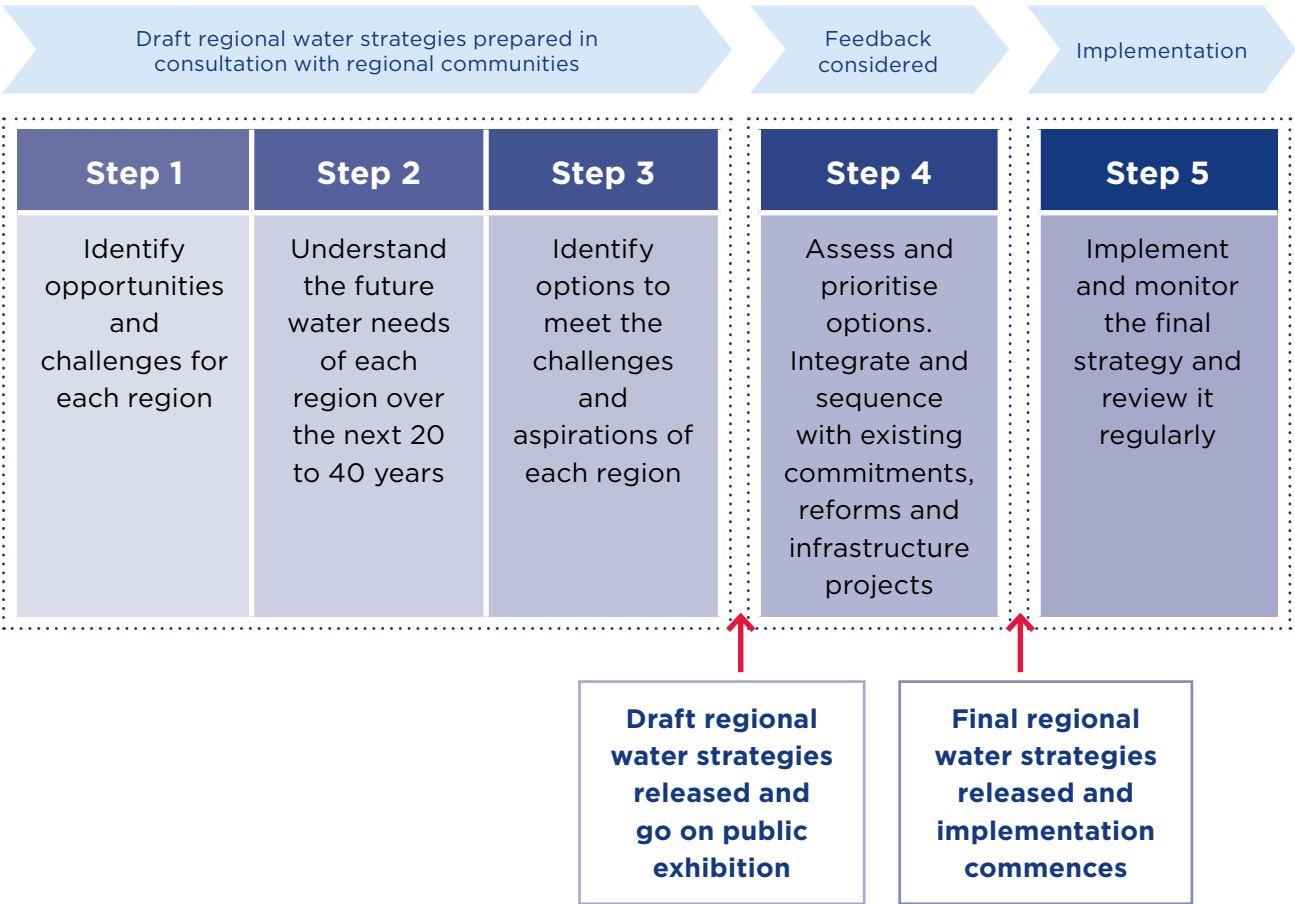
It is also important to note that when formulating water sharing plans, the NSW Government must take all reasonable steps to

prioritise the protection of the water sources and their dependent ecosystems.⁵

Through the regional water strategies, we aim to better manage these extreme events for all water users in the future.

The NSW Government is taking a five-step approach to preparing and implementing regional water strategies, as shown in Figure 5 below.

Figure 5. Five step approach to NSW regional water strategies



5. Subsections 9(1)(b), 5(3)(a) and 5(3)(b) of the NSW *Water Management Act 2000*

1.3 What has informed the draft regional water strategies?

To ensure we are using the best evidence and most recent data, and fully consider ideas and options from each region, we have used a wide range of sources to inform each strategy.

1.3.1 Improved climate modelling and data

Until now, water management in NSW has been based on historical data and observations going back to the 1890s. This has provided a limited understanding of extreme events. The NSW Government has invested in new climate datasets and modelling to develop a more sophisticated depiction of past and future climatic conditions. These improved datasets integrate recorded historical data with paleoclimate data (data reconstructed from before instrumental records began, using sources such as tree rings, cave deposits and coral growth) to give a modelling tool that generates 10,000 years of synthetic climate data. When combined with other sources of climate data (such as climate change projections), this has helped us to better understand natural climate variability, including the probability of wet and dry periods in each region, and estimate risks to future water availability.

This improved modelling for drought management means that we have moved from making decisions based heavily on single ‘worst-case’ scenarios drawn from a short climatic record to a much more accurate understanding of the length and frequency of past wet and dry periods.

We can now better understand the probability of future climate characteristics—such as the frequency, length and distribution of droughts in each region—and also better understand how to mitigate these risks and assess the possible benefits of medium and long-term solutions.

This new method is an important advance on previous climate datasets and models. Through this work, we can now assess the impact of changes in flows and water security over a much wider range of climatic conditions than if we had only considered the observed historical records.

This updated climate information has been used in developing the draft regional water strategies and will help to assess and compare the effectiveness of the draft options included in each strategy. It will also support all water users in making more informed decisions and better planning and preparing for climate risks.⁶

Chapter 2 sets out the results from the new climate method for the Gwydir region. We will continue to use the best and latest evidence about the future climate to develop solutions to address the challenges associated with protecting and enhancing environmental assets, regional towns and industries in a more variable climate and during extreme events.

Ongoing analysis will yield more specific and robust results, giving an updated understanding of risks to town water supply, irrigation and environmental water security in the Gwydir region. The final Gwydir Regional Water Strategy will use this new data to identify the best ways to share, manage and use water to manage these risks.

6. More information about this improved climate information and how it is being used in our river system models is provided in the *Regional Water Strategies Guide*.

1.3.2 Existing studies

A significant amount of work has been undertaken to understand the risks affecting water resource management in regional NSW. Development of the Draft Gwydir Regional Water Strategy and the long list of options identified for the region has been informed by catchment and water security studies, water allocation and drought planning, and regional development, infrastructure and environmental strategies prepared by a range of NSW Government departments and agencies.⁷

The strategy has also been informed by WaterNSW's Gwydir Valley Priority Catchment Study, Namoi Unlimited's Water for the Future Strategy 2019 and the *Independent Review of the Northern Basin First Flush Assessment*.

We have also taken into account the documentation developed to meet NSW's obligations under the Murray-Darling Basin Plan.

The Australian Government has requested an independent panel undertake an assessment of social and economic conditions in communities across the Murray-Darling Basin. The expert panel's draft report was released in March 2020.⁸

In August 2019, the Australian Government also announced that it would direct the Australian Competition and Consumer Commission (ACCC) to conduct an inquiry into markets for tradeable water rights in the Murray-Darling Basin.

The ACCC was asked to recommend options to enhance markets for tradeable water rights, including options to enhance their operations, transparency, regulation, competitiveness and efficiency. An interim report was released in July 2020 and a final report to the Federal Treasurer is due at the end of February 2021.⁹

These investigations will be important sources of information as we assess options for the final Gwydir Regional Water Strategy.

1.3.3 Community engagement

Over the last few years the NSW Government has been consulting on water sharing plans, floodplain harvesting, water resource plans, metering reforms, environmental water management and drought. Through these processes, we have heard many ideas about how to be better prepared for future droughts and floods and a more variable climate.

We have also been talking with local councils, local water utilities and Aboriginal and community groups about their thoughts on what the Gwydir Regional Water Strategy could cover. Further information about these initial meetings and discussions is in Attachment 1.

7. More information about this work is provided in the *Regional Water Strategies Guide*.

8. Murray-Darling Basin Authority 2019, *Independent assessment of social and economic conditions in the Basin*, www.mdba.gov.au/publications/independent-reports/independent-assessment-social-economic-conditions-basin

9. Australian Competition and Consumer Commission 2019, Murray-Darling Basin water markets inquiry, www.accc.gov.au/focus-areas/inquiries-ongoing/murray-darling-basin-water-markets-inquiry



What local councils and other groups have told us so far:

- Current drought conditions are impacting on local employment and the wellbeing of residents across the region.
- There is support for a long-term strategy for water.
- People are seeking meaningful engagement during the development of the strategy.
- There needs to be a 'multi-water source' approach to water security that considers climate-independent water sources.
- The social and amenity value of water is important to the community.
- Future economic development in the region will require improved water security and reliability.
- The strategy needs to consider options to meet additional demands on town water supplies during drought from water carting to residents who are not on the reticulated water supply and for fighting bushfires.
- New infrastructure is needed, such as reservoirs to assist with town water supply and recreational activities.

- We need to review current demands on groundwater resources to ensure vital supplies for regional towns are protected.
- There are opportunities to consider innovative solutions for water reuse, recycling and groundwater recharge.

What Aboriginal people have told us so far:

- We need to better recognise and deliver on cultural water rights.
- Having the ability to access cultural sites and waterways is important for connection to Country and community wellbeing.
- More culturally appropriate information and education is needed on how governments manage water.
- Aboriginal people want more opportunities to manage land and water utilising their traditional cultural knowledge.

These early insights have been considered in developing this draft strategy.



1.4 Building on existing commitments and reforms

The NSW Government has made significant commitments to improve water resilience and reliability. Much of our current work is to address the risks facing regional NSW and set our regions up for the future. This includes investigating dam upgrades and investing in water saving infrastructure in the current drought and to prepare for the next one.

We are implementing a range of state-wide water reforms, including improving water and sewage services for Aboriginal communities, improving compliance and transparency around water use and access, and introducing robust new metering laws to make sure that most water taken in NSW is accurately measured and monitored.

We are improving how we protect environmental water in the NSW Northern Murray-Darling Basin to maximise environmental outcomes by implementing 'active management' in some unregulated systems, including sections of the Lower Gwydir. Along with other states, we are implementing the Murray-Darling Basin Plan, which aims to rebalance water sharing between the environment and other water users. We continue to work with communities on the infrastructure and rule changes needed to implement the Basin Plan.

We have also streamlined the approvals process for drought and major dam projects through the *Water Supply (Critical Needs) Act 2019*.

We continue to work towards a state-wide Aboriginal water policy to better represent the interests of Aboriginal people in water management.

More information about these reforms is in the *Regional Water Strategies Guide*.

The Gwydir Regional Water Strategy will build on these commitments and reforms, seek to enhance and leverage them where possible, and address any outstanding gaps.

Responding to drought

Up until August 2020, over **\$4.5 billion has been committed to the drought response in NSW**. This commitment to drought relief and water security is providing immediate support to farmers, families, towns and businesses impacted by drought:

- More than \$2 billion has been provided for a support package for primary producers, businesses and communities.
- With the Commonwealth, the NSW Government will deliver over \$1 billion to state significant dam projects, including the upgrade of the Wyangala Dam and Dungowan Dam and pipeline.
- Since 2016, \$1.019 billion has been committed to 189 water projects, including building and upgrading water storages, pipelines and bores across regional NSW through programs like the \$1 billion Safe and Secure Water Program and the NSW drought response.

1.5 Policy and planning context

Each regional water strategy sits within a broader policy and planning context. This includes a range of policies and plans that guide the management of water resources in NSW (Figure 6).

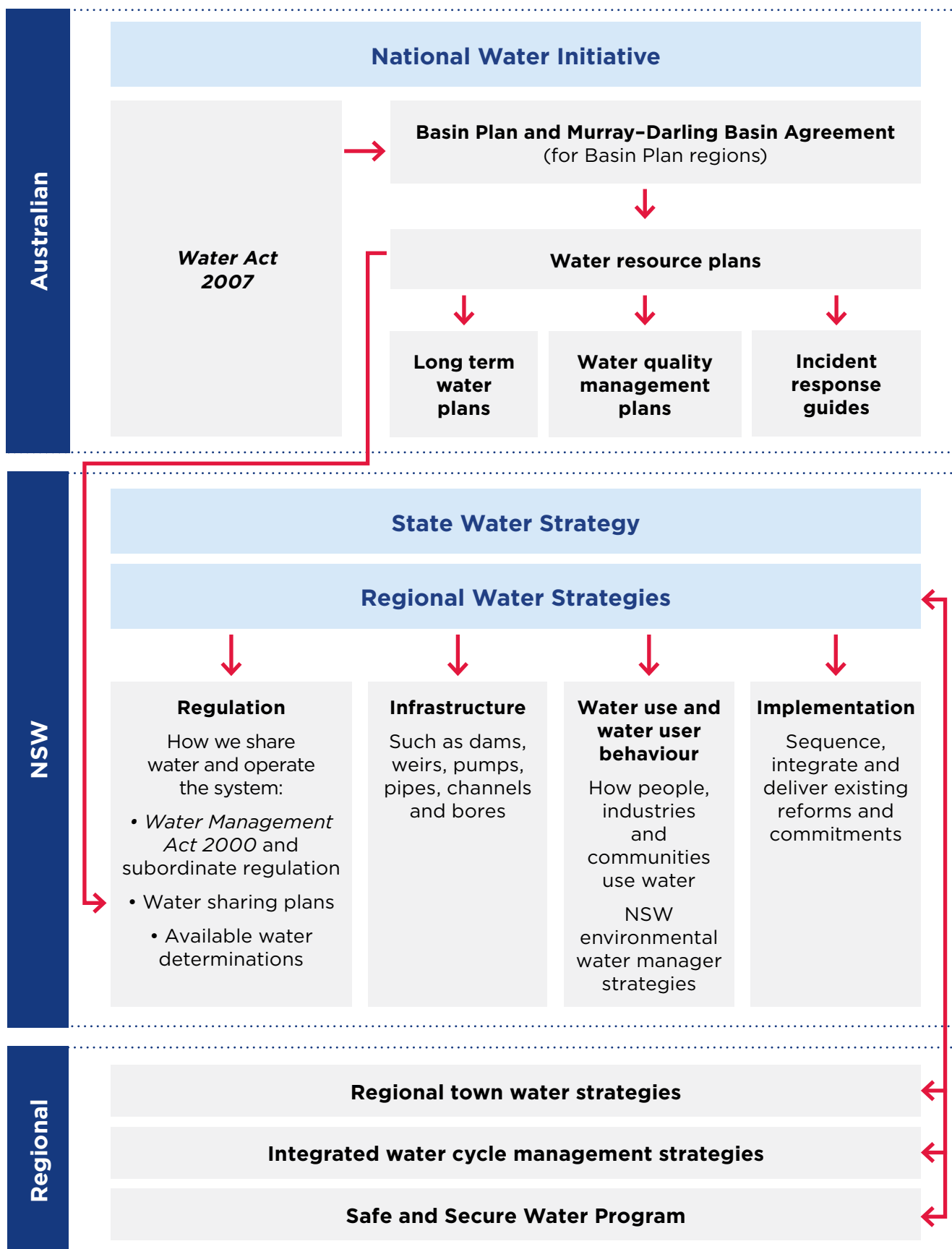
The NSW Government is also developing a 20-year State Water Strategy. This will establish overarching directions for managing water resources and services to ensure future water security, reliability and resilience, and address long-term challenges such as greater climate variability and population changes. The State Water Strategy will set high-level outcomes and actions to achieve these across public and environmental health, service delivery, liveability, economic development and technology, and for Aboriginal people.

Regional water strategies are an opportunity to explore how we can bring together existing commitments and better integrate and shape these plans, policies and investments for improved water outcomes. In particular, the strategies will play a key role in the ordering, sequencing and integration of water reforms in each region.

The strategies also align with the NSW Government's strategic planning hierarchy and will be integrated with current land use and regional plans.¹⁰

10. More information about how the strategies relate to strategic, regional and water planning is in the *Regional Water Strategies Guide*.

Figure 6. NSW water policy and planning context



An aerial photograph of an industrial facility, likely a water treatment or storage plant. In the foreground, there is a large white warehouse with a corrugated metal roof. To its right, numerous blue and white water storage tanks are stacked in rows. In the background, two large, tall, cylindrical concrete silos stand prominently. The sky is blue with scattered white clouds.

Chapter 2

The Gwydir region, its opportunities and challenges

Snapshot

Climate conditions are placing the region's water resources—and the towns, communities, industries and ecosystems that rely on them—under considerable stress.

- The Gwydir region has a naturally variable climate that includes periods dominated by either wet or dry conditions. Hydrological models updated with more sophisticated climate data for this strategy found that:
 - the region can move between wet and dry periods more frequently than previously understood—and periods of drought may occur more frequently in the future
 - long-term data beyond the observed records shows Copeton Dam could fall below 5%, although it is unlikely
 - the towns of Bingara, Inverell and Gravesend, which are supplied from water stored in Copeton Dam, are at a low risk of experiencing future supply shortfalls based on their current water access licence volumes
 - average water availability for other water users supplied from Copeton Dam may be similar to that experienced in the region's historical records, with the exception of average annual extraction by general security water access licence holders, which could decrease under long-term climate change.
- Between February 2018 and February 2020, Copeton Dam experienced its second lowest 24-month inflow volume on record (54 GL). The lowest inflow was 53 GL in the 24 months to January 1920. Analysis of the long-term historical climate has shown that it is possible, but highly unlikely, for inflows to be half that volume (27 GL over 24 months).
- Water security for towns and villages in the Gwydir region that rely mainly on single supply sources, in particular unregulated rivers and creeks, will be more challenging in a future of greater climate variability and change.
- Large on-farm storages are a feature of irrigation in the region, but suffer high evaporation losses. With climate change projections predicting increased evapotranspiration in the near to long term, these losses will increase.

Water users in the Gwydir have adapted to a variable climate, but we need to review how we manage, use and deliver water to meet future challenges.

- We have an important opportunity to use new climate data and advances in climate modelling to review current water allocation and river operating rules to determine how we can enhance the region's water resilience in the future.
- Agricultural industries in the region rely on floodplain harvesting, which now accounts for more than one third of all surface water taken in the region. While the diversion of water from the Gwydir floodplain is not currently licensed or measured, floodplain harvesting licences and approvals for all five northern basin valleys are scheduled to be in place by July 2021. The NSW Floodplain Harvesting Policy will help manage growth in this activity to ensure a fair share of water for downstream users and to protect the environment.
- As a regional centre, Moree is expected to grow over the next 20 years, stimulated by the Moree Special Activation Precinct, Inland Rail Project and government investments. Resilient water sources and access to water for new commercial uses will be needed to support this growth. More efficient delivery of water and the development of a diversified portfolio of water sources would enhance water resilience for Moree and other towns and communities.

Water is essential for Aboriginal people's health, wellbeing and connection to Country.

- The health of waterways impacts the wellbeing of Aboriginal people in the Gwydir region.
- While there are some provisions for accessing water for cultural purposes, these do not currently meet the needs and obligations of Aboriginal people to care for Country or achieve the cultural water flows and water management aspirations set out in the 2007 Echuca Declaration. Aboriginal people seek ownership of their water.
- Options to improve Aboriginal people's involvement in water management, recognise their water rights and provide dedicated cultural water allocations will protect cultural values and deliver cultural, spiritual, social, environmental and economic benefits.

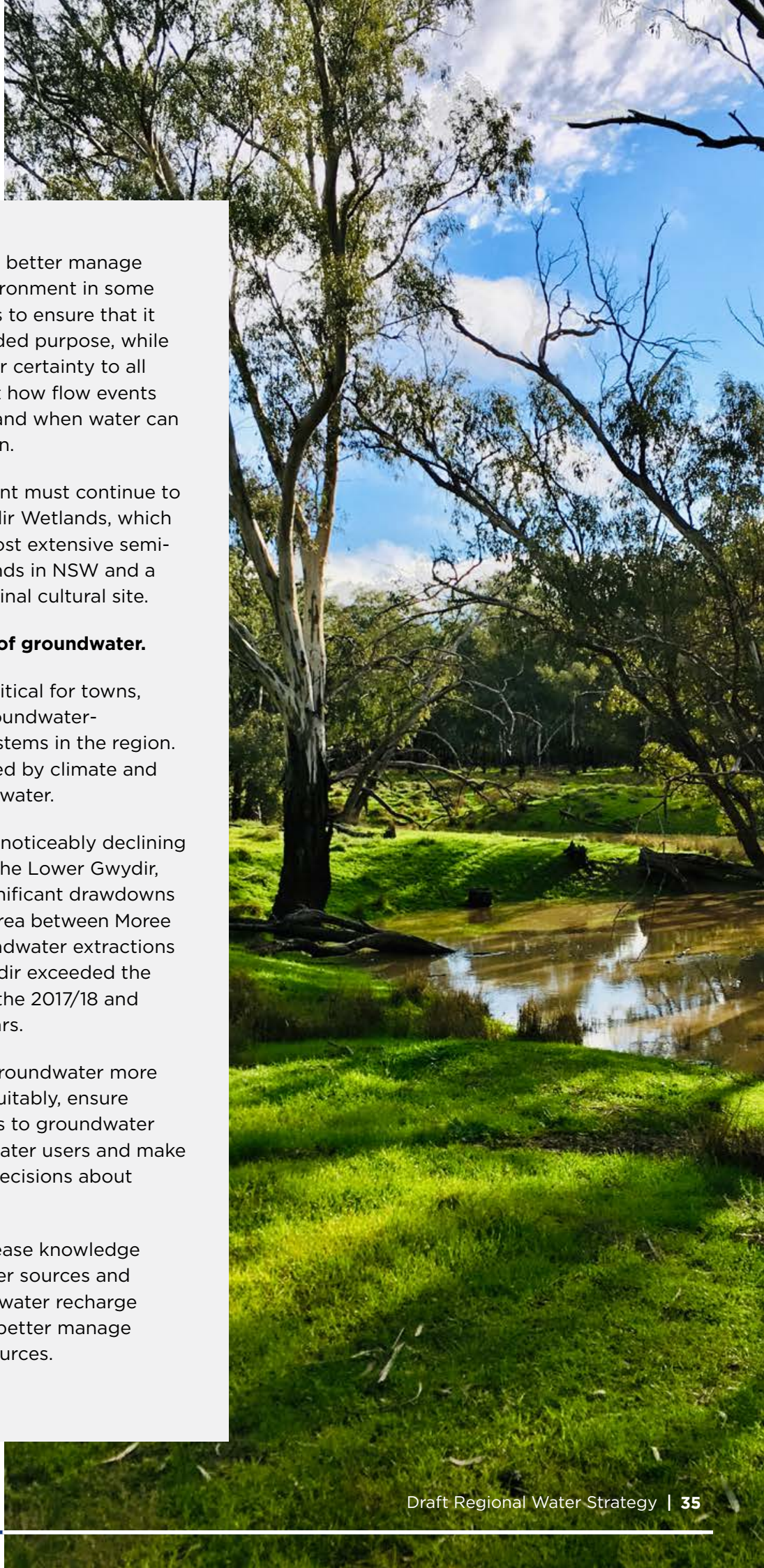
There will be challenges in protecting the region's critical environmental assets in the future.

- Healthy water sources support the region's environment, which—in turn—supports liveable communities and thriving industries.
- Water set aside for the environment through the Murray-Darling Basin Plan and NSW water sharing plans has helped to maintain the Gwydir valley's fish community in a moderate condition. This gives a strong platform for native fish population recovery, provided management actions are developed and implemented appropriately.

- There is a need to better manage water for the environment in some unregulated rivers to ensure that it achieves its intended purpose, while also giving greater certainty to all water users about how flow events will be managed and when water can or cannot be taken.
- Water management must continue to support the Gwydir Wetlands, which are among the most extensive semi-permanent wetlands in NSW and a significant Aboriginal cultural site.

Better management of groundwater.

- Groundwater is critical for towns, industries and groundwater-dependent ecosystems in the region. Its use is influenced by climate and access to surface water.
- Aquifer levels are noticeably declining in some areas of the Lower Gwydir, with the most significant drawdowns occurring in the area between Moree and Ashley. Groundwater extractions in the Lower Gwydir exceeded the allowable limit in the 2017/18 and 2018/19 water years.
- We need to use groundwater more efficiently and equitably, ensure sustainable access to groundwater resources by all water users and make better informed decisions about its management.
- Options that increase knowledge about groundwater sources and studies of groundwater recharge rates can help to better manage groundwater resources.



2.1 What we know about the Gwydir region's climate

Today's climate

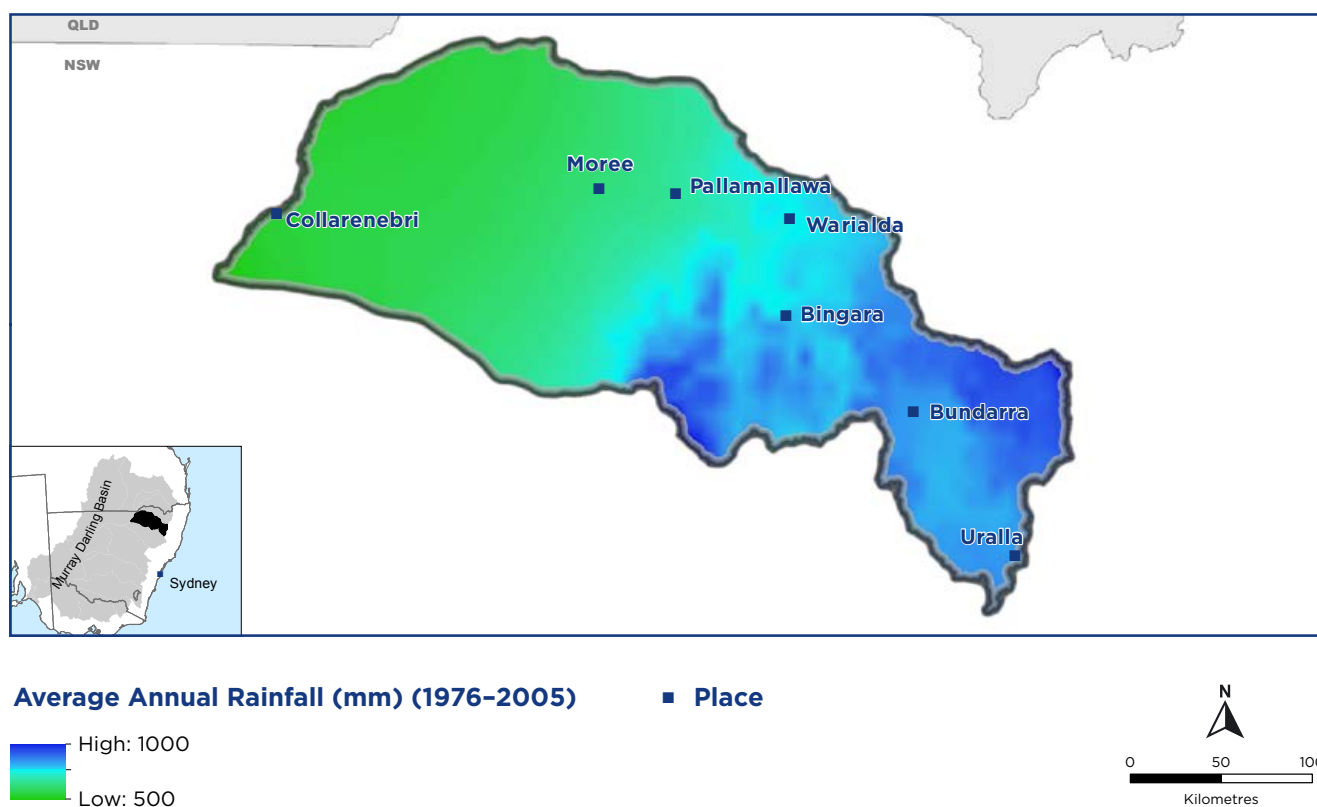
The Gwydir region has a temperate to subtropical climate, with the east cooler and wetter than the west. Average, maximum and minimum temperatures in the region have been increasing over the length of the observed historical record, and over the last 30 years there have been more hot days and consecutive days above 38°C each year.¹¹

The eastern (elevated) half of the catchment has an annual average rainfall of 700–900 mm, while the average annual rainfall on the western floodplains ranges from 450–550 mm (Figure 7).

Rainfall throughout the catchment is highly variable year-to-year, with the highest falls in summer. Summer storms can cause flooding and erosion, and winter flooding can also occur when soils remain saturated after summer rains. In the last 30 years, rainfall has been most reliable in summer when compared to other seasons. Rainfall has decreased in the autumn and spring months over the same period.

Annual evapotranspiration¹² is highest inland (~2000 mm). Totals are lower in the eastern portion of the region (~1200 mm).¹³

Figure 7. Observed average annual rainfall in the Gwydir catchment



Source: Department of Industry 2018, *Gwydir Surface Water Resource Plan: Surface water resource description*, October 2018



Image courtesy of Daryl Albertson.

11. www.climatekelpie.com.au/index.php/climatensw/north-west/
12. Evapotranspiration (ET) is the combined process of water surface evaporation, soil moisture evaporation and plant transpiration.
13. www.bioregionalassessments.gov.au/assessments/11-context-statement-gwydir-subregion/1123-climate

A better understanding of current climate variability and future climate change

As outlined in section 1.3.1, new climate datasets and improved modelling are providing a better understanding and more realistic picture of the natural variability of the Gwydir's climate beyond the observed historical records.

This new analysis shows that the most significant systematic shifts in climate conditions in the Gwydir relate to rainfall, with average annual rainfall expected to be 66 mm higher (and annual average annual evaporation 13 mm lower) during wet periods.¹⁴ The analysis also found that the average length of each wet and dry period can be shorter than those since measurement began in the 1850s (eight years compared to 15 years), however on some occasions their maximum duration can be up to 60 years.¹⁵

Our improved modelling also incorporates recognised climate change forecasts,¹⁶ which suggest that in the Gwydir region there will likely be:

- **changing rainfall patterns**—annual average rainfall in the region could decline by up to 13% and heavy rainfall events are likely to be more intense over the long-term (2060 to 2079). Changes to average monthly rainfall totals and seasonal shifts in when the region receives rainfall are predicted. The largest reductions in monthly rainfall totals are expected from May to July, while totals for March could increase by 40% over the long term (2060 to 2079) (Figure 8a)

- **higher evapotranspiration**—potential evapotranspiration is expected to increase by up to 6% by 2070 compared to levels between 1990 and 2009, with the largest increases in winter and spring (Figure 8b)
- **higher minimum and maximum temperatures**—this includes a rise in average temperatures of between 0.4 to 1°C in the near future (2020 to 2039) and 1.9 to 2.7°C over the long-term (2060 to 2079)
- **more hot days (temperatures over 35°C)**—while more hot days are expected across the entire region, the greatest increase is projected for the region's north-west plains, which will likely experience an additional 10 to 20 hot days in the near future and an additional 40+ hot days each year by 2070.

Using climate change projections in water modelling

The NSW Government's NARCLiM (climate change) datasets include a range of different future climate scenarios. We have used the most conservative result from NARCLiM in our modelling—the scenario which represents the greatest reduction in average monthly rainfall. While the results of the other scenarios in the current version of NARCLiM are arguably equally appropriate and probable, we intend to stress test the water system and understand the worst-case climate scenario for strategic water planning. This will test the resilience of options proposed in the regional water strategies, particularly options that go towards securing water for critical human needs.

14. The wet period refers to the negative phase of Interdecadal Pacific Oscillation.

15. Further information about the development of new climate datasets is provided in Attachment 2 of the *Regional Water Strategies Guide*. Specific analysis related to the Gwydir region has been prepared for the Department of Planning, Industry and Environment by the University of Adelaide.

16. The modelling uses forecasts for the New England North West drawn from the NSW and ACT Regional Climate Modelling (NARCLiM) project: www.climatechange.environment.nsw.gov.au/Climate-projections-for-NSW/Climate-projections-for-your-region/New-England-North-West-Climate-Change-Downloads Further information about how these forecasts have been used in combination with the new climate datasets is provided in Attachment 2 of the *Regional Water Strategies Guide*.

Figure 8a. Average monthly changes in rainfall for the Gwydir region for the periods 2020 to 2039 and 2060 to 2079 compared to the period 1990 to 2009 from NARClIM projections

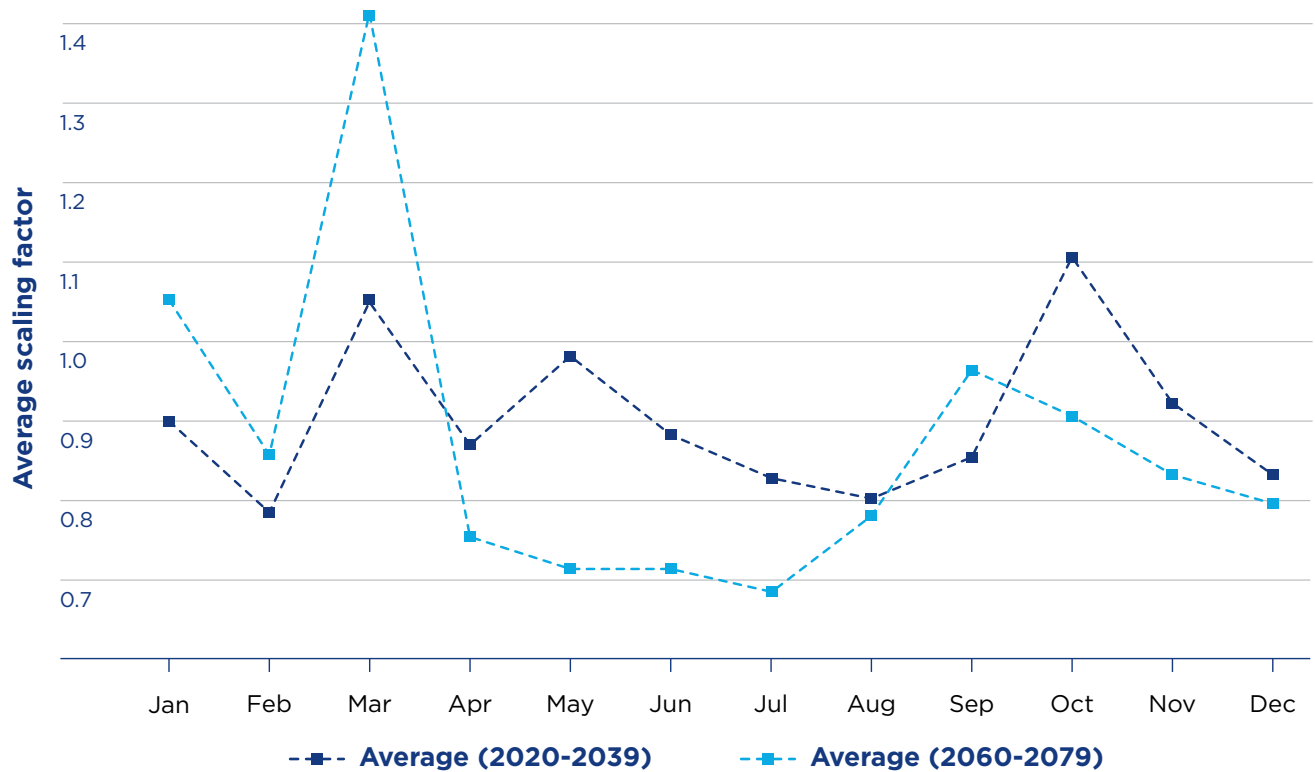
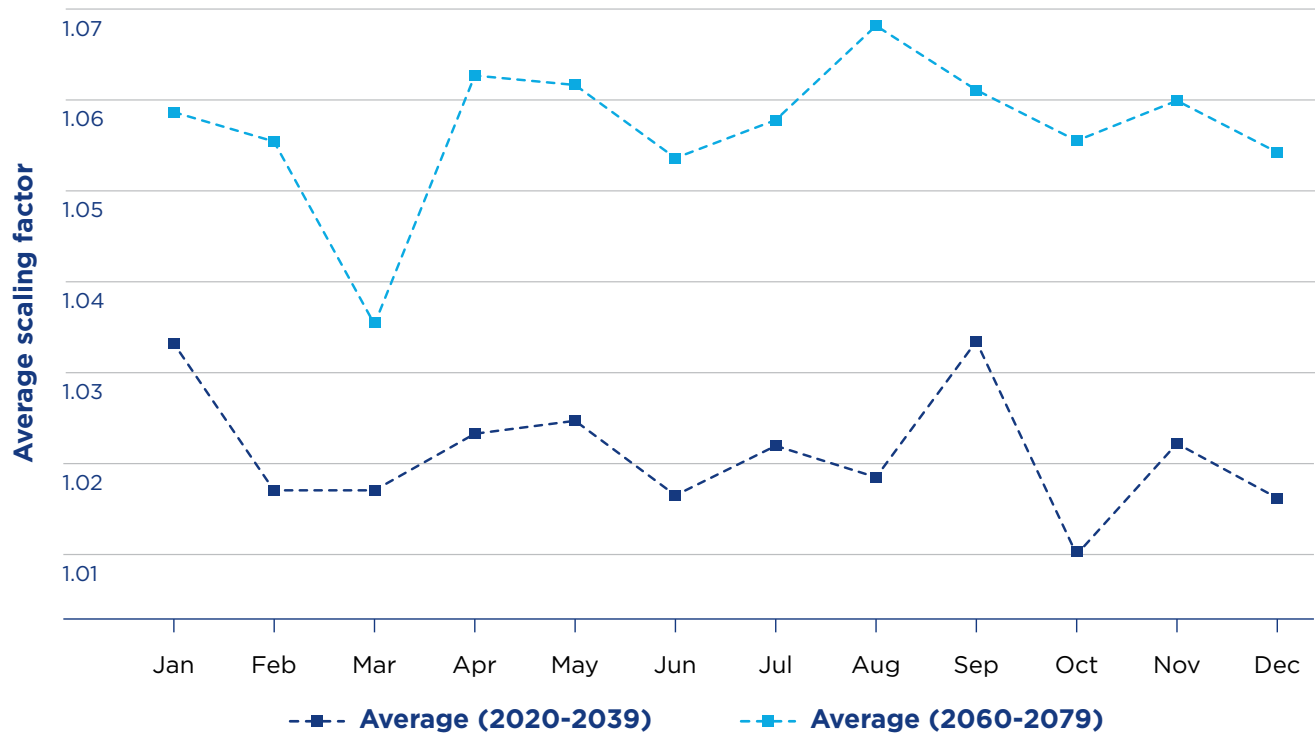


Figure 8b. Average monthly changes in evapotranspiration for the Gwydir region for the periods 2020 to 2039 and 2060 to 2079 compared to the period 1990 to 2009 from NARClIM projections



Source: Department of Planning, Industry and Environment—Water 2020, catchment climate data

The region has experienced persistent droughts, as well as intense shorter droughts

The Gwydir region has experienced extreme droughts¹⁷ over the past 130 years of observed records. The most well-known are the Federation Drought (1895 to 1903), the World War II Drought (1939 to 1945) and the Millennium Drought (1997 to 2009).

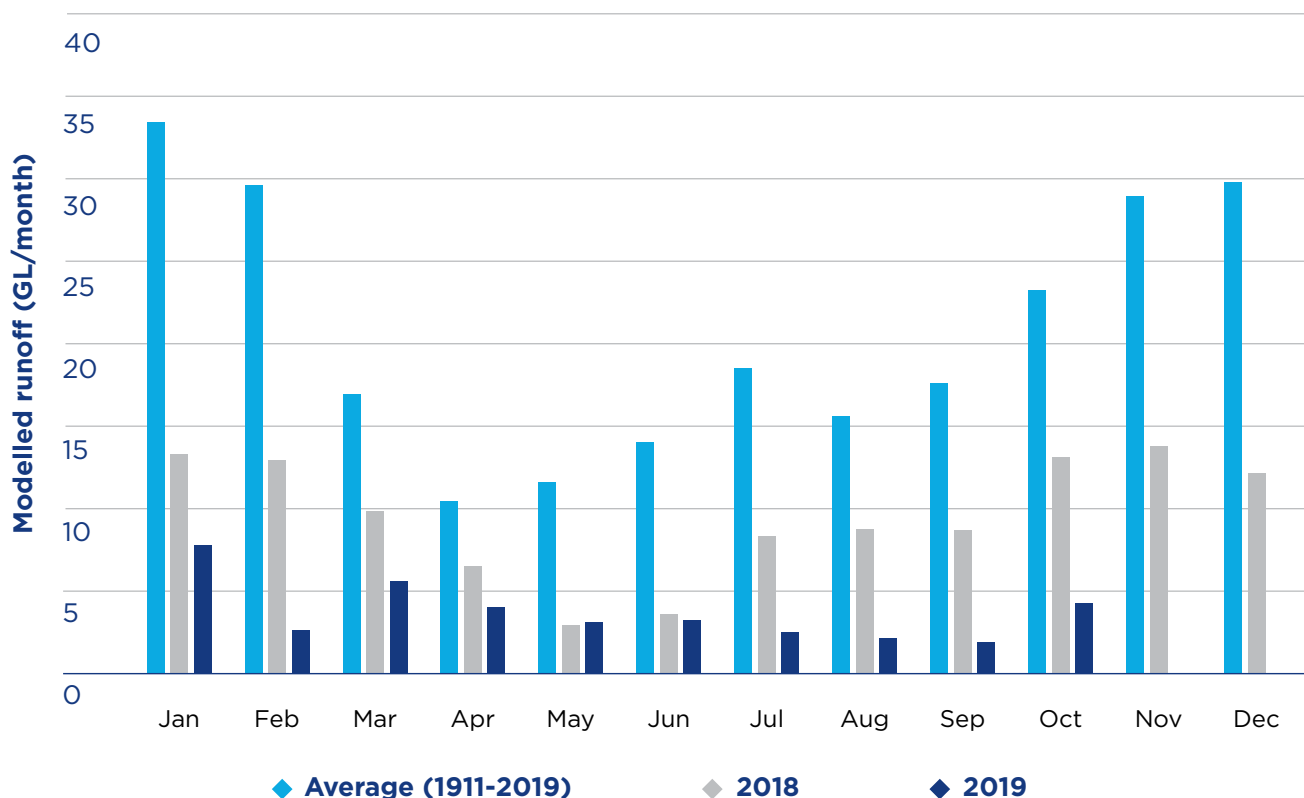
The region's lowest 10-year rainfall total on record occurred during the WWII Drought. At this time, the region had been dominated by dry conditions since 1912. Our new datasets and modelling suggest that this protracted drought is not unique; nor is it the worst the region is likely to have experienced in the context of a longer timeframe. Our new extended dataset has established that similar events have

occurred in the longer climate record, meaning it is plausible that they could be experienced in the future.

The region has just experienced its driest 36-month period on record (March 2017 to February 2020) according to the Bureau of Meteorology. Over the same period, potential evapotranspiration was either the highest on record, or significantly above average across the entire region.¹⁸

These dry conditions resulted in Copeton Dam receiving inflows that were well below average during 2018 and 2019 (Figure 9). Between February 2018 and February 2020, Copeton Dam experienced its second lowest 24-month inflow volume on record (54 GL). The lowest inflow was 53 GL in the 24-months to January 1920.¹⁹ As at August 2020, Copeton Dam's

Figure 9. Copeton Dam catchment runoff in 2018 and 2019 compared to average



Source: Bureau of Meteorology 2019, *Special Climate Statement 70 update—drought conditions in Australia and impact on water resources in the Murray-Darling Basin*, Canberra

storage level was at 15% and general security licence holders in the Gwydir valley (which includes water for the environment) have received only a 4.77% water allocation in the 2020/21 water year, following a 2.17% allocation in the 2019/20 water year, no water allocation in 2018/19 and a 17% allocation in the 2017/18 water year.

Our new modelling shows that:

- in conditions similar to the driest period in our long-term historical climate projections,²⁰ it is possible for inflows into Copeton Dam to be half the volume (27 GL over 24 months) seen during the current drought
- under the driest climate change projection scenario, inflows could be one-third of those seen during this drought (17 GL) (Figure 10).

However, the probability of this occurring is small. These estimates are based on the driest, or 'worst case', climate projection scenarios. These scenarios will not necessarily eventuate, but they give us an idea of the plausible future climate risks.

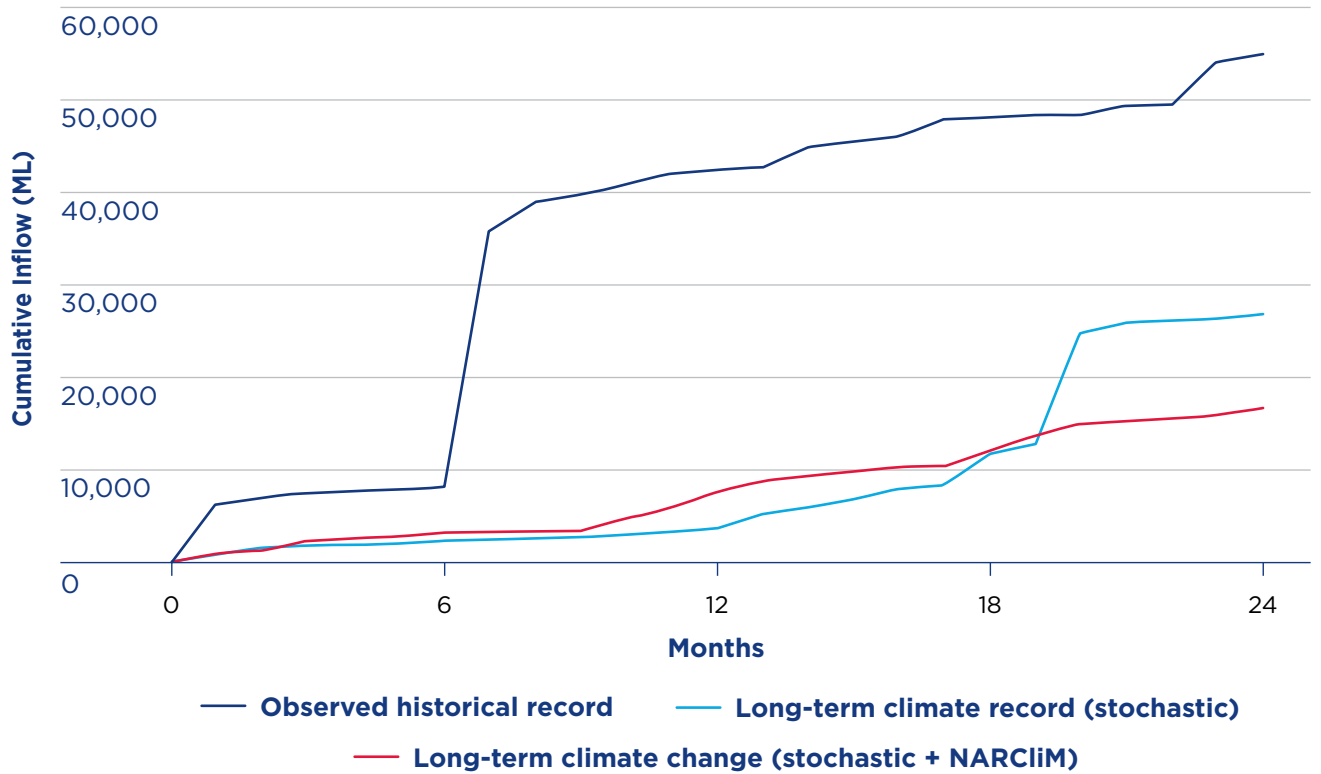
By comparison, the average 24-month inflow volume is likely to be similar to the historical record if the future climate is consistent with our long-term historical climate projections, but inflows could decrease by approximately 25% under long-term climate change projections (Table 1 below).

Table 1. Average 24-month inflows under different climate scenarios

Historical	Long-term historical climate (stochastic)	Climate change (stochastic and NARCLIM)
668 GL	685 GL	493 GL

17. Drought is defined in terms of periods of rainfall deficit (meteorological drought), low catchment streamflow (hydrological drought) and soil moisture depletion (agricultural drought). This strategy discusses meteorological and hydrological drought.
18. See www.bom.gov.au/climate/drought/ and BOM 2019, *Special Climate Statement 70 update—drought conditions in Australia and impact on water resources in the Murray-Darling Basin*, Canberra
19. www.industry.nsw.gov.au/water/allocations-availability/allocations/statements
20. The worst-case scenarios are defined as the 130-year periods (out of 10,000 years) with the lowest annual average extraction volume by general security entitlement holders.

Figure 10. Worst minimum inflow into Copeton Dam over 24 months under observed historical climate records, long-term climate (stochastic) and climate change scenario (stochastic + NARClIM)

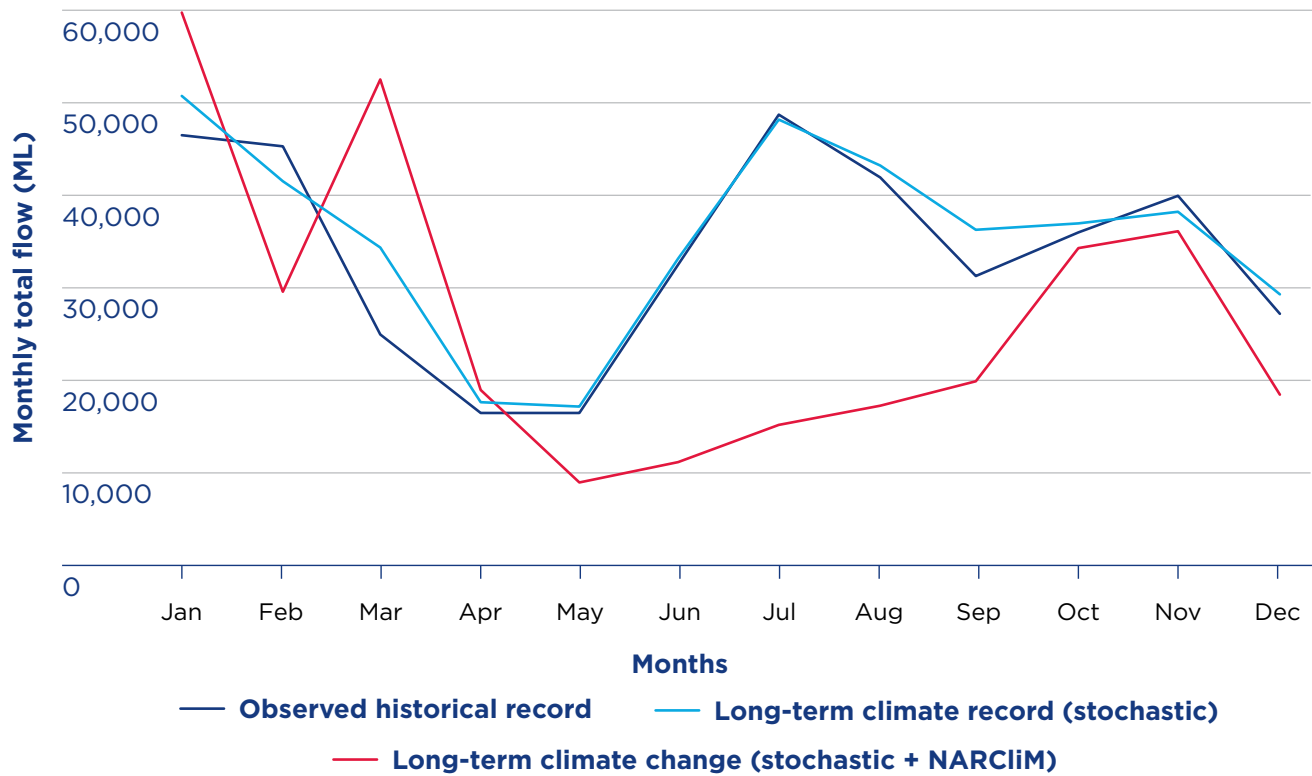


We also now understand more about the timing of inflows into Copeton Dam and possible future storage volumes based on our new modelling data.

Inflows into Copeton Dam could be lower in the long term in all months except January and March under the future climate projection

scenario (see Figure 11). This is also predicted for inflows below Copeton Dam. The most obvious changes are a marked increase in average total inflows in the months of January and March (due to increase in projected rain in January and March), but a sustained decrease in average total inflows from May to September.

Figure 11. Monthly inflows into Copeton Dam under observed historical climate records, long-term climate and climate change scenarios



Copeton Dam is not expected to reach dead storage (18,490 ML) under any of our modelled climate projections, but could sit below 5% capacity (85,660 ML) for longer periods than previously understood. Within our observed records, Copeton Dam has never fallen below 5% capacity. Even in this current drought, Copeton Dam has not fallen below 5.5%. Our new modelling results show:

- in the longer term data beyond the observed records (stochastic data) Copeton Dam falls below 5% capacity 12 times in 10,000 years, with the longest

duration below 5% being just over 400 days

- in the projected future climate change scenario, Copeton Dam could fall below 5% capacity 50 times in 10,000 years. The worst of these scenarios would see Copeton Dam remain below this level for up to 800 days.

Securing water for users of unregulated rivers will become increasingly difficult in a future with even greater climate variability.

A note of caution: the scenarios in these models will not necessarily eventuate. They are potential scenarios and there is always a level of uncertainty with this type of modelling, which needs to be taken into account as part of any water decision-making and planning.

In some instances, this may mean managing risks to our water security by being prepared and resilient, rather than relying on firm predictions and hard numbers.

As the science develops further, we will be able to reduce or quantify some of these uncertainties.

Floods are a feature of the past, and the future

In wetter years, flooding is common in the Gwydir region. Typically, the major floods occur in January and February, with occasional smaller floods in winter.²¹

The Gwydir region has experienced significant flood events over the past 130 years of observed historical records, notably in 1893, 1950 and 1954. The most recent significant flood event was in September 2016, when area-averaged rainfalls for the catchment were the wettest on record.²²

Floods are a vital, natural process that supports the Gwydir region's ecological productivity. They can also have significant detrimental impacts on people and businesses—damaging infrastructure, creating safety risks and causing financial and economic loss.

Research indicates that the intensity of heavy, flood producing rainfall events is expected to increase with climate change. However, this may not translate into increased runoff and larger floods due to the likelihood of drier soils and catchment conditions. Drier catchments might mean that when we get high intensity rainfall events there may still be a lower likelihood of flood events.

21. Department of Environment, Climate Change and Water 2011, *Gwydir Wetlands adaptive environmental management plan*, Department of Environment, Climate Change and Water, Sydney

22. Bureau of Meteorology 2017, *Special Climate Statement 58—record September rains continue wet period in much of Australia*, Canberra



2.2 The landscape and its water

The Gwydir region is located in northern NSW. It covers more than 26,000 km² and includes the towns of Moree, Uralla, Bingara and Wyallda. The region is bounded by the Border Rivers region to the north, the western slopes of the Great Dividing Range to the east, the Namoi catchment to the south and the Barwon River to the west (Figure 12).²³

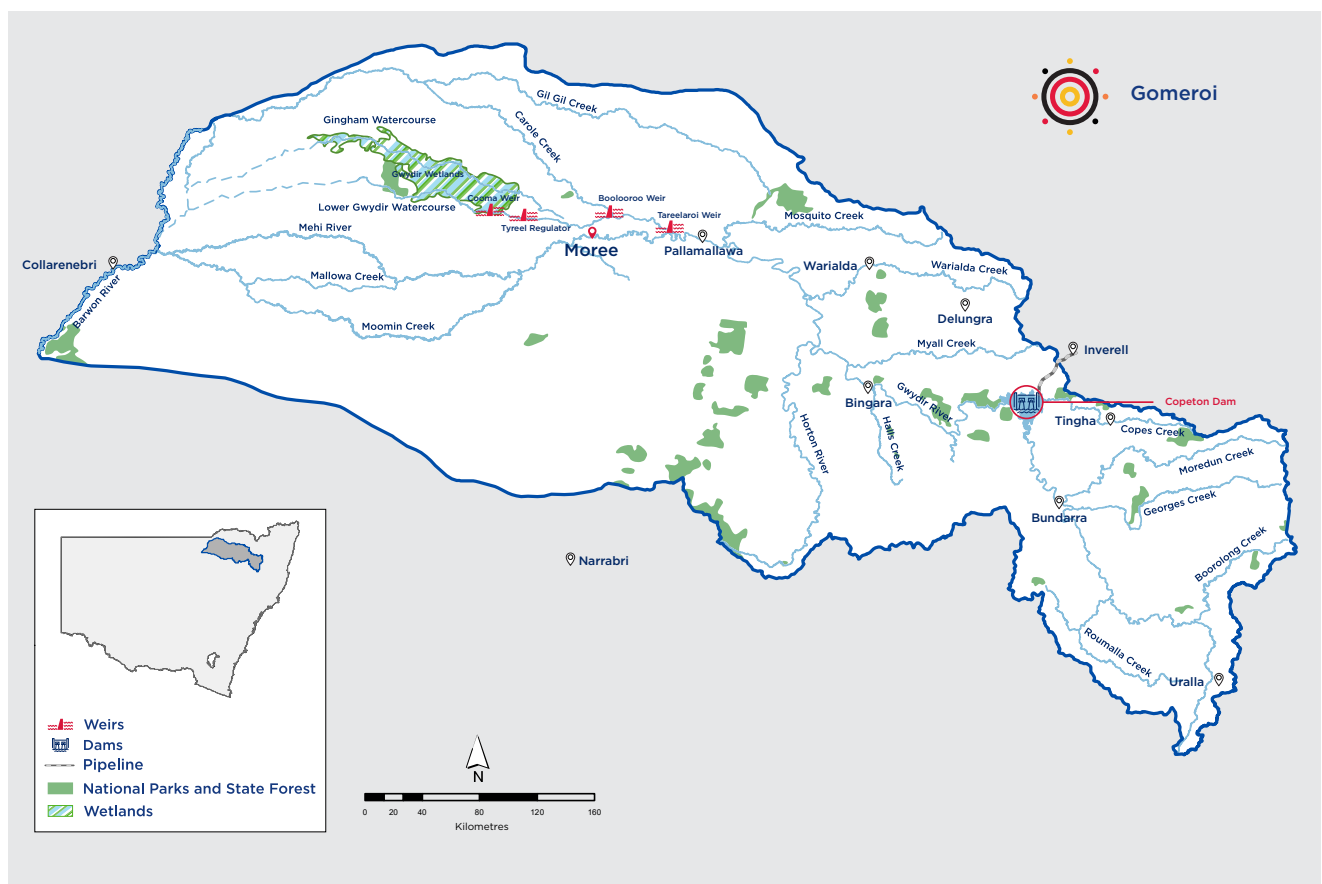
2.2.1 Water resources in the region

Water is critical to the health of the environment, the social fabric and liveability of the Gwydir region and its economic prosperity.

The region's towns, communities and industries use water from multiple sources (shown in Figures 12, 13 and 14):

- the regulated Gwydir River, supplied from Copeton Dam
- a system of unregulated rivers and creeks²⁴
- floodplain harvesting
- groundwater sources
- recycled water from local water utilities
- local runoff from rainfall captured in farm dams.

Figure 12. Map of the Gwydir region: key water resources and infrastructure



23. Department of Industry 2018, *Gwydir Surface Water Resource Plan: Surface water description*, first published October 2018

24. A **regulated river** is one where the flow has been modified from its natural state through structures such as a major state-owned dam, weir or off-takes. Major dams usually control the flow of water down regulated rivers. An **unregulated river** or stream is not controlled by releases from a major state-owned dam. Water users are reliant on climatic conditions and rainfall.

Major rivers and dams

The Gwydir River system is relatively short (480 km) compared to some other systems in NSW. The river begins northwest of Uralla and flows generally west, joined by over 30 tributaries. Upstream of the village of Pallamallawa, the Gwydir River is largely a single major stream with significant flow contributions from the Horton River. Downstream of Pallamallawa, the valley widens into an alluvial floodplain and flows towards the Barwon River. The system branches out to three different systems: the Mehi River, the Lower Gwydir and Carole-Gil Gil Creek system. The Gingham-Gwydir watercourse flows into the Gwydir Wetlands.²⁵

Copeton Dam is the region's main public water storage, located on the Gwydir River 60 km upstream of the town of Bingara (Figure 13). The dam can store up to 1,364,000 ML and is one of the largest in inland NSW. The yield from Copeton Dam depends on inflows from upstream unregulated tributaries that drain a catchment area of 5,360 km². The dam's catchment area is small relative to its storage capacity and the dam has only been full four times since it was completed in 1976. During the Millennium Drought, the dam never exceeded one third full as winter-spring rains did not provide sufficient inflows.²⁶

The Mehi River, Moomin Creek and Carole Creek systems can receive water from Copeton Dam. Weirs divert flow from the Gwydir River into these systems to supply irrigators with water. Users along these systems also access surface water that originates from the unregulated system and flows across the floodplain.²⁷

Delivering water along the length of the river maintains many water-dependent ecosystems and helps to recharge groundwater systems.

The efficiency with which water is delivered from Copeton Dam to water users, including industry and environmental assets, is relatively low. This is due to high evaporative losses from Copeton Dam and the trunk stream of the regulated Gwydir River. For example, in 2018/19, 102,414 ML of the 241,948 ML released from Copeton Dam was lost from the system through evaporation.²⁸

This is reflected in drought contingency approaches, which include bulking deliveries into block releases during the summer months. Under drought conditions, significantly more water is used to provide flows along a low or dry river. This may become unmanageable in an extreme drought and presents significant economic and environmental risks for the region.

25. Department of Industry 2018, Gwydir Surface Water Resource Plan: Surface water description, first published October 2018

26. Department of Planning, Industry and Environment—Water Group General Purpose Water Accounting reports

27. Department of Primary Industries—Water 2016, *Water Sharing Plan for the Gwydir Unregulated and Alluvial Water Sources 2012: Background document*

28. Department of Planning, Industry and Environment—Water Group General Purpose Water Accounting reports

Unregulated rivers and creeks

Most of the Gwydir's unregulated river flow joins the system between Copeton Dam and Gravesend. Major unregulated tributaries of the Gwydir River include Horton River, Keera Creek, Myall Creek, Warialda Creek and Halls Creek.²⁹

These systems do not always flow, but are an important water source for small villages, agricultural industries and environmental, cultural and stock and domestic needs. The flows are also a key source of water for downstream supplementary water access licence holders in the regulated system who can access water when river flows exceed normal requirements. An estimated 11,000 ML/year are taken directly from the region's unregulated rivers. The majority of water taken is for irrigation, with a significant proportion also used for town water supply.³⁰

Many landholders have harvestable rights dams. Harvestable rights dams allow landholders in most rural areas to collect a proportion of their basic landholder rights' runoff on their property and store it in one or more farm dams up to a certain size. These dams are not part of the storage capacity for floodplain harvesting (discussed below). An estimated 124,000 ML/year are taken from runoff dams in the unregulated river water sources across the region. Harvestable rights dams in the regulated system have been identified as a low risk to water available for the environment. In the unregulated systems, their risk to water availability for the environment ranges from low to high.³¹

Connectivity with the Barwon-Darling River

The Gwydir catchment also connects to the Barwon-Darling River and contributes 6% of the long term average flow recorded at Menindee.³² The Barwon-Darling River, and the communities that depend on that river, rely on inflows from the northern catchments of NSW.

Flows from the Mehi River, Carole Creek and Moomin Creek join the Barwon River near Collarenebri during times of moderate to high flow. Only during large flood events when the floodplain is inundated does water from the Gwydir Wetlands reach the Barwon River. The Gwydir catchment's connection to the downstream Barwon River is managed by a suite of water sharing rules. The water sharing plan for the Gwydir Regulated River Water Source includes rules to restrict access to natural flow events to help deliver flows to the Barwon River.

In recent years, the NSW and Australian governments have progressed a number of reforms to help improve water flows throughout the catchment and into the Barwon-Darling River. This includes:

- coordinated environmental water releases including the Northern Connectivity Event and Northern Fish Flow event
- protecting the first flow of water from extraction after the extended drought in early 2020
- changing rules in water sharing plans to enable environmental water to remain in the system as it moves downstream.

29. Department of Industry 2018, *Gwydir Surface Water Resource Plan: Surface water description*, first published October 2018.

30. www.industry.nsw.gov.au/water/plans-programs/water-resource-plans/status

31. Department of Industry 2018, *Gwydir Surface Water Resource Plan: Schedule D Risk Assessment for the Gwydir Surface Water Resource Plan Area (SW15): Part 1*, www.mdba.gov.au/publications/mdba-reports/gwydir-water-resource-plan

32. Department of Planning, Industry and Environment 2019, *Barwon-Darling Watercourse Resource Plan: Draft surface water resource description*, www.mdba.gov.au/publications/mdba-reports/barwon-darling-watercourse-water-resource-plan

However, some communities downstream of the Gwydir region have been requesting additional measures to improve connectivity between water sources. In addition, the independent review of the Northern Murray Darling Basin First Flush Assessment recommended that the NSW Government:

- develop clear arrangements around how decision makers aim to achieve connectivity within and between water sources after an extended dry period
- engage with water users, Traditional Owners and communities on these arrangements

- embed these arrangements into the regulatory and policy framework for managing drought.

The connection of the Gwydir catchment to the Barwon-Darling River may mean looking at cross-regional options that improve that connectivity and enable all communities across NSW to have fair and equitable access to water. The Western Regional Water Strategy may also consider options that have cross regional impacts.

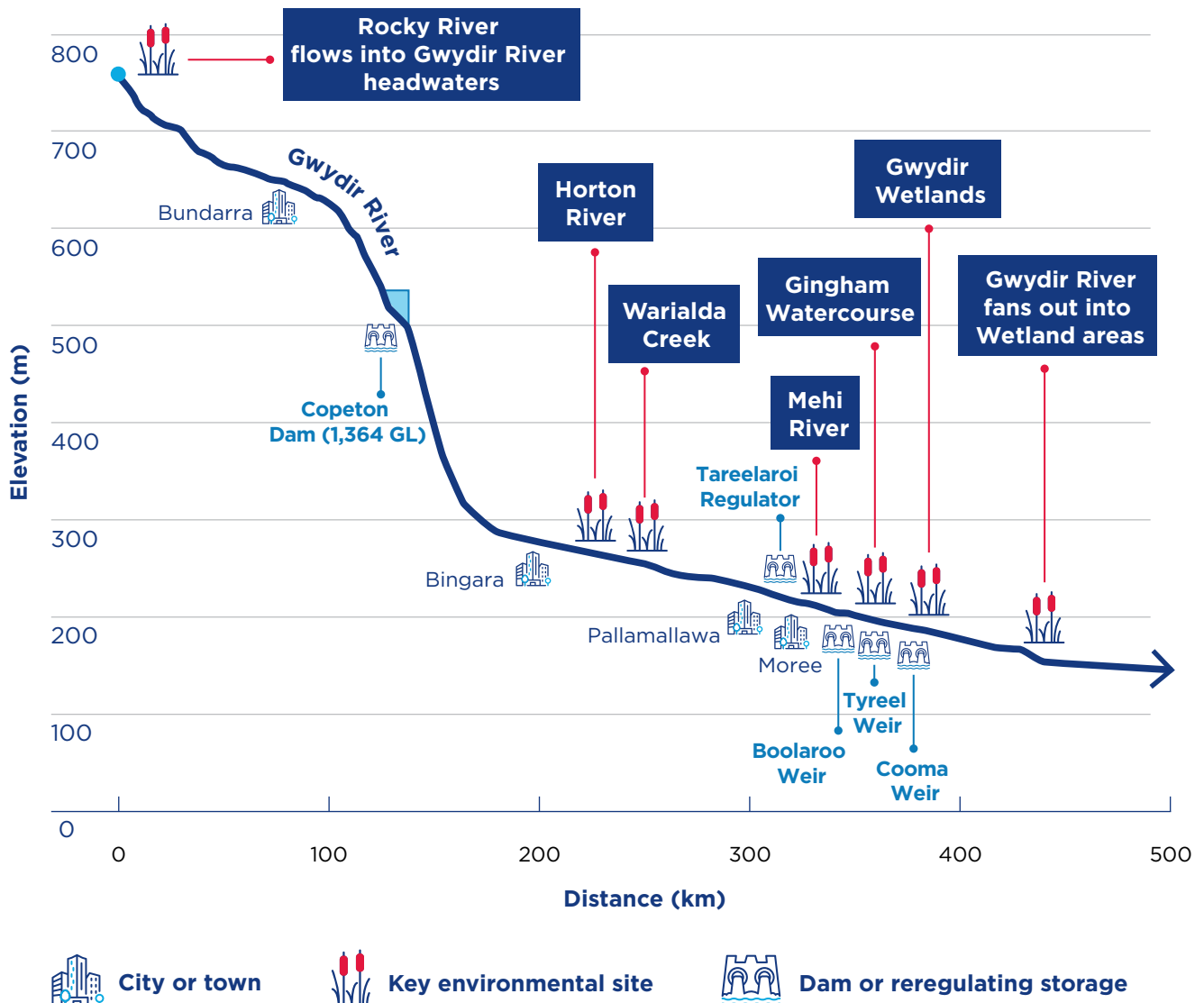
Reforms to improve northern Basin connectivity

Under the *Water Reform Action Plan*, the NSW Government committed to better management of water for the environment. To achieve this, changes to water sharing plans have been proposed to protect environmental water in unregulated systems in the northern Basin and improve connectivity within and between valleys in the north. The proposed changes include:

- **active management:** protect held environmental water in unregulated systems from extraction so that it can remain in rivers for the benefit of the environment

- **IDECS:** implementing limits (known as Individual Daily Extraction Components or IDECs) on the total volume of water that can be extracted daily by individuals in the Barwon-Darling catchment system will help to mitigate the local environmental impacts of water extraction and enable shared access to flows for both local and downstream users
- **resumption of flow rule:** the first flow of water through the Barwon-Darling system after an extended dry period would be protected from extraction under a resumption of flow rule to help maintain ecological assets (such as threatened fish species) during critical times, improve longitudinal connectivity between refuge pools and deliver downstream social and cultural benefits.

Figure 13. Gwydir River: longitudinal profile



Source: Murray-Darling Basin Authority, www.mdba.gov.au/publications/mdba-reports/geographic-profile-maps-basin-catchments

Note: This figure is not an accurate representation of the Gwydir River system. It is only intended to give a high level overview of the river system's length and elevation.

Floodplain harvesting

Floodplain harvesting is significant in the Gwydir region. An estimated 327 (472 GL) permanent storages and 29 (10 GL) buffer storages (spread across 130 properties), which include storages classified as both 'regulated' and 'unregulated' (i.e. with reference to surface water sharing plan areas), are eligible to be

licensed under the floodplain harvesting program. These storages are located within the western section of the Gwydir region. Approximately 31% of storage capacity is in the Moomin area, followed by the Mehi, Carole Creek and Gwydir areas (27%, 24% and 15% respectively).³³

More than one third of all surface water taken in the region comes from water diverted from the floodplain. The region's agricultural industries now rely on floodplain harvesting as a key source of water and have leveraged its use to support growth in emerging and existing industries.

There has been significant growth in floodplain harvesting infrastructure over the last 20 years, with the amount of water being taken now estimated to be greater than the limit set in the region's water sharing plan. The NSW Government is implementing its Floodplain Harvesting Policy³⁴ (see box below) in the Gwydir region. This policy will help quantify and address this growth and bring it back within statutory limits.

In addition to the evaporation from rivers and dams, there are large evaporative losses from on-farm storages. The total surface area of

on-farm storages in the Gwydir catchment is estimated to be about 206 km²—about 3.75 times the area of Sydney Harbour.

Hydrologic modelling indicates that combined evaporative losses from on-farm storages are around 188,000 ML per annum or 30% of storage capacity.

The 2016 Floodplain Management Plan for the Gwydir Valley Floodplain sets clear rules for managing the development of new flood works and alterations to existing flood works. The plan seeks to protect the passage of floodwater through the floodplain, while recognising the need to minimise the risk to life and property.

The planning process has also identified existing floodwork structures that are causing significant impacts on important environmental and cultural assets.

Better management of floodplain harvesting

The NSW Government introduced a Floodplain Harvesting Policy in 2013 so that it can be better managed within legal limits.

The policy brings floodplain harvesting within the current water licensing framework and caps the amount of water that is taken so that water use can return to the statutory limits set by the water sharing plans. Long-term average annual extraction limit estimates are being updated and other amendments made to the water sharing plans to incorporate floodplain harvesting.

In 2020 the NSW Government placed a temporary water restriction on floodplain harvesting, protecting the first flow of water after an extended dry period. This helped water flow down the system, meeting critical human and environmental needs, both within the Gwydir valley and in downstream communities.

The 2019 *Floodplain Harvesting Action Plan* sets out the NSW Government's commitments to use the best available facts, data and scientific analysis, consult and set clear rules, ensure rules are followed and improve floodplain harvesting management over time.

33. Department of Planning, Industry and Environment 2019, *Floodplain Harvesting Action Plan*, www.industry.nsw.gov.au/water/plans-programs/healthy-floodplains-project/harvesting

34. www.industry.nsw.gov.au/water/plans-programs/healthy-floodplains-project/plans/gwydir-valley

Groundwater

Groundwater sources in the Gwydir region include the Lower Gwydir and Upper Gwydir Alluvial groundwater sources and the Surat Groundwater Source of the Great Artesian Basin which underlies the Lower Gwydir Alluvium (Figure 14). The Lower Gwydir Alluvial source (approximately 33,000 shares of water entitlements) is more productive than the Upper Gwydir Alluvial (approximately 1,200 shares of water entitlements). Several other groundwater sources also underlie areas of the Gwydir and neighbouring regions.

Water from the Upper and Lower Gwydir Alluvial and Surat groundwater sources is generally good quality and suitable for horticulture, irrigation, stock water supply and drinking water. Groundwater is an important town water source for Moree, Wyallda, Gravesend and North Star and is also used by some remote Aboriginal communities. The Upper and Lower Gwydir groundwater sources also sustain areas of high and very high ecological value groundwater-dependent woodlands and forests, including areas of River Red Gum woodlands.

An extensive groundwater monitoring bore network exists in the Gwydir region, providing 40 years of continuous data. This data shows that, over several decades, the extensive use

of groundwater has led to a decline in levels in some areas (up to 15 km wide) of the Lower Gwydir source—particularly between Moree and Ashley.³⁵ Growth in groundwater use from the deep aquifer since the 1980s means that groundwater levels in this aquifer have fallen.³⁶ A trade management area was introduced in this part of the region to manage water levels. The Upper Gwydir source requires additional monitoring bores and metering to monitor water quality and water extraction.

In 2006, when the water sharing plan³⁷ commenced, the Lower Gwydir Alluvial water users had their shares reduced to the extraction limits. In addition, the volume of water available under the supplementary water access licences gradually reduced over the period 2006/07 to 2013/14 and these licences were cancelled at the end of the 2014/15 water year.

Groundwater extractions in the Lower Gwydir slightly exceeded the allowable limit in the 2017/18 and 2018/19 water years.

During periods of drought with limited surface water availability, people with groundwater licences rely more on groundwater. This means that groundwater may become an increasingly important water source in the future.

35. Department of Planning, Industry and Environment 2019, *Gwydir Alluvium Water Resource Plan, Appendix A—Gwydir Alluvium WRP Groundwater Resource Description Report*, www.mdba.gov.au/publications/mdba-reports/gwydir-alluvium-water-resource-plan

36. Department of Planning, Industry and Environment 2019, *Gwydir Alluvium Water Resource Plan, Appendix A—Gwydir Alluvium WRP Groundwater Resource Description Report*, www.mdba.gov.au/publications/mdba-reports/gwydir-alluvium-water-resource-plan

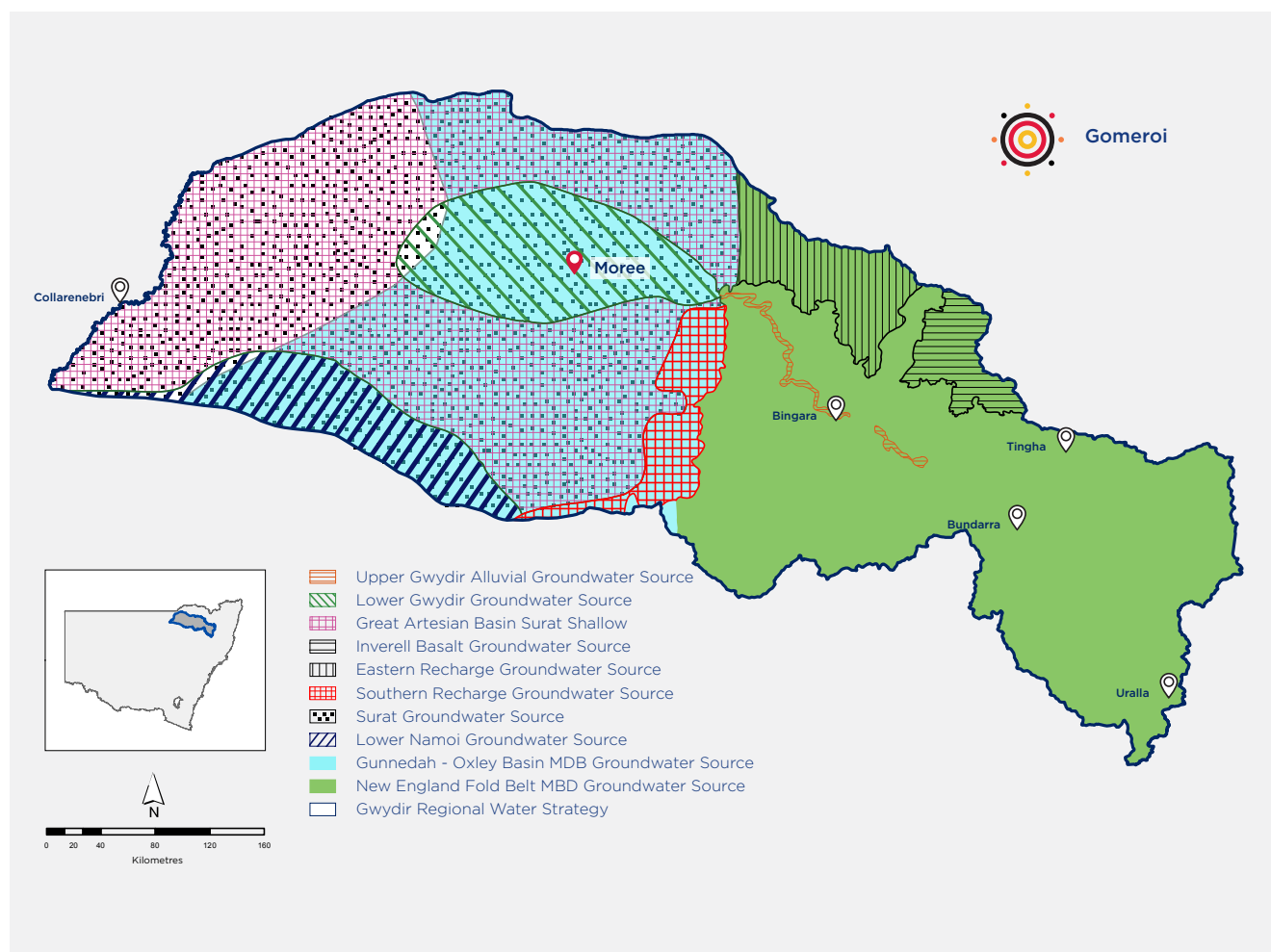
37. Refers to the *Water Sharing Plan for the Lower Gwydir Groundwater Source 2003*.

Continuing to improve our understanding of groundwater will enable better informed decisions about its management and use. Gaining knowledge about groundwater availability across the entire Gwydir region, not just in areas where it is usually accessible, and providing this information to towns and industries could significantly improve planning for drought. It could also help communities to make informed decisions about which water sources to access at different times.

NSW has a strong groundwater management framework that has undergone significant reform. However, opportunities still exist

to continue to improve how we manage groundwater resources. In particular, the Draft Gwydir Regional Water Strategy will consider options to improve the understanding of groundwater processes, provide reliable and sustainable access to groundwater and give greater clarity in managing groundwater extraction (see Options 5, 14, 15 and 16 in Table 4). These and other options aim to use groundwater more efficiently and innovatively to make sure groundwater of suitable quality is available for critical needs and to manage risks to the resource.

Figure 14. Map of groundwater sources in the Gwydir region



Recycled water

Two of the four local water utilities that source water from the Gwydir region produce recycled water for reuse. In 2018/19:

- 35.5 ML of recycled water was supplied by Gwydir Shire Council (15% of the total wastewater collected by the local water utility)
- 1,417.5 ML of recycled water was supplied by Moree Plains Shire Council (74.25% of the total wastewater collected by the local water utility).³⁸

The bulk of water recycled is reused for commercial, industrial, agricultural and municipal purposes, as well as for managed recharge of groundwater sources. It is not used for drinking water supply. The regional water strategies provide an opportunity to explore whether treated water should be used as a drinking water supply, along with other initiatives (such as stormwater harvesting) that could increase town water security (see Option 3 in Table 4).

Recycled water: contributing to a liveable Moree

The Moree Plains Shire Council undertakes water recycling for non-household uses. Treated wastewater is used to irrigate Ron Harborne Oval, Moree cemetery, Moree Golf Course, Mike Shaw Park and a citrus farm. In dry weather, Moree is able to reuse nearly all of its treated wastewater. In wet weather, overflows are discharged to a wetland: in a significant flood event, these flows can reach the Mehi River.

In addition, about 1.7 ML/day of artesian water from the Moree Artesian Aquatic Centre is re-chlorinated and pumped to the recreational water ski park. The re-use of water for non-household uses contributes to the liveability of the region by supporting local parks and recreational activities.



2.2.2 Water and the regional environment

The Gwydir Wetlands are a major environmental feature in the region, covering an area of over 100,000 hectares. These are among the most extensive and significant semi-permanent wetlands in north-west NSW, with four sites listed under the international Ramsar Convention: Goddard's Lease, Crinolyn, Windella and Old Dromana. The wetlands also include many archaeological sites of cultural significance to the Gamilaroi people.³⁹

Other significant environmental assets in the catchment include the Mallowa Wetlands, Gwydir River channel, the Mehi River and Moomin and Carole creeks.

The Gwydir River, its tributaries and distributaries, and the region's groundwater sources support a range of surface water- and groundwater-dependent native flora and fauna species including the Lowland Darling Endangered Aquatic Ecological Community, 15 native fish species, endangered and critically endangered ecological communities and migratory waterbirds.

Five of the 15 native fish species recorded in the Gwydir valley are listed as threatened in NSW waters under state or federal legislation: Southern Purple Spotted Gudgeon, Freshwater Catfish, Olive Perchlet, Silver Perch and Murray Cod. The threatened river snail species *Notopala sublineata* is also listed as an endangered species in NSW.⁴⁰

Healthy water sources are essential to support these environmental assets and species. A healthy environment also improves the liveability of the region, contributes to the health and wellbeing of communities and sustains the tourism, resources and agricultural industries. For example, healthy fish species support Aboriginal cultural and recreational fishing in the region and provide an economic stimulus to the local economy.

Many factors have contributed to the deterioration of river health and native fish populations in the Gwydir valley. These include changes to water flow, siltation, degradation of in-stream habitat and riparian vegetation, poor land management, barriers to fish passage and introduced fish species. However, the majority of the fish community of the valley is in a moderate condition, which provides a strong platform for native fish population recovery—provided management actions are developed and implemented appropriately.⁴¹

Copeton Dam has had an impact on water quality downstream, both as a result of higher nutrients immediately downstream and cold water pollution for an estimated 200 km downstream. This has had a number of impacts on aquatic environments, including reductions in fish spawning and increased fish mortality.⁴²

38. www.industry.nsw.gov.au/water/water-utilities/lwu-performance-monitoring-data

39. Department of Primary Industries—Water 2012, *Water Sharing Plan for the Gwydir Unregulated and Alluvial Water Sources 2012: background document*.

40. Office of Environment and Heritage 2018, *Gwydir Long Term Water Plan Part A: Gwydir Catchment*, www.environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/gwydir

41. Office of Environment and Heritage 2018, *Gwydir Long Term Water Plan Part A: Gwydir Catchment*, www.environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/gwydir

42. Department of Industry 2018, *Gwydir Surface Water Resource Plan: Schedule D Risk Assessment for the Gwydir Surface Water Resource Plan Area (SW15): Part 1*, www.mdba.gov.au/publications/mdba-reports/gwydir-water-resource-plan



Other infrastructure associated with river regulation (such as weirs and regulators) can affect waterway connectivity, the health of riparian and aquatic environments and the movement, spawning and feeding of native fish. Each year, millions of native fish are lost from rivers across the Murray-Darling Basin through being extracted by pumps and diverted into channels. This could be prevented through the introduction of screens that can stop fish and debris entering pumps and diversions, potentially reducing fish mortality by over 90% and improving environmental, social and economic outcomes across the region.⁴³

Both the water sharing plan for the region and the Basin Plan protect water to deliver environmental outcomes. Environmental rules in the plans help to maintain and improve the environmental condition of rivers and groundwater sources. Today in the Gwydir region, 135,700 ML of water entitlements are managed by state and federal environmental water holders (Figure 15).⁴⁴

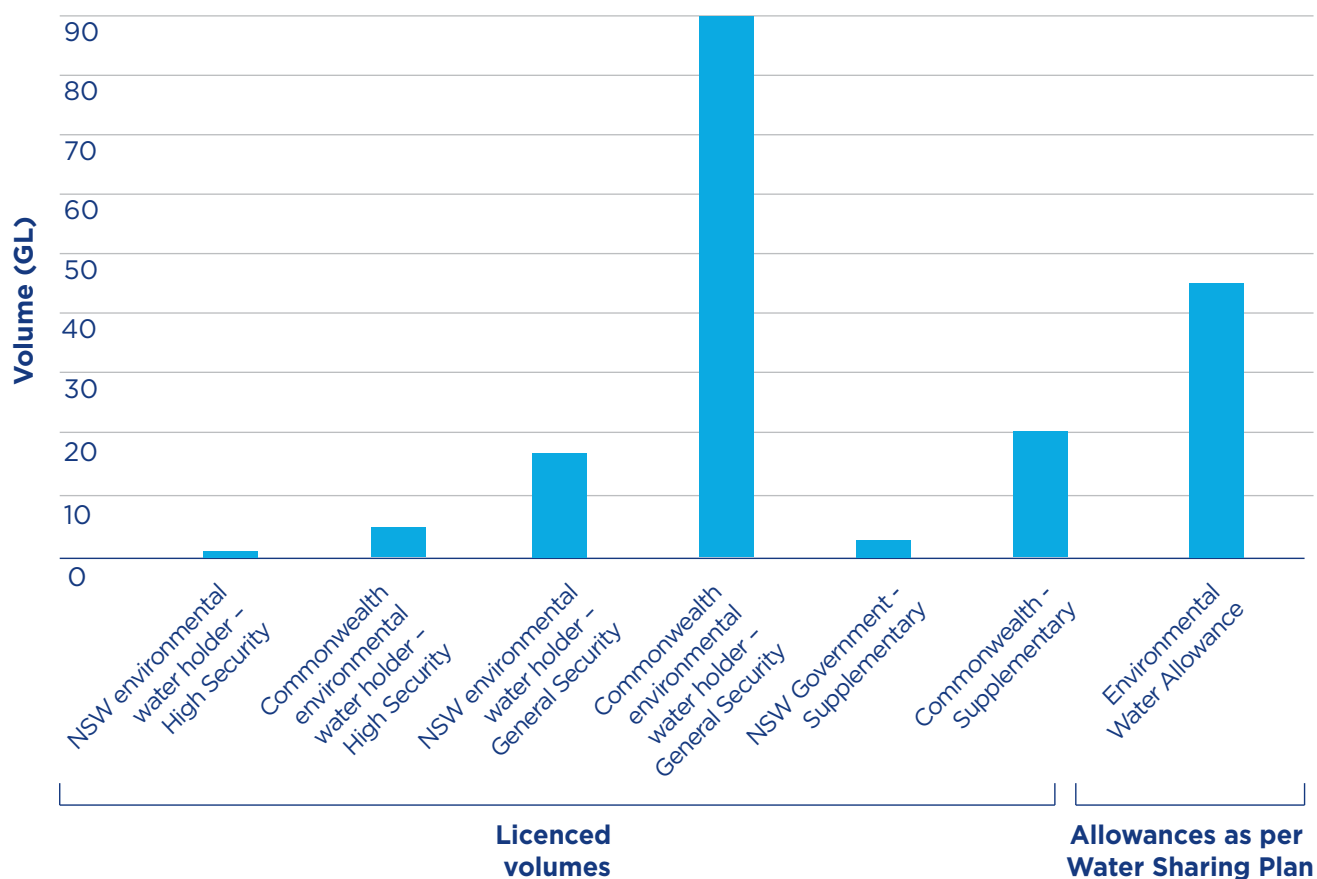
Water sharing plan rules also help meet the region's environmental needs:

- An environmental water allowance of up to 45,000 ML (that can accrue up to 90,000 ML) allows releases to support wetland or river health, as well as birds, fish or other fauna.
- A minimum flow of up to 500 ML a day of combined flow from the Horton River, Myall Creek and Halls Creek is required to be passed to the Gwydir Wetlands.
- Only a portion of the flows may be extracted, with the rest left in the river for environmental purposes.

Environmental water allowance

An environmental water allowance (EWA) is set aside in Copeton Dam. A volume of 45,000 ML is allocated to the EWA in the same way as general security licences are accounted. However, a larger relative account limit up to 90,000 ML (or 200% of the 'entitlement') can accrue to the EWA. Releases may be made for a wide range of purposes related to wetland or river health or for the direct benefit of birds, fish or other fauna.

Figure 15. Graph of environmental water volumes in the Gwydir region



Source: Department of Planning, Industry and Environment 2019, Gwydir Catchment Annual Environmental Watering Priorities 2019/20, www.environment.nsw.gov.au/topics/water/water-for-the-environment/gwydir/annual-environmental-water-priorities

Providing water for a healthy environment can be difficult at times. Water for the environmental assets in the catchment comes primarily from general security licences and allowances, so water available for the Gwydir Wetlands and other ecological assets and ecosystem functions is subject to the same pressures as that of the general security irrigation industry.

A number of constraints have been identified that affect the Gwydir region's ability to meet environmental watering objectives:⁴⁵

- The channel capacity of some creeks and rivers, such as the Lower Gwydir, is limited.
- Floodplain structures on private property limit the ability of water to flow down the system in some locations. These are identified in the Floodplain Management Plan.

43. Office of Environment and Heritage 2018, *Gwydir Long Term Water Plan Part A: Gwydir Catchment*, www.environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/gwydir

44. Water Register waterregister.watersnsw.com.au/water-register-frame

45. Office of Environment and Heritage 2018, *Gwydir Long Term Water Plan Part A: Gwydir Catchment*, www.environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/gwydir

These constraints can also impact river flows into other systems, such as the Barwon-Darling River.

Improving environmental outcomes also becomes more difficult when conditions have been dry and there has been reduced inflow into Copeton Dam, as well as declines in the frequency and magnitude of floods. Environmental water released from Copeton Dam has been used to refresh waterholes and provide connectivity in the Gwydir and Barwon-Darling systems to protect and support native fish.

Coordinated NSW and Australian Government activities in the region are helping to improve the health of riparian and aquatic environments and native fish habitat.

Higher temperatures, increased evaporation, increased fire risk, changes to rainfall patterns and associated flows, and potentially more intense dry and wet periods have the potential to significantly impact water-dependent ecosystems that have evolved over millennia to thrive in natural cycles that are now changing.

Modelling the effects of long-term climate change on hydrology in the Gwydir catchment indicates the potential for significant changes to river flows, with associated impacts on riverine and floodplain ecosystems. Similar alterations to the flow regime were predicted in the regulated Gwydir River,⁴⁶ the unregulated river system⁴⁷ and the Gwydir Wetlands.⁴⁸ In general, the modelling shows the total volume of water flowing each year in these sections of the catchment reducing by 26% to 35%, impacting all components of the flow regime under the projected climate change scenario (see Figure 16).

The magnitude of regular high flows⁴⁹ could decrease by 20% to 35%, limiting the number of events that may trigger fish movement and spawning, and reducing large tributary flows that stimulate riverine productivity by transporting carbon and nutrients into the system. The changes to the magnitude of high flows would decrease the number of overbank flows that deliver water to the Gwydir Wetlands, potentially leading to a decline in the wetland vegetation community. Flows into Copeton Dam are estimated to decline, reducing the ability to inundate the Gwydir Wetlands by held environmental water entitlements and the environmental water allowance. The decline in inundation of the Gwydir Wetlands will also reduce opportunities for water birds to breed and successfully rear their young, and limit occasions when fish temporarily access floodplain aquatic habitats to feed and reproduce. Furthermore, less frequent large flows may decrease productivity in the Gwydir River because water returning from the floodplain to the main-stem river carries dissolved carbon and organic detritus, micro-organisms and small plankton animals.

There could also be a large increase in the number of years in which a cease-to-flow event occurs; this is most pronounced in the unregulated river systems. Cessation of flow in rivers and streams will result in drying of flowing water habitats, increased sedimentation, water quality deterioration (elevated water temperatures and low dissolved oxygen levels) and the loss of connectivity throughout the river system, all of which will have damaging effects on the aquatic ecosystem.

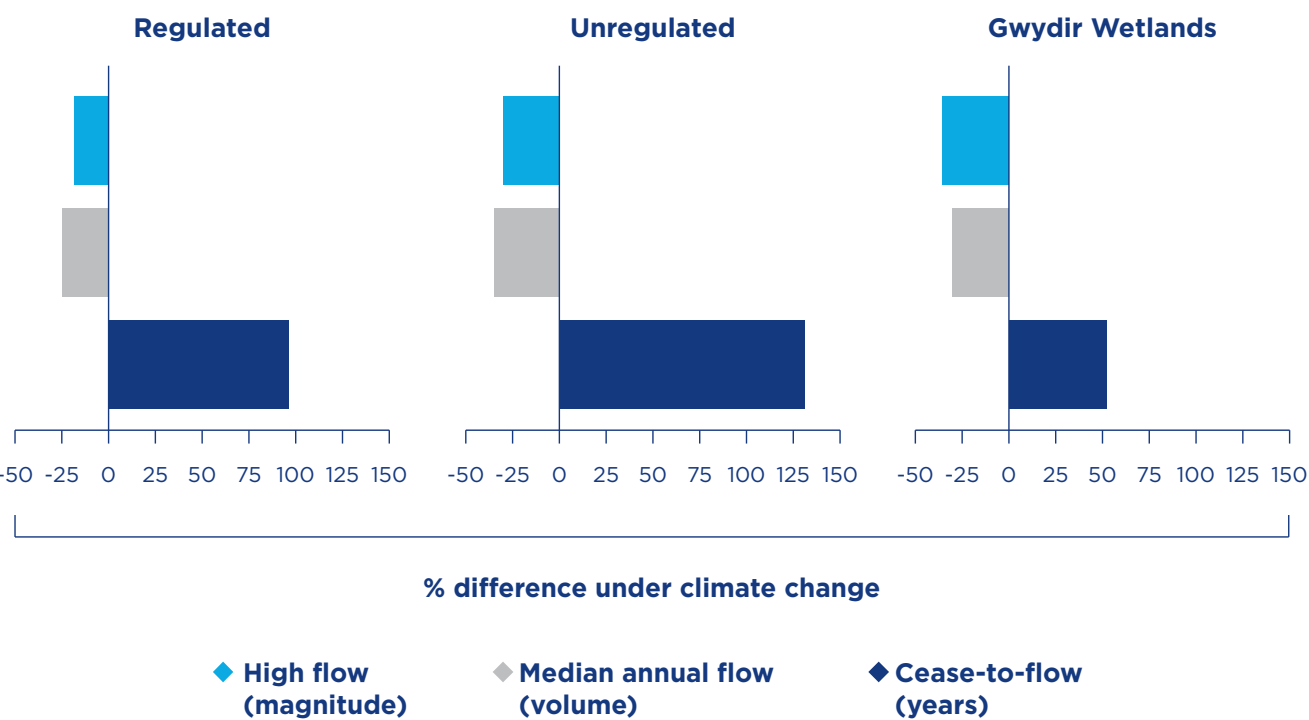
46. Measured at 418001 Gwydir @ Pallamallawa.

47. Measured at 418015 Horton @ Rider.

48. Measured at 418076 Gingham @ Tillaloo.

49. Measured as 2.5 Average Recurrence Interval. Average Recurrence Interval is the likelihood of occurrence, expressed in terms of the long-term average number of years, between flood events as large as or larger than the design flood event. For example, floods with a discharge as large as or larger than the 2.5-year Average Recurrence Interval flood will occur on average once every 2.5 years.

Figure 16. Effect of the long-term climate change scenario on the magnitude of the Average Recurrence Interval 2.5 flood, median annual flow volume and number of years with cease-to-flow events in the regulated Gwydir River



Note: Regulated—418001 Gwydir @ Pallamallawa, a major unregulated tributary—418015 Horton @ Rider and the Gwydir Wetlands—418076 Gingham @ Tillaloo.

Importantly, these climatic changes will not occur in isolation, but will coincide with potential water resource development, market shifts, land use and agriculture changes and associated changes to water management. This presents a long-term risk to river, wetland and floodplain health, making it more difficult to manage our landscapes and ecosystems—and the human activities that depend on and benefit from them. A more variable climate means that concerted and coordinated efforts will be required to protect and enhance the region’s vital environmental, economic, social and cultural assets into the future.

Options being considered through the Draft Gwydir Regional Water Strategy have a strong focus on improving the health of natural systems and protecting water-dependent species, such as native fish. These include measures to reduce the impacts of cold water pollution (see Option 12 in Table 4), works to improve environmental flows (Options 9, 11, 17 and 18) and actions to improve the health of native fish species (Options 10 and 13).

Water quality

Water quality in the Gwydir is strongly correlated to flow. High flow from rainfall and runoff results in higher suspended solids (turbidity), nutrients and possibly pesticides and pathogens. There is also a general trend towards increasing turbidity and nutrient concentration with distance down the catchment as cumulative impacts increase. This has been driven by land use practices and removal of riparian vegetation.

The turbidity of surfacewater supplies is particularly problematic for the region’s town water supply operators as it can cause odour problems and reduce the effectiveness of disinfection. Along with blue-green algae, it can also affect the cultural and social uses of water.

The Gwydir catchment has highly variable in-stream salinity and salt load. High in-stream salinity comes from the mid valley catchments below Copeton Dam. The Myall Creek sub-catchment contributes significant salinity and is a priority for improved land management use and practices. Causes of salinity in the Gwydir catchment include changes in water balance, sources of salt and redistribution in the landscape, groundwater processes and dry salt scalds that expose saline salts.

Previous analysis to support development of the Gwydir Surface Water Resource Plan⁵⁰ found that:

- There are locations where turbidity, nutrients, pH and dissolved oxygen are outside of target ranges. In these places, there are high risks to ecological values: from turbidity in the lower sections of the catchment; from total phosphorus, total nitrogen and pH in the Gwydir River around Yarrowyck; and from low concentrations of dissolved oxygen and elevated levels of nitrogen and phosphorous at several locations.
- Cold water from Copeton Dam is a high risk to ecological values downstream of the dam as far as Pallamallawa.
- There are elevated levels of salinity in the Mehi River from time to time, which are a high risk to ecological values and also create a medium risk of irrigated crop damage where water is taken from the river.
- Harmful algal blooms occur regularly in Copeton Dam during warmer months.
- Fish deaths from low dissolved oxygen can occur in the Lower Gwydir valley following the resumption of flow after an extended period of zero flow.

2.2.3 Managing water in the Gwydir region

Water in NSW is managed and shared under the *Water Management Act 2000*, with specific water sharing rules set out in water sharing plans.

Dealing with extraction limits

The Murray-Darling Basin Plan sets the limit on the amount of water that can be extracted from water sources in the Gwydir region, based on long-term models of the river system. The current draft estimated sustainable diversion limits for the Gwydir are 381 GL per year for surface water and 33.72 GL per year for groundwater.^{51 52} Extractions in the Gwydir region are managed so that they remain within these limits, irrespective of the licensed entitlement volume.

These limits are implemented through water sharing plans for the *Gwydir Regulated River Water Source 2016*, the *Gwydir Unregulated Water Sources 2012* and the *Gwydir Alluvial Groundwater Sources 2020*.

The following plans also operate in the Gwydir Region:

- *NSW Great Artesian Basin Groundwater Sources (2020)*
- *NSW Great Artesian Basin Shallow Groundwater Sources (2020)*
- *NSW Murray-Darling Basin Porous Rock Groundwater Sources (2020)*
- *NSW Murray-Darling Basin Fractured Rock Groundwater Sources (2020)*.

50. Department of Industry 2018, *Water quality management plan for the Gwydir Surface Water Resource Plan area (SW15), Schedule H*, www.mdba.gov.au/publications/mdba-reports/gwydir-water-resource-plan

51. Note: The sustainable diversion limit figures are draft figures until the Gwydir Surface Water and Groundwater Water Resource Plans have been finalised and accredited.

52. Department of Industry 2018, *Sustainable diversion limit scenario model for the Gwydir regulated river system, Appendix C to Schedule F*, www.mdba.gov.au/publications/mdba-reports/gwydir-water-resource-plan and Department of Industry 2018, *Gwydir Alluvium Water Resource Plan: Groundwater Resource Description*, www.mdba.gov.au/publications/mdba-reports/gwydir-alluvium-water-resource-plan

The Water Sharing Plan for the Gwydir Regulated River Water Source 2016 and the *Water Sharing Plan for the Gwydir Unregulated Water Sources 2012* are due for replacement or amendment during 2020.

The current rules for allocating surface water and determining extraction limits in NSW are based on rainfall records from the 125 years prior to the development of the first water sharing plan. Reserves are set aside to operate the river system through extended dry periods based on the dry periods recorded in the historical data. The rules do not anticipate a scenario where the region's climate is likely to be more variable in the future, with more severe droughts occurring more often.

Preparation of the regional water strategies offers an opportunity to consider whether our resource assessment and allocation settings are at the right levels, particularly in relation to new climate data, regional trends and other contemporary information.

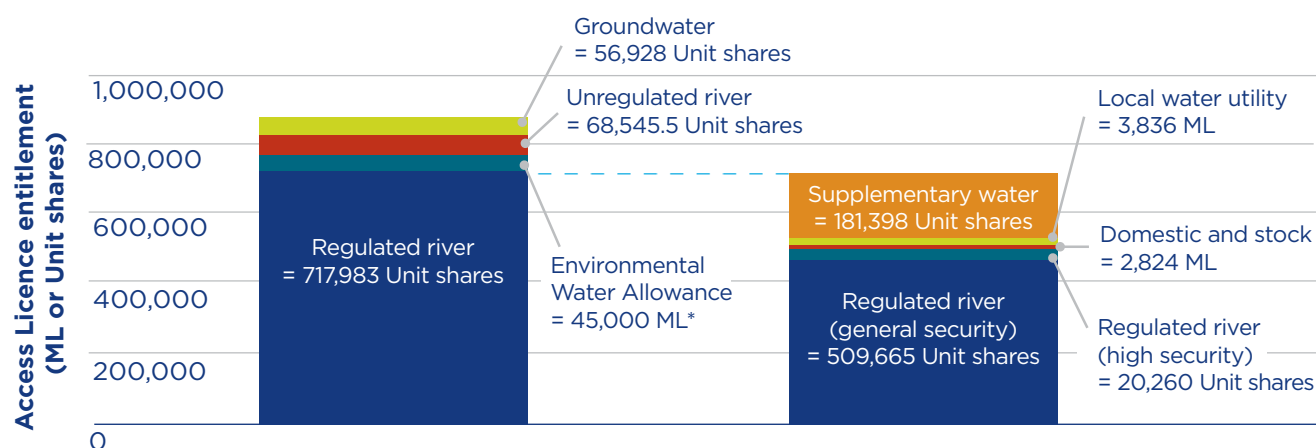
In addition, the growth in floodplain harvesting structures in recent years means the potential to extract water above the sustainable diversion limit is high.

Water take in the Gwydir

Most of the water taken in the Gwydir is from regulated river sources: 717,983 ML of regulated entitlement is licensed along the length of the river below Copeton Dam, with the majority below Moree. Most of the regulated river allocations are for general security licences (Figure 17). General security licences are less reliable, but the water sharing plan allows the unused general security water to be carried over from one year to the next.

As discussed in section 2.2.1, floodplain harvesting makes up more than one third of all surface water taken in the region. Floodplain harvesting extractions in the Gwydir valley have increased above legal limits. Implementing the NSW Floodplain Harvesting Policy will address this growth.

Figure 17. Distribution of water entitlements for the Gwydir region



Note: Entitlement is based on licensed share components only and this figure does not include floodplain harvesting or Basic Landholder Rights.

Source: Department of Planning, Industry and Environment 2018, *Gwydir Water Resource Plan: Surface water resource description*, Gwydir Surface Water Resource Plan and WaterNSW water licence database and internal Department of Planning, Industry and Environment—Water data

The volume of environmental water entitlements (held environmental water) in the Gwydir region has gradually increased. The entitlements currently total 135,700 ML (106,500 ML of general security, 23,500 ML of supplementary and 5,700 ML of high security) out of the available 717,983 ML of regulated entitlement—an increase of 21,482 ML of water entitlements for the environment prior to implementation of the Basin Plan. This has led to a commensurate reduction in water entitlement that is available for irrigation, in an effort to provide balance in meeting the needs of the environment, communities and industries.⁵³

In some unregulated rivers, an increase in the volume of environmental water entitlements can lead to an increase in the ability of other water users to take water. This is because the environmental water is left in the river, thereby raising the river levels: in the unregulated systems, whether or not a water user can access water (assuming they have the necessary entitlements) is linked to the height of the river and not to a water meter. Several options are available to better manage environmental water in the region, including investigating options to actively manage access to flows to allow held environmental water to remain in-stream for environmental purposes in parts of the Lower Gwydir.

This will help to ensure that environmental water achieves its intended purpose, provide greater certainty to all water users about how flow events will be managed and improve transparency around when water can or cannot be taken.

Setting priorities around water sharing

The *Water Management Act 2000* sets out how we prioritise water sharing during normal operations, with the highest priority being for the environment, followed by basic landholder rights (Table 2).

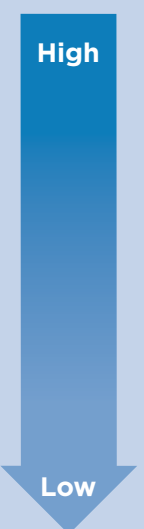
During extreme events, such as prolonged droughts, the priority changes. Basic landholder rights and essential town water services (authorised by an access licence) become the highest priority in the Murray-Darling Basin, followed by the environment.

This change in priorities is triggered when a water sharing plan (or part of a plan) is suspended. The aim is to operate within the plan rules for as long as possible, as they provide clarity for all users of these water sources. The Gwydir Regional Water Strategy is an opportunity to consider whether the trigger should be reviewed (see Option 27 in Table 4).

53. Water NSW licence register and Office of Environment and Heritage data.



Table 2. Priorities for water sharing

Priority	Extreme events	Normal circumstances
Highest	Critical human water needs	Needs of the environment
	Needs of the environment	Basic landholder rights
	- Stock - High security licences - Commercial and industrial activities authorised by local water utility - Water for electricity generation on a major utility licence - Conveyance in supplying water for any priority 3 take	- Local water utility access licences - Major utility access licences - Stock and domestic access licences
	General security licences	Regulated river (high security) access licences
	Supplementary licences	- All other forms of access licences - Supplementary access licences

Source: Based on priorities table in *Gwydir Surface Water Resource Plan: Schedule G—Incident Response Guide for the Gwydir Surface Water Resource Plan Area SW15*

Managing water quality

Water quality is managed through several legislative and regulatory instruments and agencies. For all inland NSW regions, water quality management plans have been developed to support the development of the water resource plans and meet the relevant requirements of the Murray-Darling Basin Plan.

The water quality management plans provide a framework to protect, enhance and restore water quality to achieve the following outcomes:

- provide essential and recreational amenities for rural communities
- protect and improve ecological processes and healthy aquatic ecosystems
- support Aboriginal peoples' spiritual, cultural, customary and economic values
- assist industry to be productive and profitable.

Water sharing plans are a key mechanism to manage water quality in the Gwydir region. The plans use flow levers (including extraction limits, protection of tributary flows and cease

to pump rules) to help ensure sufficient flow is available to meet water quality objectives and targets. Additional levers are available through the approval and licensing framework, including ensuring setback distances and construction standards for new water supply works are enforced to limit groundwater drawdown and minimise the likelihood of increased salinity.

The quality of the water in a river or stream is a reflection of underlying climate and geology and the multiple activities occurring in a catchment area. There are numerous factors contributing to water quality, many of which are outside the influence of flow management and therefore cannot be addressed through water planning alone. Greater emphasis must also be focused on preventing pollutants such as sediment and nutrients from entering waterways through land, soil and vegetation management.

The Gwydir Regional Water Strategy is an opportunity to consider if additional actions are necessary to manage water quality in the Gwydir region (see Option 20 in Table 4).

Gathering better information

Improving the information we have about water use and water needs will help us to manage the Gwydir region's water more efficiently and ensure we can plan to have enough water available at the right time. Improving the collection of data will give us a better understanding of the water risks in the region for the environment and all water users. More data and knowledge will also support future decisions about water sharing.

Improved information can also help water users, future investors and regions make more informed decisions about the industries that are most suited to each region.

The Gwydir region has a number of unregulated water courses where streamflow gauges are not installed and water extraction is not measured. This means there is limited data on water extraction and flow patterns from these rivers and streams, making it difficult to manage equitable sharing during dry conditions.

This lack of data is being addressed through the implementation of the new non-urban metering framework announced by the NSW Government as part of its 2017 Water Reform Action Plan.

Under the framework, large surface water works in the Gwydir will be required to be fitted with compliant metering and telemetry equipment by 1 December 2021. All remaining surface and groundwater works covered by the rules will need to be fitted with compliant metering equipment by 1 December 2022. An estimated 893 water supply works in the Gwydir valley will be subject to the metering rules: 138 in the unregulated rivers, 379 in the regulated Gwydir systems and 376 in the Lower Gwydir Alluvial.

Technology can help

The NSW Government and WaterNSW are developing a new data platform to increase the availability and accessibility of critical non-urban water information, including:

- water sharing plan rules
- entitlements and works approvals
- transactions
- water take
- water flows.

The initiative will be developed progressively and be fully operational by 2025.

In addition, under the new metering laws, large surface water users will need to install telemetry and remotely transmit water information to government. This will give the Natural Resources Access Regulator a reliable source of data about water take to inform its compliance and enforcement functions, as well as supporting WaterNSW and Department of Planning, Industry and Environment in their billing and other water management activities.

Water users will also be able to access their information via a private online dashboard.

Better data and information on floods in the Gwydir region is also critical to understand how floodplains are connected, how groundwater reserves are replenished and the flood risk of towns and villages.

Flood studies that analyse the characteristics and movements of floods will help to protect rural properties and vital infrastructure, while ensuring that environmental and cultural assets are not negatively affected. The NSW Government released the Gwydir Floodplain Management Plan in 2016.

Given the expected continuing demands on groundwater, enhancing our understanding of the interaction between surface water and groundwater resources in the Gwydir will help us improve the resilience of our water sources. We need to understand where a change in groundwater use can influence flows to rivers and vice versa. We also need to understand how a changing climate is impacting the replenishment of groundwater resources. More broadly, we need to ensure ongoing investment in the groundwater monitoring network so we have the water quantity and quality information we need to manage the resource into the future (see Option 14 in Table 4).

In addition, the Department of Primary Industries is undertaking a three-year program to identify and map important agricultural lands.⁵⁴ Knowing where this land is situated and understanding its location, value and contribution will assist in making decisions about current and future agricultural land uses and their water needs. A comprehensive and consistent approach to collecting water statistics information will greatly help this process.

54. Department of Primary Industries 2019, *Important Agricultural Land Mapping in NSW*, www.dpi.nsw.gov.au/agriculture/lup/agriculture-industry-mapping/important

Collecting better data

Across the Gwydir region, there are opportunities to gather more information about:

- the water requirements (when and how much) of communities, the environment, urban-based commercial businesses and industries and what a reduction in water availability will mean for these users
- what the water is being used for, including crop types and yield values
- the interaction between groundwater and surface water in the Gwydir
- quantity of water use and patterns of water use in the unregulated system and some groundwater systems
- the characteristics and movements of floods
- water quality.

The Draft Gwydir Regional Water Strategy will explore new opportunities to improve data collection, information, monitoring and storage around water use, including ways to harness water data collected by industries (see Option 30 in Table 4).

Gathering and analysing this information will improve our understanding of the water risks in the region for the environment and all water users, and support future decisions about water sharing.

2.3 People, industries and water use

2.3.1. Aboriginal people

The Gwydir lies within the lands of the Gomeroi Nation, which extend from around Singleton in the Hunter Valley through to the Warrumbungles in the west and up through the Namoi and Gwydir valleys to just over the Queensland border.

Water is the lifeblood of Aboriginal people. It allows kinship, connection, stories, songlines and healing through medicine and food. Healthy waterways and groundwater systems are critical to Aboriginal people for health, wellbeing and culture.

Aboriginal people have been caretakers of the land and water of the Gwydir region for over 60,000 years. Irrespective of European colonisation, which interfered with Aboriginal peoples' traditional land and water management, Aboriginal people have an ongoing cultural obligation to care for Country.

Today, Aboriginal people make up around 18% of the total population in the region.

A number of significant Aboriginal cultural water-dependent sites are recognised throughout the Gwydir region including ceremony and dreaming sites, scar trees and waterholes. The Gwydir Wetlands are culturally significant for the Gomeroi Nation.⁵⁵ They support plants such as nardoo, cumbungi, river cooba, coolibah and river red gum. Scar trees, dreaming sites, burial sites and artefacts are also found within the wetlands. Providing water to the wetlands supports Aboriginal people in their custodial roles. Protecting the wetlands and other water-dependent sites across the region is important to Aboriginal people.

Water used by Aboriginal people

Aboriginal people's legal rights as they apply to water management have been recognised in international human rights treaties and conventions, in Australian and NSW Native Title and land rights laws, and in national and state-based water plans. These instruments recognise the right to self-determination and the right to access traditionally owned lands and water. They also recognise the importance of maintaining the environmental knowledge and practices of Aboriginal people, promoting their full participation in decisions about water resources and acknowledging Aboriginal cultural values and uses in water planning.

In addition, the 2007 Echuca Declaration defines cultural flows as 'water entitlements that are legally and beneficially owned by the Nations of a sufficient and adequate quantity and quality to improve the spiritual, cultural, natural, environmental, social and economic conditions of those Nations'.⁵⁶

While there are some ways of accessing water for cultural purposes, we heard from Aboriginal people in the Gwydir that the current provisions in the *Water Management Act 2000* are not meeting their spiritual, cultural, social and economic needs.

Australia's Native Title laws recognise the traditional rights and interests to land and water of Aboriginal people. Anyone who holds Native Title with respect to water can take and use water for personal, domestic and non-commercial communal purposes. Native title holders often have water related aspirations from the protection of water, to advice on water management practices in a determinations area, to water allocations. The Gomeroi people are currently in the process of applying for a Native Title determination, which is inclusive of the Gwydir River.

Culturally, Aboriginal people can apply for Aboriginal cultural water access licences. If granted, this licence can provide up to 10 ML/year for drinking, food preparation, washing and watering domestic gardens, as well as for Aboriginal cultural uses.⁵⁷

Despite this, during our consultation we heard that current cultural water access licences are inadequate to meet the social, spiritual, cultural and economic needs of Aboriginal people. We need to ensure the licences allow for equitable access to water, the licence assessment framework is culturally appropriate and clearly communicated to Aboriginal people.

We also heard that water for Aboriginal people should be licences or water entitlements owned by Aboriginal people and allow for economic benefit. While some Aboriginal businesses, groups and Aboriginal Land Councils own water access licences, which are available on the market for trading, often the cost involved prohibits Aboriginal people from buying these entitlements and allocations.

Within the Gwydir, access to sacred and cultural landscapes is a significant issue with fencing on Traveling Stock Reserves preventing gathering and cultural practices. Collectively, these constraints prevent adequate access to water and Country to fulfil Aboriginal cultural rites, or to protect Aboriginal sites.

Aboriginal people also want to be more involved in water management decision making. Increasingly, Aboriginal knowledge is recognised as an essential element of how we manage natural resources in Australia. However, the complexities of water management, legislation and licensing—along with a lack

of opportunities to participate in decision making—are significant barriers to making better use of Aboriginal people's knowledge and skills. Aboriginal people would also like to see more economic opportunities around the management of water.

For Aboriginal people, uncertainties around the future climate in the Gwydir region add urgency to developing policy settings and programs that fully recognise Aboriginal water rights and provide dedicated water allocations for Aboriginal people. This includes prioritising water for Aboriginal people in water sharing arrangements.

The Gwydir Regional Water Strategy will reflect the results of our consultation with Aboriginal people in the region and consider options on how to recognise and deliver their water rights.⁵⁸ This includes a culturally appropriate water knowledge program (see Option 33 in Table 4), a project to identify and map water-dependent cultural sites (Option 34), a review of cultural water access licences (Option 40) and support for Aboriginal people to purchase water entitlements (Option 38). The draft strategy also includes options for an Aboriginal River Ranger (Option 19), co-management of Travelling Stock Reserves (Option 39) and a Regional Aboriginal Water Advisory Committee (Option 37). These and other options could potentially be incorporated in a state-wide Aboriginal water policy.

We will also assess all draft options to assess whether the options would have a positive or negative impact on outcomes for Aboriginal people.

55. Department of Environment, Climate Change and Water 2011, *Gwydir Wetlands Adaptive Environmental Management Plan, Synthesis of information projects and actions*, Sydney, www.environment.nsw.gov.au/topics/water/water-for-the-environment/gwydir/annual-environmental-water-priorities

56. Murray Lower Darling Rivers Indigenous Nations, 2007, Echuca Declaration, Part 1. The full declaration is available here: www.mdba.gov.au/about-us/partnerships-engagement/aboriginal-partnerships

57. See Part 7, Section 37 (3) www.legislation.nsw.gov.au/#/view/regulation/2012/355/full Similar rules are proposed in the draft Water Sharing Plan for the Gwydir Regulated River Water Sources 2020.

58. More information about our Aboriginal engagement approach is in the *Regional Water Strategies Guide*.

2.3.2 People and towns

The Gwydir region is home to around 25,000 people.⁵⁹ Moree is the region's largest centre and there are also smaller towns with populations ranging from around 300 to 2,500 people, including Uralla, Bingara, Wialda, Tingha and Delungra.⁶⁰ These and other small towns are located close to productive agricultural lands and are important to the regional economy.

Economic growth and employment in the region will be stimulated by the Moree Special Activation Precinct.⁶¹ Special activation precincts are a new way of planning and delivering infrastructure projects in specific regional locations in NSW to attract businesses, stimulate the local economy and provide more local employment opportunities.

Future population and jobs are likely to be centred in Moree, which is anticipated to grow as a service hub with improved connections to the wider Northern Tablelands, North West NSW, Newcastle, Sydney, Armidale, Tamworth and South East Queensland. It is also anticipated that global connectivity will increase through additional international investment. NSW's strategic planning framework for NSW—including *A 20-Year Economic Vision for Regional NSW*,⁶² the regional economic development strategies⁶³ and *Future Transport Strategy 2056*⁶⁴—capitalises on Moree as a centre of employment and services for surrounding towns. In addition, the *New England North West Region Plan*⁶⁵ sets out planning directions for state government, councils, and other organisations to realise the potential for growth in Moree and the wider region.

The NSW Government is also committed to improving employment opportunities for Aboriginal people in the Gwydir. The Aboriginal Participation in Construction Policy supports a minimum of 1.5% Aboriginal participation in construction projects undertaken by government agencies.⁶⁶

Significant investments in transport, community and digital infrastructure by the NSW Government will continue to support growth in the region and improve liveability and amenity for regional towns and communities. This includes:

- almost \$4 million from the NSW Growing Local Economies program for the Moree Intermodal Project, which will facilitate higher productivity and broader economic growth and have flow-on effects for urban infrastructure and services
- over \$14 million for community infrastructure including upgrades to libraries in Bingara and Moree, Moree Youth Precinct and new playgrounds across the region through grant programs such as Regional Communities Development Fund, Regional Cultural Fund, Regional Growth Environment and Tourism Fund, Regional Sports Infrastructure Fund and the Stronger Country Communities Fund
- a \$400 million package to improve digital connectivity across regional NSW, which will deliver better mobile connectivity and internet access and support technological innovations in agribusiness
- \$500 million in upgrades to the Newell Highway
- significant future investment in infrastructure, planning and industry development for the Moree Special Activation Precinct.



Water for people and towns

Providing a secure and resilient water supply to regional centres, towns and outlying areas is vital for the long-term sustainability of the region, particularly in the context of a changing, more variable climate.

Secure water supports a growing population and contributes to the amenity, liveability and wellbeing of residents and visitors. Water in regional towns and communities also provides broader social benefits. Rivers and wetlands, town swimming pools and infrastructure such as Copeton Dam and the Moree Water Park offer social and recreational opportunities. Open spaces and parks connected to water are also important community and recreational assets.

Town water within the Gwydir region is supplied by local water utilities that are owned and operated by local councils. Four utilities source water from the Gwydir region: Uralla Shire Council, Gwydir Shire Council, Moree

Plains Shire Council and Inverell Shire Council. Inverell Shire Council, the largest holder of town water supply entitlement in Copeton Dam, is predominantly located in the Border Rivers region. Inverell's water supply is piped to Inverell directly from Copeton Dam.

All town water supply systems are developed to balance costs with the community's expected service level targets. As such, all town water supplies have an inherent water security risk and are designed to accommodate moderate levels of restrictions. In regional NSW, these supply systems are planned and sized considering the historical and future consumptive needs and climate projections in consultation with the community.

It is the responsibility of local water utilities to plan and provide water and sewerage services to each of their respective communities in a way that balances costs and community expectations. This responsibility extends to planning for and delivering secure water supplies.

59. Department of Planning, Industry and Environment 2019, *NSW Population Projections*, NSW Government

60. Australian Bureau of Statistics 2016, *Australian Census of Population and Housing via TableBuilder*, www.abs.gov.au/websitedbs/censushome.nsf/home/tablebuilder?opendocument&navpos=240

61. Department of Planning, Industry and Environment 2020, *Moree Special Activation Precinct*, www.nsw.gov.au/improving-nsw/regional-nsw/snowy-hydro-legacy-fund/activation-precincts/moree-special-activation-precinct/

62. Department of Premier and Cabinet 2018, *A 20-Year Economic Vision for Regional NSW*, www.nsw.gov.au/improving-nsw/regional-nsw/a-20-year-economic-vision-for-regional-nsw/

63. www.dpc.nsw.gov.au/programs-and-services/centre-for-economic-and-regional-development/projects/regional-economic-development-strategies/

64. NSW Government 2016, *Future Transport Strategy 2056*, future.transport.nsw.gov.au/plans/future-transport-strategy

65. Department of Planning and Environment 2018, *New England North West Region Plan*, www.planning.nsw.gov.au/Plans-for-your-area/Regional-Plans/New-England-North-West

66. beta.buy.nsw.gov.au/policy-library/policies/aboriginal-participation-construction

The region's local water utilities are permitted to use up to a total of 8,238 ML each year to supply their connected towns and villages (Figure 18). This equates to roughly 1% of all licensed water entitlement in the region. Annual water use by the region's towns has typically been less than this. Despite this, there may be security issues in the Gwydir in the future (see Table 3).

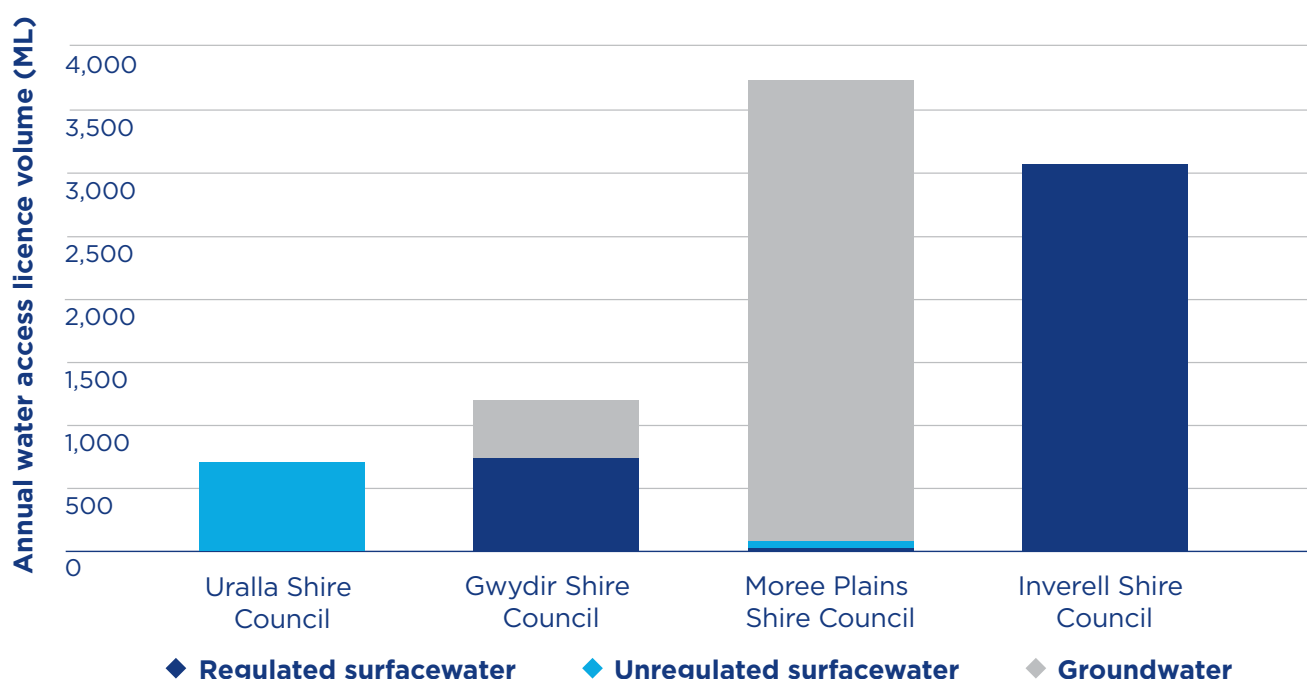
Potential growth in Moree could result in increased water demand for the town. The construction of Inland Rail (see box on page 76) and other new developments and industries could also increase water demand.

A number of towns in the Gwydir region also rely on groundwater as either a primary or alternate source, including Moree, Wyallda and Gravesend. Funding from the Restart NSW Water Security for Regions Program has supported local water utilities in Moree Plains Shire to drill bores to secure additional water supplies for their communities. The regional water strategy process provides an opportunity to improve reliable access to groundwater by towns, including the removal of regulatory barriers, better policies and processes, and new infrastructure investment (see Option 5 in Table 4).

For towns and Aboriginal communities, the potential for more frequent and longer dry periods will mean less secure water supplies unless actions are taken now to invest in diversified water sources—including climate-independent sources—and change how we manage major storages. This risk will be greatest for towns that rely on water from unregulated rivers. Groundwater, which is the primary source of water for some of the region's towns, may also become less secure as groundwater sources, particularly those that are narrow or shallow, will potentially receive less recharge.

About 40% of people in the region source their own drinking and domestic use water from roof water harvesting in rainwater tanks, harvesting runoff within their property into farm dams, accessing unregulated rivers and groundwater aquifers.⁶⁷ These individual private systems have higher inherent water security risks and these risks are exacerbated during extended dry periods resulting in an increase in demand on council operated town water supply systems from private water tankers. The projected increase in the frequency and duration of these extended dry periods are likely to further stress the already stretched town water supply security.

Figure 18. Annual town water entitlement volumes and supply sources in the Gwydir region



Source: WaterNSW licence register

Based on our new climate data and modelling, the towns of Bingara, Inverell and Gravesend, which are supplied from water stored in Copeton Dam, are at a low risk of experiencing future supply shortfalls based on their current water access licence volumes. These towns are the highest supply priority during critical water shortages under the water sharing plan.

Our new modelling found that:

- Inverell is not expected to experience a supply shortfall in any year based on climate variability or climate change modelling.
- There is a 1% probability of Bingara's town water supply experiencing three consecutive days of shortfall in any water year based on the observed historical record and the longer term stochastic climate data, compared to four consecutive days under expected long-term climate change conditions.
- There is a 1% probability of Gravesend's town water supply experiencing one day of shortfall in any water year based on the observed historical record and the stochastic climate data, compared to two consecutive days under long-term climate change conditions.⁶⁸

In addition to these modelled risks for surface water entitlement reliability, water security access risk analysis is also undertaken by local water utilities (secure yield analysis as part of integrated water cycle management strategies). This additional analysis takes into account a local water utility's:

- headworks arrangement and capacities
- physical water delivery system and operational rules under water sharing plans
- operating protocol and past experiences in delivering water in drought conditions.

This results in a water security access risk specific to each local water utility's town water supply system that is different to the modelled surface water entitlement reliability risk. The water security access risk for each water utility is in Table 3 below.

To make sure that towns in the Gwydir region have adequate water security into the future, we may need to make decisions and choices now about how and where to direct additional investment. For example, taking action now to diversify town water sources will increase the resilience of town water supplies to water security risks and water quality issues.

Table 3. Water security risk for centres and towns in the Gwydir region

Water utility	Drinking water supply system	Population served in 2014 (approx)	Water security risk
Gwydir Shire Council	Bingara	1,093	Very High
Gwydir Shire Council	Warialda	1,120	Low
Inverell Shire Council	Inverell + Tingha	11,205	Very Low
Moree Plains Shire Council	Moree	7,720	High
Uralla Shire Council	Uralla	2,338	Very High

Note: The table only covers drinking water supply systems for a population greater than 500 people these risks represent the preliminary water security risks as assessed by the Safe and Secure Water Program as of April 2020 and are subject to change over time based on further investigation, new information from councils and/or delivery of projects/solutions addressing these risks.

Source: NSW Government's Safe and Secure Water Program

67. Department of Planning, Industry and Environment town water utility data

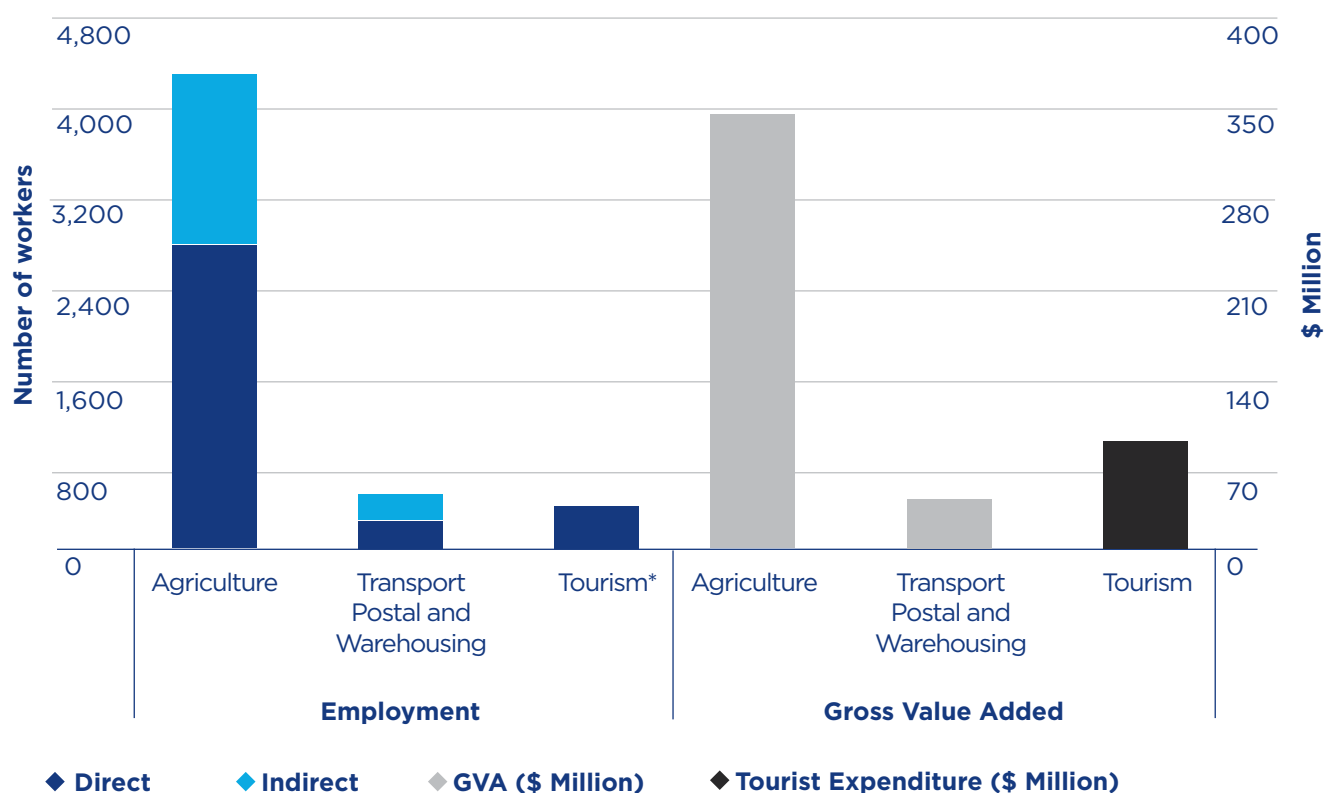
68. More information about this new climate data and modelling is in Attachment 2 of the *Regional Water Strategies Guide*.

2.3.3 Jobs and industries

The Gwydir region is home to some of the most productive land in NSW.⁶⁹ Gross Regional Product grew from \$1 billion in 2011 to \$1.34 billion in 2018.⁷⁰ In 2016, over 9,000 people were employed across the region (Figure 19).⁷¹

The wider regional economy relies on water-dependent industries such as agriculture and tourism. Innovations in agriculture and energy are capitalising on NSW Government investments to increase economic output in the region. Service industries such as health and education also contribute significantly to the region's employment.

Figure 19. Employment and economic outputs of key industries in the Gwydir region



Note:

**'Tourism' is not a defined industry category, and indirect employment and contribution to Gross Value Added cannot be calculated. Listed value is total spend on Tourism services as defined by REMPLAN

Source: REMPLAN 2019, Economic analysis for Department of Planning, Industry and Environment

69. Department of Premier and Cabinet 2018, *Upper North West Regional Economic Development Strategy 2018-2022*, www.dpc.nsw.gov.au/programs-and-services/centre-for-economic-and-regional-development/projects/regional-economic-development-strategies/

70. REMPLAN 2019, *REMPPLAN Economy: Custom data*, www.rempln.com.au/economy/

71. REMPLAN 2019, *REMPPLAN Economy: Custom data*, www.rempln.com.au/economy/

The success of the local economy relies on access to surface and groundwater. In particular, groundwater provides high quality, low salinity water to agriculture and industrial water users. Along with floodplain harvesting, this has meant that industry and local businesses have not been as constrained by inadequate water supply in times of drought compared to some other regions. We know from our discussions with local councils that enhanced water resilience will create a greater sense of water security that will help to attract new businesses and maintain existing ones.

Attracting new high value industries and supporting economic diversification is a strong focus for the region. Access to reliable water is important to realising this vision. The Inland Rail Project, upgrades to the Newell Highway and the new Moree Intermodal Project will enable the region to leverage its position along nationally significant rail and road corridors, encouraging further industry development and jobs growth. The Moree Special Activation Precinct will help stimulate economic growth and investments made by the NSW Government and will improve the speed, access and reliability of digital connections in the region. In turn, these improvements will support Agricultural Technology (AgTech) advances that increase water efficiency and drive higher agribusiness productivity.

While the COVID-19 pandemic will have an impact on regional communities and economies in the short term, we expect these investments to sustain and catalyse the economic contribution of the Gwydir region in the longer term.

Agriculture

Agriculture is the main industry and the biggest water user in the Gwydir region. In 2016, the industry directly employed over 2,800 persons and indirectly employed almost 1,500 workers.⁷²

Industries in the Gwydir region are exploring resilient and innovative farming techniques. For example, the cotton industry is particularly advanced in its use of AgTech including water saving technologies. Cotton growers have been early adopters of new land management practices, production techniques, business models and technology. There are opportunities for AgTech to expand to other types of agribusiness in the region.

Land use in the region is dominated by extensive grazing for cattle and sheep production, with lucerne and pasture grown on the narrow alluvial floodplains of the Upper Gwydir for grazing enterprises. Dryland cropping occurs predominantly on the plains. Wheat is the main crop, but a range of other cereals, legumes and oilseeds are also grown.

While irrigated crops account for a relatively small amount of land use in the Gwydir, cotton production in the region accounts for 23% of the state's crop by volume.⁷³ The dominance of cotton is unlikely to change in the foreseeable future, as the gross margins and return per megalitre of water are significantly higher for cotton than other broadacre crops.

72. REMPLAN 2019, *REMPAN Economy: Custom data*, www.remplan.com.au/economy/

73. REMPLAN 2019, *REMPAN Economy: Custom data*, www.remplan.com.au/economy/

AgTech: unlocking productivity and improving water efficiency on farms

Farm and Water is one of three priorities in the NSW Government's \$400 million Regional Digital Connectivity Program. AgTech investments made through the program aim to boost the productivity of agribusinesses and help more people in regional areas make the transition to higher skilled jobs.

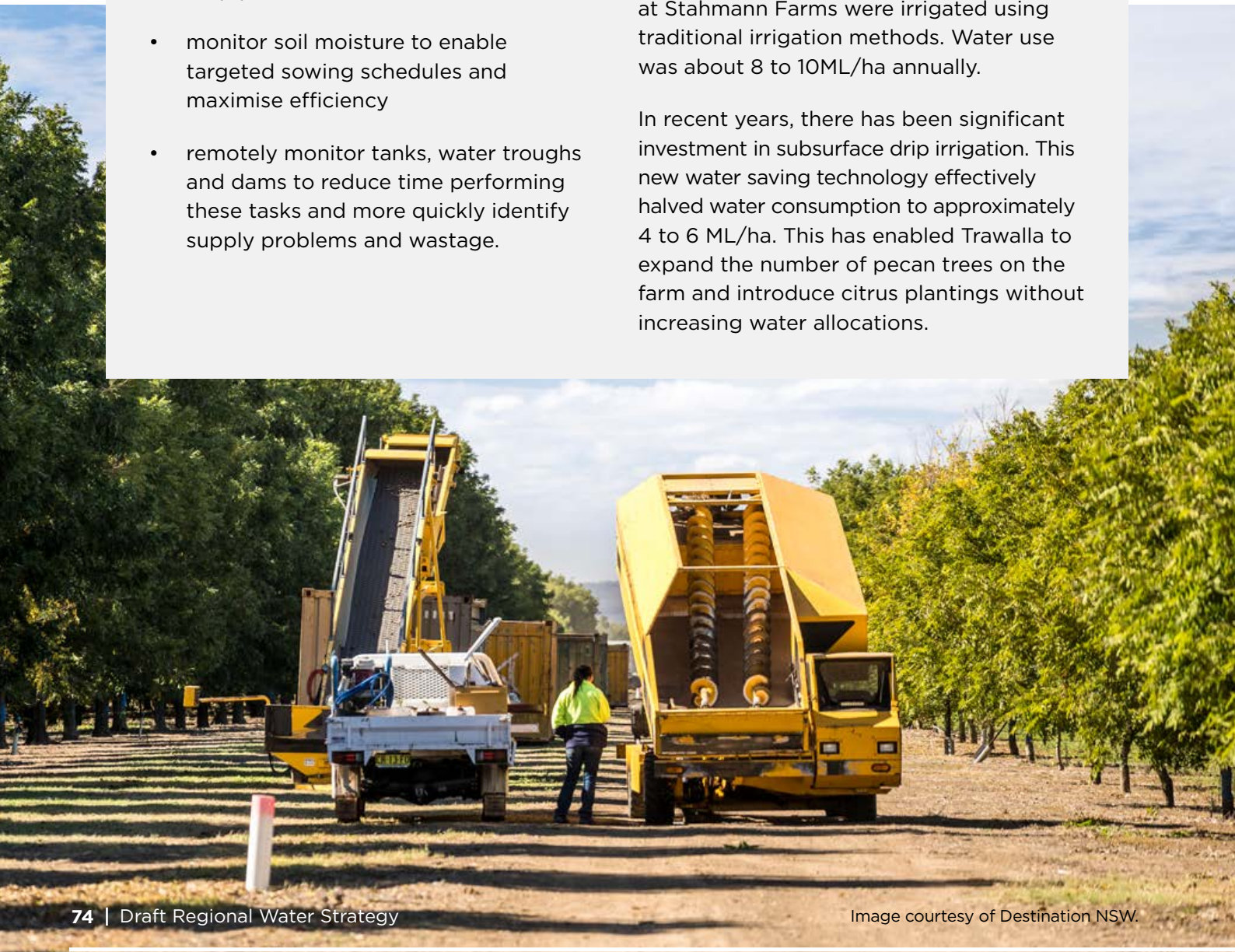
Practical on-farm, water-related AgTech enables farmers to:

- monitor water use in irrigated crop production
- monitor soil moisture to enable targeted sowing schedules and maximise efficiency
- remotely monitor tanks, water troughs and dams to reduce time performing these tasks and more quickly identify supply problems and wastage.

It is estimated that more widespread adoption of digital agriculture could increase the gross value of Australian agricultural production by more than \$20 billion nationwide.⁷⁴ Other economic benefits include increased demand for regular labour, as well as high skilled jobs, to meet the needs and challenges of technology and horticulture.

Innovative agricultural businesses in the Gwydir region are using AgTech to improve on-farm productivity and water efficiency. 'Trawalla' is the largest pecan farm in the southern hemisphere and currently has around 110,000 trees across about 2,500 acres. The original pecan plantings at Stahmann Farms were irrigated using traditional irrigation methods. Water use was about 8 to 10ML/ha annually.

In recent years, there has been significant investment in subsurface drip irrigation. This new water saving technology effectively halved water consumption to approximately 4 to 6 ML/ha. This has enabled Trawalla to expand the number of pecan trees on the farm and introduce citrus plantings without increasing water allocations.



Agricultural water use

Water entitlements for agriculture total approximately 78% of available licensed water.

Most of the water use in the Gwydir region is for cotton production, grown largely on the alluvial plains downstream of Moree. Average annual water use on cotton for the region is 434,586 ML (2010/11 to 2015/16)—an average of 6.65 ML per hectare.⁷⁴ The irrigated area is linked to general security water allocations, with production of cotton declining in years with low water allocations (2006/07 to 2009/10) and increasing in years with higher general security allocations (2010/11 to 2012/13).

Currently, there are about 1,700 hectares of pecans, walnuts, oranges and olives being grown in the region. These commodities (fruit trees, nut trees and plantation or berry fruits) used around 9,700 ML of water in 2015/16, while other cereals for grain or seed consumed around 7,100 ML over the same period. Landowners establishing permanent plantings are likely to purchase high security entitlements within the regulated system to ensure a higher reliability of supply.

The region's future climate will present challenges for agricultural industries (see section 2.4). However, because agriculture in the Gwydir region often has access to multiple sources of water (including many significant on-farm storages), these water users may be better able to adapt to changes in climate than in some other regions. Water users can also choose to modify their on-farm structures to improve efficiency.

Tourism and recreation

The Gwydir region is a popular tourism destination, offering numerous water-based recreation and camping options. Tourism provides jobs for about 470 workers in the region (about 5% of total employment). In 2018, tourist expenditure amounted to about \$96 million across the local economy.⁷⁶

Important tourist attractions in the area rely on water. For example, Copeton Dam and areas of the Gwydir and Mehi rivers provide boating, swimming, fishing, camping and bushwalking opportunities that contribute to the local economy. Copeton Dam is one of the largest inland dams in NSW and a popular sport and recreational destination. The dam's proximity to Inverell and on-site accommodation makes it a favourite spot for water sports, fishing, bushwalking, camping and picnicking.

Artesian water complexes are located in Moree, Mungindi and Boomi and have been operating since 1895. These are a major tourist attraction—an average of 250,000 people from outside the local area visit the Moree Artesian Aquatic Centre each year—and provide a significant boost to the economy of Moree Plains Shire. These complexes are highly reliant on water from the Great Artesian Basin.

The mineral spas also support other recreational activities through water from the Moree spa being diverted to the Moree Water Park (a purpose-built recreational lake about 10 km south of Moree) instead of being pumped into the Mehi River. This solves an environmental issue for the Mehi River and contributes to the region's health, wellbeing and sustainability.

Tourism in the region has been impacted by the 2020 COVID-19 pandemic, as is the case for all other parts of Australia. However, over the long-term tourism is expected to continue to be an important part of the Gwydir region's economy.

74. Cotton Research and Development Corporation 2017, *Accelerating Precision to Decision Agriculture*, www.crdc.com.au/precision-to-decision

75. Australian Bureau of Statistics 2019, 4618.0—*Water Use on Australian Farms, 2017/18*, www.abs.gov.au/ausstats/abs@.nsf/mf/4618.0

76. REMPLAN 2019, *REMPLAN Economy: Custom data*, www.remplan.com.au/economy/

Enabling industries

Enabling industries, including transport, freight and logistics are important in the success of the region's agriculture and tourism industries and also rely on productivity in these industries.

Government investments including the Inland Rail Project (which will provide fast, efficient and reliable freight connectivity to meet market demands), the Moree Special Activation Precinct, upgrades to the Newell Highway (which performs an important role in road freight and maintaining regional NSW's competitiveness in agriculture and mining) and the Moree Intermodal Project will provide opportunities for economic and job growth.

While industries in the Gwydir are generally well-adapted to the variable climate, new approaches will be needed to keep pace with

changing industry profiles and water needs, and to make sure that industries across the region have access to reliable water supplies. Options being considered in the Draft Gwydir Regional Water Strategy to maintain and diversify water supplies (for example, see Options 1, 3 and 8 in Table 4) or improve water efficiency (such as Options 2, 22, 25 and 26) would benefit and potentially add value to existing regional industries, as well as opening up opportunities for emerging industries.

Reuse/recycle and stormwater projects (Option 3) and water efficiency projects (Option 22) may offer innovative solutions that expand the scope, scale and diversity of existing industries such as agriculture, food processing and tourism, while also attracting new businesses and supporting new industry development.

Inland Rail: creating new regional opportunities

Inland Rail is a once-in-generation project that will become the backbone of freight and supply chain networks connecting regional NSW with Victoria and Queensland. Opportunities for regional NSW include:

- more jobs—the project is expected to create 16,000 new jobs during construction, with an additional 700 ongoing jobs across the network
- better connections within the national freight network
- better access to and from NSW regional markets, with farms and mines moving goods via rail to domestic and international markets
- better transit time, reliability and cost savings—less than 24-hour transit time will mean that perishable goods can access markets faster
- transport cost savings, with horticulture and post processed food supply chains estimated to save on average \$76 per tonne when travelling via inland rail (compared to road trips).⁷⁷

77. Higgins AJ, McFallan S, Bruce C, Bondarenko A, McKeown A. 2019, *Inland Rail Supply Chain Mapping Pilot Project*, CSIRO, Australia



Industry water use and climate risks

Industries in the Gwydir region, in particular agriculture, often have access to multiple sources of water (including many significant on-farm storages) and invest in crops with the flexibility to adjust to changes in water availability.

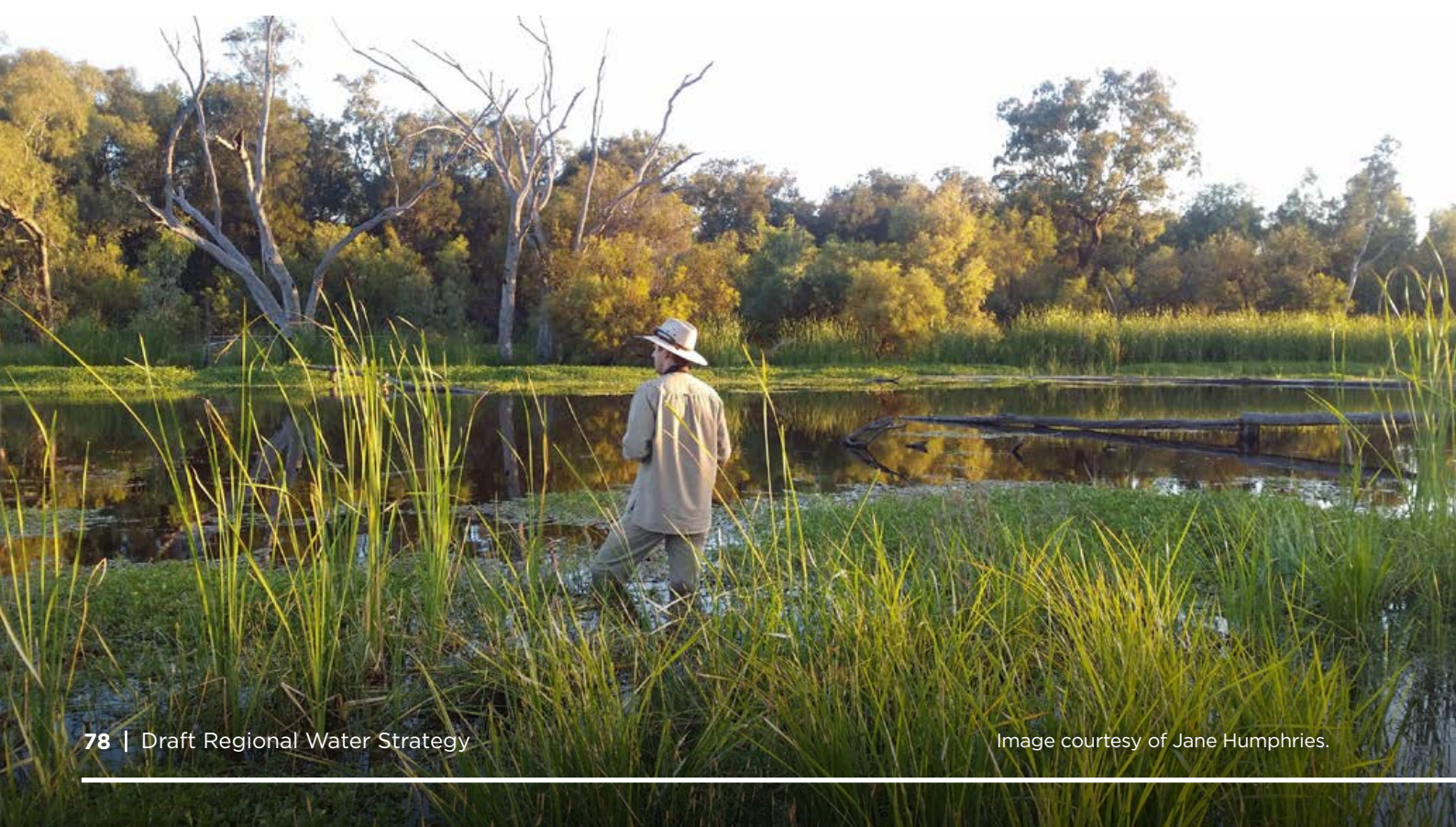
Our new modelling looked at a range of plausible climate scenarios for the Gwydir region to understand how future climate risks may impact on water licences in the regulated Gwydir River. They show that, overall, the future climate in the Gwydir could increase the water security risk for almost all water users.

The modelling included looking at the results from an 'average' 130-year period of 10,000 years of data points (shown in Figure 20). The results showed that water availability may be similar to that experienced in the region's historical records.

The exception to this was annual extraction by general security water access licence holders, which could decrease by 6% based on the long-term historic variability of the climate and 26% if there are increased changes in the climate over the long term.

The results demonstrated that the high security and high priority licences are relatively secure. We looked at results from a 'worst case' 130-year period which showed there is no impact on water availability for high security licences (or local water utility licences).

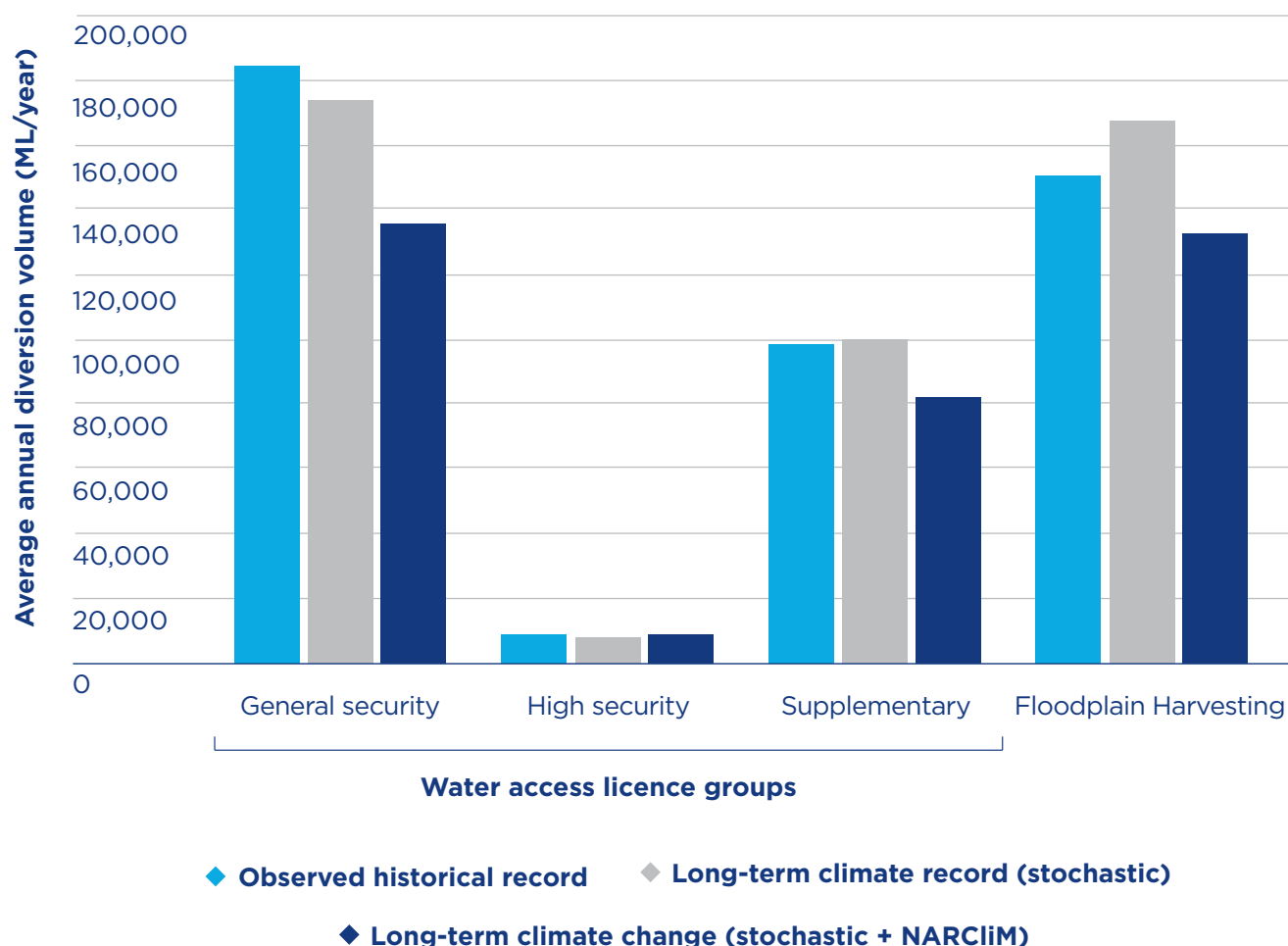
The regional water strategy provides an opportunity to look at options to mitigate the impact of these risks for towns and communities, industries and the environment. We can then use these climate risk scenarios to 'stress test' options proposed for the strategy and understand how options will perform under a range of different climate scenarios.



In addition, to better understand the effects of climate variability on agriculture, Department of Primary Industries—Agriculture is undertaking a vulnerability assessment to consider potential changes to yield and crop substitution (for

example, substituting cotton for high value legume or speciality crops or other cereal crops) and identify adaptation opportunities. These findings will be available in mid-2022 and will inform future water policy and actions.

Figure 20. Impacts on Gwydir regulated river water access licences under the ‘average’ 130-year period of the future climate change projection period compared with the observed record



Chapter 3

Options for the Gwydir Regional Water Strategy

Snapshot

We have developed a long list of options that could be included in the final Gwydir Regional Water Strategy.

- To identify these options, we have drawn ideas from previous studies, experience with the Millennium Drought, community consultation and government reforms and programs.
- Each option is expected to address at least one of the objectives set for the regional water strategies.
- The options aim to contribute to achieving our vision of having healthy and resilient water resources for a liveable and prosperous Gwydir region.
- The options have not been prioritised and not all options have been costed.

The options we are considering aim to tackle the challenges facing the Gwydir region and maximise opportunities arising from regional change.

Options in the long list focus on:

- **maintaining and diversifying water supplies** by establishing alternative water sources and improving existing storages
- **protecting and enhancing natural systems**, including better protection for native and threatened aquatic species, the removal of floodplain structures that impede delivery of water to priority ecological assets and improved water flows to the Gwydir Wetlands
- **supporting water use efficiency and conservation**, including new and upgraded infrastructure, changes to operational rules to reduce evaporative water losses, water efficiency measures and trade reviews
- **strengthening community preparedness for climate extremes**, such as reviewing existing plans, policies and operational

rules to make sure that industries and communities have enough water at the right times to meet their needs

- **improving the recognition of Aboriginal people's water rights, interests and access to water** such as reviewing cultural water access licences, investigating options for cultural flows and ensuring greater involvement of Aboriginal People in water management and Aboriginal water advisory committees.

In each of these areas, we are open to exploring fresh ideas and innovative solutions that will add value to regional industries, leverage new investments and support new economic, employment and environmental opportunities.

Not all options will be progressed.

- Inevitably, these options will involve trade-offs and choices. To fully understand these impacts and trade-offs, we will first seek feedback on these options before undertaking a formal assessment process.
- The assessment process will look at the positive and negative effects of the option, its cost efficiency, how widely its benefits are likely to be distributed and its feasibility. Not all the regional water strategies objectives can be quantified. When the outcome is difficult to assess in a financial context, options will be assessed on how effective they are in terms of achieving objectives, rather than on a cost basis.
- Preferred options, and packages of options delivered together, will be informed by a range of evidence including modelling, expert judgement and Aboriginal and community input. These will form the final, comprehensive Gwydir Regional Water Strategy.

3.1 Our vision for the Gwydir Regional Water Strategy

The challenges in the Gwydir region stem from more variable climatic conditions and increasing water demand. We can't change today's climate or the basic hydrology of our river and groundwater systems. However, we can deliver better outcomes for the region by changing:

- infrastructure in the region, such as dams, weirs, pumps, pipes and channels
- how we operate the water system, such as water sharing arrangements, allocations, environmental flow requirements and flood mitigation
- how water is used and water user behaviour, including demand management measures
- any combination of the above three options.

We have identified policy, planning, regulatory, educational, technology and infrastructure options that address the challenges the region may face and maximise opportunities arising from emerging and expanding industries and new investments in transport and community infrastructure.

Our vision for the strategy

Our vision for the strategy is to support the delivery of healthy, reliable and resilient water resources for a liveable and prosperous Gwydir region. To achieve this, we need to position the region so there is the right amount of water of the right quality delivered in the right way for people, Aboriginal people, towns, industries and the environment.

3.2 Identifying and developing the options

We have developed a long list of options that could be included in the final Gwydir Regional Water Strategy. In preparing this list, we recognise that a great deal of work has been done over the last few years to identify initiatives that could improve water management and water security in the region. We have collated these initiatives and supplemented them with further actions

based on feedback from local councils, joint organisations, Aboriginal communities and government agencies. The public consultation process will provide another opportunity to identify options and seek feedback on the long list of options. Bringing all of these options together will help us to align and better sequence the various water reform processes as we develop the strategy.

In developing the long list of options for the Gwydir region, we have specifically considered the following:

- Each option is expected to address at least one of the regional water strategy objectives (see Figure 4 in Chapter 1). Some options will support multiple objectives. Other options may have positive benefits for one objective while having negative impacts for another objective. We do not have all of the information at the moment to understand these impacts. We will do further work to understand these impacts and seek your views on how each option may impact you and your values.
- While considering a range of options to maintain and improve the resilience of the region's water resources in the face of a variable and changing climate, we have also included options that take the next step in identifying innovative water solutions that will add value to existing industries, create opportunities for new industries and generate greater benefits that extend across the community.
- As discussed in section 1.3.1, the NSW Government has invested in new climate datasets and improved modelling to gain a more accurate understanding of future climatic conditions in the Gwydir region. A number of options in the long list propose reviews of existing policy settings, operational rules and management plans considering this new data.
- As discussed in section 1.3, we have drawn on a range of sources to develop the options, including existing studies, past experience (such as river operations during the Millennium Drought), community engagement and current NSW Government initiatives and programs. This process acknowledges the significant amount of thought and work already directed towards addressing the region's water-related challenges. More information about these sources is in the *Regional Water Strategies Guide*.
- We have had conversations with local councils and local water utilities to understand their views on what options could be considered in the Gwydir Regional Water Strategy to improve water security and quality for towns and communities (see section 1.3.3).
- We have included options following discussions with Aboriginal communities. These options and feedback are reflected in the long list of options.
- We have sought expert advice from government agencies.

We have not ordered or prioritised the options identified for the *Gwydir long list of options* and many options on the list have not been costed.

A number of preliminary options did not make it onto the long list. We carefully considered these options before determining they should not proceed further. Recent analysis completed by WaterNSW also recommended these options should not proceed. These options and the reasons they are not included in the draft strategy are set out in the long list of options for the Gwydir region.

3.3 Which options will be progressed?

Not all options in the long list will be progressed. Only feasible options will be progressed following an assessment process.

Inevitably, these options—and their priority in the Gwydir Regional Water Strategy—will involve trade-offs and choices. To understand the impacts and trade-offs we will first seek your feedback on these options and then use a formal options assessment process which will look at:

- **Effect**
To what extent are the options expected to contribute to or otherwise impact on the objectives over the planning horizon and/or during extreme events?
- **Impacts and magnitudes of impacts**
A risk assessment of the positive or negative impact of the option on the objectives, and the magnitude and frequency of these impacts.
- **Cost efficiency**
To what extent are the options likely to deliver cost-effective outcomes?
- **Distribution of benefit**
Is there likely to be a broader public or regional benefit from the option, or is the benefit concentrated to a small number of users?
- **Feasibility**
To what extent is the option likely to be feasible, including regulatory/policy change, stakeholder acceptance, time to implement, cost, alignment with government policy, both national and international, as well as technical feasibility.

Further information on this process is in the *Regional Water Strategies Guide*.

It is unlikely that a single option will be capable of addressing the identified risks across the objectives we have set for the strategy. The greatest benefits are likely to be realised by combining (or packaging them together) so that they complement each other to improve the efficiency of the system, offset impacts or unlock greater benefits by using the different levers that are available—such as policy and infrastructure levers.

For example, infrastructure options may improve water reliability for industries and water security for towns but could have negative environmental impacts. To mitigate these impacts, and increase the benefit of the projects, infrastructure projects could be combined with:

- environmental options that mitigate the impacts of the infrastructure on native fish species and environmental assets, such as wetlands
- demand management measures to make sure industries are operating as efficiently as possible
- policy and regulatory options that review whether existing water sharing arrangements under altered conditions are appropriate.



Image courtesy of Daryl Albertson.

However, combining some of the options might mean that other options cannot be pursued. At present, we do not have enough information to understand the trade-offs between options or combinations of options that are described in Table 4.

As development of the strategy progresses, preferred options and combinations of options—and their trade-offs—will be informed by a range of evidence including modelling, expert judgement and community input. Improved data about potential future climatic conditions in the Gwydir region (see sections 1.3.1 and 2.4), along with economic analysis, will be used to understand the pros and cons of each option and the impact of various combinations of options in addressing the challenges facing the region.

It is important to remember that the way we progress options will need to take account of the *Water Management Act 2000* and NSW commitments under the Murray-Darling Basin Plan (for example, the Sustainable Diversion Limits set in the Basin Plan for each valley⁷⁸).

Other important considerations when we arrive at shortlisted options will be who owns and maintains infrastructure options, who benefits from the option, what the impacts are and how to pay for the option: for example, should the cost be recovered from water users and what will the Australian Government pay for and what will the NSW Government pay for?

78. Murray-Darling Basin Authority 2019, *Sustainable diversion limits*, www.mdba.gov.au/basin-plan-roll-out/sustainable-diversion-limits

3.4 Gwydir: Long list of options

Table 4 summarises the long list of options we have identified for the Draft Gwydir Regional Water Strategy. Detailed information about each option, the challenges it will address, its potential combination with other options and further work required to progress the option is set out in the *Gwydir: Long list of options*.

The draft long list of options focuses on:

1. **maintaining and diversifying water supplies**
2. **protecting and enhancing natural systems**
3. **supporting water use efficiency and conservation**
4. **strengthening community preparedness for climate extremes**
5. **recognising Aboriginal people's water rights, interests and access to water.**

Concentrating on these five actions enables us to address the challenges facing the Gwydir region, while maximising opportunities for regional communities and industries, and supporting their aspirations. It will also ensure we preserve our important natural systems and include the extensive knowledge of our Traditional Owners in water management decisions.

We have heard from communities that the regional water strategies should not just focus on the risks and challenges of today. This is why our draft long list of options not only focuses on the issues identified in Chapter 2, but also includes a number of options that may become important in future decades.

These options need to be supported by comprehensive and robust data and information and the right tools and infrastructure to implement change in the future.

However, this means that some of our draft long list options are still in a conceptual state. We need to continuously work with communities, local councils, environmental managers, Aboriginal peak bodies, Aboriginal people and industries to develop and refine these ideas further.

As noted previously, the options included in Table 4 are not ordered or prioritised and many have not been costed.

Regional water strategy objectives:



Deliver and manage water for local communities

Improve water security, water quality and flood management for regional towns and communities.



Enable economic prosperity

Improve water access reliability for regional industries.



Recognise and protect Aboriginal water rights, interests and access to water

Including Aboriginal heritage assets.



Protect and enhance the environment

Improve the health and integrity of environmental systems and assets, including by improving water quality.



Affordability

Identify least cost policy and infrastructure options.

Table 4. Long list of options: summary

Option	Description	Objective
Maintaining and diversifying water supplies — <i>Opportunities to improve town water security, maintain suitable water quality and support growth and jobs in the region.</i>		
1. Enlargement of Tareelaro Weir	Tareelaro Weir is a major re-regulating structure on the Gwydir River approximately 20 km east of Moree. This option would increase the weir's storage capacity from 2.5 GL to 6 GL, resulting in an estimated additional 3.65 GL/year of water through efficiency savings. This option could also provide greater operating flexibility in delivering flows to the lower reaches of the Gwydir River.	
2. New Lower Gravesend Dam on the Gwydir River downstream of Warialda Creek	Construct a new dam on the Gwydir River downstream of Warialda Creek, near the town of Gravesend, with capacity of 175 GL. The dam would provide more efficient storage than existing on-farm dams, resulting in estimated savings from reduced evaporative losses of about 29 GL/year.	
3. Reuse, recycling and stormwater projects	Investigate opportunities to maximise the use of surface water and groundwater for potable and non-potable uses through reuse/recycling initiatives or stormwater harvesting. Suitable options would need to be scoped; however, options could focus on improving water security for individual towns and maintaining 'green' spaces—such as local parks and town lakes—during extended drought. This could be investigated as part of each council's integrated water cycle management strategy. Councils could seek co-funding under Safe and Secure Water Program for preparing their integrated water cycle management strategies.	
4. Managed aquifer recharge investigations and policy	Investigation of possible sites for temporary storage of stormwater and river flows in aquifers to improve storage efficiencies. This is normally referred to as managed aquifer recharge. This option would develop a supporting policy to regulate the storage and recovery of this water.	
5. Reliable access to groundwater by towns	Strategic review and planning across the state to identify towns where future water demands will exceed the capacity of surface water resources, groundwater resources that could be used as complementary supplies, regulatory issues, and required infrastructure investments. This option would improve processes and policies to address for future droughts the challenges faced by towns accessing groundwater in the current drought.	
6. Town water security planning and investment for Gwydir Shire	Investigate options to improve long term water security measures for towns in Gwydir Shire. This could include connecting Bingara's town water supply with the pipeline that services the township of Inverell, local access to groundwater resources or a small off-river storage.	

Option	Description	Objective
7. Town water security planning and investment for Uralla Shire	Investigate options to improve water security for Uralla Shire, in particular Uralla and Bundarra. Options could include alternative water sources or for Bundarra, re-instating the Emu Crossing Bridge Causeway. This could be investigated as part of Uralla Shire Council's integrated water cycle management strategy. Councils could seek co-funding under Safe and Secure Water Program for preparing its integrated water cycle management strategy.	
8. Reliable access to groundwater for the Moree Special Activation Precinct	Develop a strategic approach to groundwater access to support new industry in the Moree Special Activation Precinct. This option would consider past and predictions of future groundwater extraction volumes, locations, and patterns. It would also answer policy and regulatory questions posed by the special activation precinct securing access to groundwater.	
Protecting and enhancing natural systems—Opportunities to protect and enhance environmental outcomes and realise broader community benefits through a healthy environment.		
9. Removal of system constraints in the Gwydir catchment to improve flows reaching the Gwydir Wetlands	If the Australian Government supports its progression, this option will develop a detailed business case for the removal of system constraints in the catchment to improve flows passing to and through the Gwydir Wetlands (as identified in the Northern Basin Review). This will support the reconnection of floodplains and wetlands to the main river channel, support ecological processes, maintain wetland vegetation and prompt breeding cycles in a range of fauna and flora. The Gwydir Constraints Measures Project is one of several projects being considered under the Northern Basin Toolkit, a complementary program to the implementation of the Murray-Darling Basin Plan.	
10. NSW Fish Passage Strategy	Remediate fish passage at 26 priority weirs within the Gwydir valley to restore native fish access throughout mainstream waterways and to important off-channel habitat, including the Gwydir Wetlands. This option would improve native fish access to core habitat in the Gwydir, while requiring no additional environmental water entitlements. It would also improve recreational fishing and regional tourism opportunities.	
11. Ability to direct excess supplementary flows	Allow the NSW Environmental Water Manager to direct (where possible) the environment's share of supplementary events to specific environmental assets in the Gwydir regulated or unregulated river water sources. This change in system management would improve environmental assets and overall ecosystem health in the Gwydir region. This is an existing NSW Government commitment.	
12. Cold water pollution mitigation measures	Augment existing water supply infrastructure to avoid cold water pollution in the Gwydir regulated system. This option aims to restore near natural river water temperature to provide native and threatened fish species with the necessary environmental cues and conditions to spawn, recruit, move and grow. It will also have social and economic benefits by improving recreational use of the Gwydir River.	

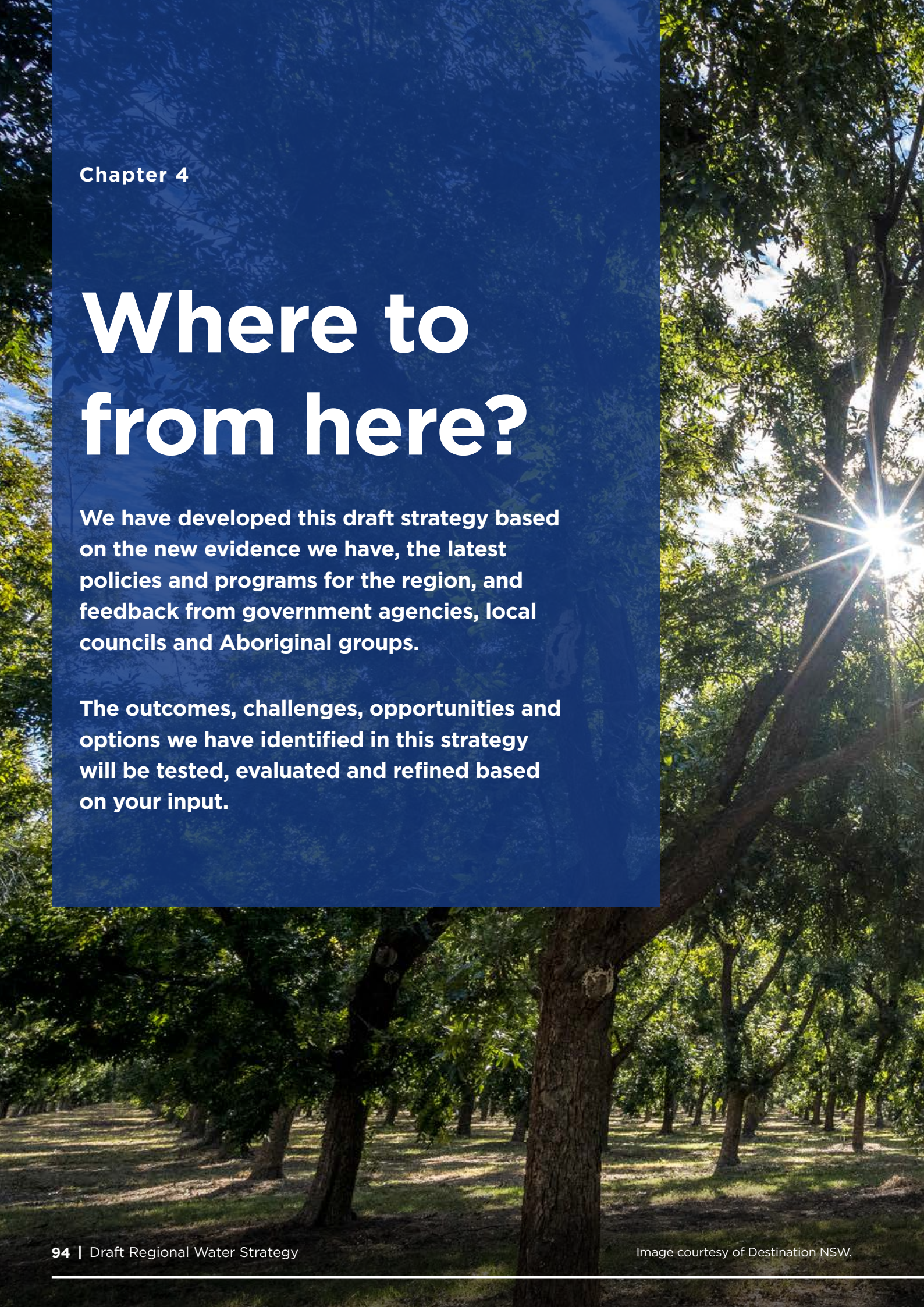
Option	Description	Objective
13. Diversion screens to prevent fish extraction at pump offtakes	Every year, large numbers of native fish are extracted by pumps and diverted into irrigation channels, never to return to the Gwydir system. This option would install screens at pump sites and diversion regulators to prevent entrainment of adult fish, larvae and eggs. It would also improve water delivery and extraction efficiency through fewer blockages caused by debris.	
14. Improved understanding of groundwater processes	This option would progress the scientific understanding of five key groundwater processes: • recharge rates, including the impacts of climate variation/change • dynamics of groundwater levels under stressed and evolving development conditions • connectivity between groundwater and surface water systems • changing patterns in groundwater quality over time • water needs of ecosystems that are partly or wholly dependent on groundwater. Outcomes would provide the scientific evidence-base for future groundwater management decisions.	
15. Sustainable access to groundwater by all users	This option would establish a systematic state-wide process to ensure ongoing access to groundwater resources by the environment, landholders, towns, agriculture and other industries. It would review existing groundwater resource extraction limits to incorporate up-to-date information (including scientific studies that incorporate new climate variation/change datasets, insight into ways to improve the integration of surface water and groundwater management, and knowledge of social and economic impacts).	
16. Improved clarity in managing groundwater resources sustainably	This option will review, revise and develop the necessary policies to give greater clarity in managing: • extraction within Sustainable Diversion Limits • groundwater systems where the extraction limit is exceeded • areas of concentrated use.	
17. Active management to share flows between consumptive and other uses	Increase operational management in unregulated rivers (determining what volumes of flows can be accessed at which times according to a set of defined rules) to protect environmental water in unregulated systems from extraction by other users. This only applies in a small part of the Gwydir valley. This is an existing NSW Government commitment.	
18. Modification and/or removal of floodwork structures causing adverse impacts	Important ecological assets in the region rely on a level of floodplain water to replenish and maintain key elements of their systems. This option would modify or remove floodplain structures and barriers that impede the delivery of water to priority ecological assets such as wetlands.	

Option	Description	Objective
19. River Ranger Program	Investigate options for the establishment of an Aboriginal River Ranger Program to assist in maintaining the health and management of rivers and wetlands throughout the Gwydir region. This role may be involved in: • pest management (fish and weeds) • remediation and mitigation of impacts on waterways • restocking native fish and vegetation species • protecting and managing riparian zones along waterways.	
20. Investigation of water quality mitigation measures	Investigate opportunities to support the water quality management plans that have been prepared for the Gwydir surface water and groundwater resource plans. This could include considering: • real time water quality monitors/loggers—to monitor dissolved oxygen • a water quality allowance in the Gwydir region water sharing plans to help manage water quality issues. This option would aim to reduce upstream pollution impacts on waterways and reduce pest species.	
21. Secure flows for water-dependent cultural sites	Consideration of options to provide regular flows to culturally important sites in the Gwydir region.	
Supporting water use and delivery efficiency and water conservation—Opportunities to improve the efficiency of existing water delivery systems, increase productivity and address water security challenges through demand management options.		
22. Water efficiency projects (towns and industries)	Investigation of water efficiency opportunities that can be deployed in regional communities and within businesses. This option may require further research and development to identify suitable case studies. As well as improving water security, this option would help industries to maintain and drive regional economic growth and productivity. This could be investigated as part of each council's integrated water cycle management strategy.	
23. Review of water markets in the Gwydir region	Review the efficiency and effectiveness of the water market in the Gwydir region (both surface water and groundwater). The review would aim to address stakeholders' concerns about the operation of the water market in the region and provide transparency and confidence to water users.	
24. Connectivity with downstream systems	Explore options to improve connectivity between the Gwydir region and the Barwon-Darling River during dry periods. The Barwon-Darling River, and communities along the River, rely on flows from Queensland as well as the Border Rivers, Gwydir, Namoi and Macquarie-Castlereagh catchments. Improving connectivity to the Barwon-Darling River was a recommendation of the <i>Independent Assessment of the 2018/19 fish deaths in the lower Darling</i> and the <i>Independent Panel Assessment of the Management of the 2020 Northern Basin First Flush Event</i>.	

Option	Description	Objective
25. Review urban water restriction policy	Development of a comprehensive policy on water use standards and appropriate temporary water restriction triggers and levels for regional towns. The investigation could complement the Gwydir Incident Response Guide and assist councils and local water utilities to revise drought management plans. This could be considered as part of each council's integrated water cycle management strategy. Joint organisations could play a facilitation role as part of this option.	
26. Addressing inefficient delivery system management	Encourage water entitlement holders to trade to more efficient areas of the Gwydir system by introducing incentives to permanently or temporarily trade water out from river reaches with high transmission losses. The option aims to decrease delivery losses and increase allocation reliability through the use of market mechanisms, improving water delivery efficiency.	
Strengthening community preparedness for climate extremes—Opportunities to develop fit-for-purpose policies and regulation to protect town water security, strengthen community health and wellbeing and better manage risks.		
27. New drought operational rules (Gwydir River)	Review the effectiveness of the <i>Gwydir Incident Response Guide</i> , including an assessment of the merit of changing the current operational rules, to maintain effective reserves for high priority needs during extreme events (such as drought).	
28. Review of surface water accounting and allocation process	Review several settings of the current surface water accounting and water allocation process in the Gwydir regulated system. The review would explore more effective approaches to ensure high priority water needs can be met in extended drought periods.	   
29. Investigation of licence conversions	Consider the potential benefits from voluntary conversion of general security licences to high security licences. The investigation would help to determine the level of water security achievable in the Gwydir region. It would potentially give water users more flexibility in production, including long-term transition to higher value enterprises that require high security water.	   
30. Improved data collection and storage	Opportunities to improve data collection around water use by industry, the environment and towns in the Gwydir region. This would generate better information to inform future water planning and management decisions in the region. This option would investigate opportunities to refurbish existing infrastructure (such as groundwater monitoring bores) and install new infrastructure and technology to enable better collection of necessary water flow, level and quality data. This option would also consider how best to share data and how to create information products suitable for different types of water users.	  

Option	Description	Objective
31. Training and information sharing programs: - new climate data/modelling - managing groundwater resources sustainably	Training and information sessions on the new regional water strategy climate data and modelling to build confidence in the new approach and identify opportunities for wider use of the new datasets. The program will also provide training and information about groundwater resources and how they are managed. This will assist councils and other water users to make more informed decisions about their water supply security.	
32. Land use change impact on water resources	Investigation of the potential impacts on water resources (quantity and quality) due to land use changes and growth in the Gwydir region. The study would help the NSW Government in making decisions about future land use applications in the region. The option would also examine the feasibility of land use planning controls.	
Improving recognition of Aboriginal people's water rights, interests and access to water—Opportunities to protect and strengthen cultural landscapes, practices, knowledge and traditions. Supporting empowerment, self-determination and economic advancement of Aboriginal people, as well as strengthening community wellbeing.		
33. Culturally appropriate water knowledge program	The management of water can often be complex with many layers of government playing different roles in the management and delivery of water across the Gwydir. This option would develop a culturally appropriate water knowledge program that would aim to increase the capacity of Aboriginal people across the Gwydir so that they can more effectively participate in negotiations on water management and policy-related matters that affect them. This program could include: • training opportunities • development of learning resources • increased consultative and communication between Aboriginal groups and government agencies on key topics.	
34. Water-dependent practices and site identification project	Options for Aboriginal people to classify and map water-dependent cultural sites throughout the Gwydir region. This would include the identification and mapping of cultural sites, places of spiritual significance and places used by Aboriginal people for traditional hunting, recreation and cultural uses.	
35. Shared benefit project (environment and cultural outcomes)	Investigation of opportunities for shared benefits from using water for the environment to also achieve cultural outcomes. The aim of this option is to support and incorporate traditional Aboriginal ecological knowledge into water management action plans for the environment and support the cultural connection of Aboriginal people to water-sustained environments.	

Option	Description	Objective
36. Regional Cultural Water Officer employment program	Investigate models for establishing Cultural Water Officer roles to assist with engaging Aboriginal people regarding water management in the Gwydir. The aims of the option include improving the awareness and involvement of local Aboriginal people in the management of water resources across the region and enabling Aboriginal people to use their local knowledge and skills to assist in decisions about water use and management.	
37. Regional Aboriginal Water Advisory Committee	Establish an Aboriginal Water Advisory Committee to improve the ability of Aboriginal groups across the region to have a unified voice on water matters that affect Aboriginal people. The committee could also be responsible for: • guiding the purchase and management of water entitlements • defining cultural water flow needs • provide representation for the wider Aboriginal community including those not part of a peak organisation of representative body.	
38. Water portfolio project for Aboriginal communities	Funding to support Aboriginal people to purchase water entitlements and build infrastructure to secure access to water for spiritual, cultural, social, environmental and economic purposes, and open up opportunities for investment in water-dependent initiatives and cultural projects.	
39. Co-management investigation of Travelling Stock Reserves	Investigation of opportunities to improve the involvement of Aboriginal people in the co-management of Travelling Stock Reserves that connect Aboriginal people to waterways and water-dependent sites of cultural importance. The option aims to improve access to waterways and other water-dependent sites of cultural importance and to support the involvement of Aboriginal people in decisions that affect them.	
40. Aboriginal cultural water access licence review	Water access licences allow licence holders to take water from rivers, lakes or aquifers for certain uses. This includes a category of water access licences that can only be held by Aboriginal stakeholders to access water for Aboriginal cultural uses. The utilisation of these categories of licences is low. This option will review Aboriginal cultural water access licences for Aboriginal cultural uses to determine their effectiveness and identify opportunities for improvement.	



Chapter 4

Where to from here?

We have developed this draft strategy based on the new evidence we have, the latest policies and programs for the region, and feedback from government agencies, local councils and Aboriginal groups.

The outcomes, challenges, opportunities and options we have identified in this strategy will be tested, evaluated and refined based on your input.

4.1 Finalising the strategy

Our next steps are to use the feedback you provide to analyse, screen and assess the long list of options, put together a portfolio of options to be progressed and develop a final strategy for release in 2021.

We recognise that in getting to the final strategy there will be hard trade-offs, but the only way we can make the best decision possible is to deal with issues proactively and realistically. This will give us the most likely chance of long-term success.

The final Gwydir Regional Water Strategy will have the flexibility to adapt over time and to new situations and circumstances. It will incorporate regular review processes to ensure the region has an effective strategy in place that remains relevant for future water management.

Following completion, each regional water strategy will be reviewed when the equivalent water sharing plans are reviewed.

4.2 Implementing the strategy

Community engagement does not end with consultation; it is a vital part of implementing the regional water strategies. The final strategy for each region will include:

- a final package of actions approved by the NSW Government
- a plan for implementing the strategy within clear timeframes which includes existing commitments
- clearly defined roles, responsibilities and governance arrangements for delivering each action or combination of actions
- well-defined opportunities for local and regional partnerships to deliver actions
- a schedule and plan for monitoring and reviewing each strategy.

Critically, the ongoing monitoring, evaluation and review of the strategies will identify if any key underlying assumptions are no longer valid, and when a revision is required. This process will require regular re-evaluation of the strategy outcomes against any updates in the available climate data.

We want to be clear about how we work with communities and regions to ensure:

- We are accountable for what we promise our regions.
- We have the right partnerships in place to drive forward action.
- We are transparent in how we go about those actions.
- We can check with those with on the ground and lived experience that the directions and actions we pursue continue to be the right ones for each region.



Your voice is important

We have prepared this draft strategy to continue our discussions with you about the future management of water in your community. It has been prepared in consultation with local councils and Aboriginal communities.

We would like to hear your views on the draft strategy and whether you have any further information that could help us to assess the benefits or disadvantages of any of the options. This may include:

- how your household, business, industry or community currently manages the impacts of a highly variable climate
- the current and future challenges you see in the Gwydir region and how you think these should be addressed
- how the management of water resources can be improved or leveraged to create and take up new opportunities in the region
- the options presented in this draft strategy
- how we can achieve our aims for accountability and transparency
- the best ways of partnering with communities and regions to implement the strategy.

Your views on the strategy's vision and objectives are also important.

This Draft Gwydir Regional Water Strategy is on public exhibition from 25 September to 13 November 2020. A range of supporting information is available at www.dpie.nsw.gov.au/gwydir-regional-water-strategy

We will be meeting with people from the Gwydir region over the coming months to help shape the final strategy. You can also have your say on the draft strategy by providing written feedback to the Department of Planning, Industry and Environment by midnight 13 November 2020 via:

Web: www.dpie.nsw.gov.au/gwydir-regional-water-strategy

Email: regionalwater.strategies@dpie.nsw.gov.au

Please note that all submissions will be published on the department's website unless you let us know in your submission that you do not wish the content to be released.

We will be holding online sessions on the draft strategy during the public exhibition period to help shape the final strategy. These sessions will give participants an understanding of the context for the strategy, what the latest modelling is telling us and what the options for better managing water in the Gwydir region could mean. Times and locations for these sessions can be found at www.dpie.nsw.gov.au/gwydir-regional-water-strategy

We will also continue to meet with local councils, local water utilities, Aboriginal communities and other stakeholders. Talking with these groups is critical for designing a strategy that builds on their knowledge and capacity, is feasible in terms of implementation and links to their relevant initiatives, plans and strategies.

Attachments

Attachment 1

Targeted stakeholder engagement

Overview

A thorough engagement program supports the development of the regional water strategies. The purpose of engagement is to inform, gain information and feedback, collaborate with key stakeholders on strategy development and build support for the regional water strategy.

Development of the Gwydir Regional Water Strategy is supported by four engagement phases:

1. Targeted engagement with councils, local water utilities, joint organisations, Aboriginal people and peak bodies
2. Public exhibition of the draft Regional Water Strategy and targeted engagement with State and regional peak bodies
3. Further targeted engagement with councils, local water utilities and joint organisations in each region, as well as Aboriginal people and peak bodies
4. Public release of final regional water strategy.

An interagency panel was formed to assist in the development of the Draft Gwydir Regional Water Strategy. This panel, chaired by Department of Planning, Industry and Environment—Water, included representatives from across the Department of Planning, Industry and Environment cluster including:

- Environment, Energy and Science
- Strategy and Reform
- Regional NSW.

Members of the panel also included representatives from WaterNSW and the Department of Primary Industries—Fisheries and Department of Primary Industries—Agriculture.

This report documents targeted stakeholder feedback during phase one of the development of the Gwydir Regional Water Strategy.

Engagement

Discussions were held with councils, local water utilities and Aboriginal communities between September 2019 and February 2020. The following organisations or communities participated in discussions.

Local council/local water utilities /other organisation	Aboriginal community
Moree Plains Shire Council	Mara Mara Community
Uralla Shire Council	North Western Local Land Services
Gwydir Shire Council	Tamworth Aboriginal Affairs NSW
	Inverell and Tingha Myall Creek Community
	Tingha Local Aboriginal Land Council
	Moree Local Aboriginal Land Council
	SYMS Academy
	Mungindi Local Aboriginal Land Council
	Traditional Owners
	Community members
	Dorrigo Plateau Local Aboriginal Land Council

The purpose of discussions was to establish a collaborative relationship with local councils, local water utilities and Aboriginal communities, as well as to gain an understanding of key water challenges and risks in the Gwydir region.

Discussions also focused on gaining feedback on a draft long list of options for the Gwydir Regional Water Strategy. Discussions with Aboriginal communities focused on cultural challenges and the development of cultural options.

Summary

Quick stats and hot topics

A total of 11 meetings were held, with over 70 people attending and participating in discussions during the targeted engagement phase. Information about participants and a summary of recurring themes and hot topics are outlined below.

Targeted council/local water utilities /other organisation engagement	Targeted Aboriginal engagement
Quick stats	Quick stats
Five targeted meetings including two round tables	Six targeted meetings
16 people participated in discussions	57 people participated in discussions
Meetings held regionally face-to-face and by video conference	Four Local Aboriginal Land Councils and a number of Aboriginal community groups and members represented
Over 200 ideas, opportunities and challenges and suggestions identified	Over 250 ideas, opportunities and challenges and suggestions identified

Recurring themes	Recurring themes
Value inclusive consultation processes	Connectivity to and between water and the land
Gwydir is a highly productive agricultural region within NSW	Protection and conservation of Aboriginal cultural heritage
Importance of water for community wellbeing and recreational purposes	Frustration with the number of different government agencies coming to engage on water
Tourism is increasingly becoming a major contributor to the region	Culturally appropriate engagement activities for better transfer of information between government and Aboriginal communities
Concern about the increasing demand on town water supplies during the drought	Importance of data use agreements
Support for long-term climate modelling	Importance of water for community wellbeing
Water storage options and regulation would be required in order to change the industry profile of the area (move away from a boom/bust cycle)	More information needed on cultural flows and water legislation
Value an evidence based and transparent options assessment process	General support for draft cultural options

Targeted council/local water utilities /other organisation engagement	Targeted Aboriginal engagement
Hot topics	Hot topics
40% of the region's population doesn't have access to reticulated waters and many are receiving water deliveries	Engagement timeframe should allow for meetings to occur on Country
Region is losing experienced workforce due to prolonged nature of the drought	Poor water quality due to contaminants and blue green-algae
Drought conditions are impacting wellbeing	Need for an 'Aboriginal Cultural Impact' statement to ensure the value of Aboriginal culture in planning decisions
There is a need for industry diversification to ensure ongoing sustainability	Concern for the management of and access to groundwater
Achieving water quality standards	Need to co-design a number of draft options in partnership with Aboriginal people

Detailed feedback

The following two tables summarise the feedback from round one and round two of the targeted engagement phase.

Council engagement

Topic	Comment
Collaboration and engagement	Attendees value inclusive consultation processes: - suggested it was important to improve consultation processes to ensure a credible process - mentioned that community trust had been negatively impacted by the Murray-Darling Basin Plan - mentioned that it was important to ensure an inclusive consultation process with the Aboriginal community - expressed 'engagement fatigue' due to the high number of water-related engagement processes and suggested that future engagement consider council staff availability during upcoming planning and budget processes - expressed concern about engaging with stakeholders on infrastructure options that had been previously discarded.
Regional growth and water security	Attendees stressed the agricultural significance of the region and concerned this is being constrained by access to water: - stressed that the Gwydir region is one of the most productive agricultural regions in NSW - stated that the region is only productive when water allocations are available - stressed the importance of high value industries across the region and the need for industry diversification for ongoing sustainability - saw significant benefits (including increased local employment opportunities) with the expansion of secondary industries and expressed concerned about the need for additional water allocations to support this - expressed concern the area is losing experienced workforce due to the prolonged nature of the drought. Some people are only working every second month - mentioned that Gwydir Shire Council has a program of employing local people during the drought - stated that some irrigators are modifying their production and water use in order to maintain a base income while others are using more advanced water efficiency methods (such as changing the water supply by converting to drip irrigation) - saw significant benefits with Inland Rail and the Moree Special Activation Precinct - stated that the area has a large number of feedlots and there are opportunities to value add through the special activation precinct - stated that new investment is likely to flow from the special activation precinct and increases in water licences would be required to support this - stressed that tourism is increasingly becoming a major contributor to the region - mentioned that tourism contributes 20% to 30% of local business income - stated that the water skiing park in Moree is an important tourism attractor in the drought.

Topic	Comment
Regional growth and water security (continued)	- expressed concern the drought is having a detrimental effect on some land owners and the environment - stated there is not enough water for native wildlife, with native fauna venturing closer to urbanised areas to access water and food - stated that two water tankers are currently delivering water to land owners and consideration is being given to extend this service - stressed the importance of water for community wellbeing and recreational purposes - stated that water plays an important role in mental wellbeing and community cohesion - stated that drought conditions are impacting wellbeing - stated that low water levels in Copeton Dam have reduced recreational opportunities and this impacts tourism and community wellbeing - suggested that changes to water storage and regulation would be required to change the industry profile of the area (move away from a boom/bust cycle).
Regional water strategy development	Attendees support the development of the regional water strategy and want to get on with 'getting the job done': - stressed the importance of considering each region uniquely, suggesting that 'one size doesn't fit all' and noting that the Gwydir region is a 'closed system' only connected to the Barwon in times of flood - expressed the view there is little to be gained from pursuing demand management efficiency gains unless there are financial incentives - mentioned that it is resource intensive and people have already modified their behaviour - expressed concern about lack of council staff resources to respond to new water management requirements and drought grants - expressed support for long-term climate modelling - suggested that the regional water strategy could provide education on water conservation measures and their role in regional water security.
Water management	Attendees value an integrated approach to water management: - expressed the view that people and communities are part of the environment with shared outcomes - expressed concern about the increasing demand on town water supplies during the drought - mentioned that 40% of the population doesn't have access to reticulated water and are receiving water deliveries - mentioned that town water is also required to meet firefighting needs - mentioned that some aquifers are being subjected to massive take for stock and domestic purposes - expressed mixed views about environmental flows - mentioned that when the rivers are dry the kids are restless and this impacts on mental wellbeing - mentioned there are noticeable impacts on flora and fauna when the rivers are dry - mentioned that environmental flows bring cold water and this kills fish - mentioned that environmental flows help to reduce silt build up in infiltration chambers - noted that Bingara has a bank infiltration chamber - stated that Moree irrigators are concerned about the amount of water take for the environment

Topic	Comment
Water management (continued)	• stressed the need for new infrastructure such as a reservoir to assist with pressure-related issues • stressed the importance of water quality and water quantity as both contributing to healthy communities – stated that water quality is an issue for Moree Council, which finds it challenging to meet water quality standards – stated that Moree irrigators are not concerned about water quality; they want water quantity • expressed concern about the current approach to water restrictions and suggested that water restrictions be applied consistently across the state – stated that water restrictions should focus on reserving water for the future – stated that all water users need to be ‘water wise’ – noted that Moree Council had resolved to not implement water restrictions for equity and culture reasons – stated that Uralla Council have had boiled water alerts • stressed the importance of creating economic efficiencies within the water system and suggested that project funding would assist this • stated that we are now paying the price for issuing a large number of water licences when there was more water • stated that the natural cycle of wet and dry in the Gwydir Wetlands is healthy, noting that ecological thresholds are required.
Groundwater	Attendees expressed a desire for greater oversight of groundwater activity: • expressed the need for policy measures to control the use of private bores • stated that basic landholder right bores are not monitored and recommended that reasonable use guidelines be developed to manage equity • expressed the need for more information on managing stock and domestic bores – stated that some people think that groundwater is a new resource – suggested that more information on aquifer types be included in the regional water strategy – stated that the upper and lower Gwydir aquifer systems are very different.
Draft options	Attendees provided a number of comments and suggestions on draft options: • expressed concern about the options assessment process, noting that all options should be evidence based and assessed in a transparent way • stated that Emu Crossing Bridge Causeway is being reinstated as a water security option for Bundarra • stated that options are needed to help smaller villages • stated that water retention solutions such as off stream storage and weirs are needed because town water relies on river flows • stated that fish passages provide added benefits to the economy • suggested options that link water licences to land titles • suggested cross border solutions, including – piping grey water from south east Queensland – policy consistency between NSW and Queensland as some irrigators own land in both states • suggested digging out river beds for deeper storage • stated that more funding is needed to support farmers to pipe and cap existing bore holes.

Aboriginal engagement

Topic	Comment
Cultural heritage	Attendees stressed that protection and conservation of Aboriginal cultural heritage is essential and is critical for continuity of culture: • expressed concern that cultural heritage is not incorporated in water planning and so is lost • expressed concern that poor water quality due to contaminants and blue-green algae has impacted on the cultural use of water • stressed the importance of mapping and protecting cultural sites so that long-term value is acknowledged - stated the government needs to clarify where cultural heritage sits in its priorities - stated that stories and song lines need to be acknowledged - stated that scientific evidence of cultural heritage impacts is important to inform future scenarios - stated that information on cultural significance, such as interpretative signs, should be available at rivers and water holes • stressed the value of Country to Aboriginal people and the importance of water - stated that the river is a 'classroom' for Aboriginal culture - expressed the belief that 'we have inherited the land from our ancestors and we borrow it from our children's children' • expressed concern about challenges in accessing the Gwydir River and Travelling Stock Reserves - stated that access to the river is important to fish and continue cultural practices - expressed concern that land is being sold off and access to plant medicines is restricted • stressed the importance of sacred areas, noting that it is a challenge discussing these areas as the knowledge can't be shared • stressed the value of connectivity, or awareness that what happens in one area affects other areas, because there is a cultural responsibility to look after all areas - stated that government models try to separate Aboriginal people into health, housing and employment and 'this doesn't work': Aboriginal people see everything as being connected • suggested that an 'Aboriginal Cultural Impact' statement could be developed to ensure the value of Aboriginal culture in planning decisions - stressed that the true value of what Aboriginal people bring to the table has to be made concrete.
Engagement and partnership	Attendees value having culturally appropriate conversations about water: • stressed the importance of culturally appropriate engagement processes including face-to-face meetings and two-way feedback - stated the importance of sharing information and equity in discussion about water across the different Countries - stated that Aboriginal people are trying to be reasonable about providing information and want the government to be reasonable and consistent in meeting Aboriginal needs - expressed frustration that information is provided by Aboriginal people but they do not get any feedback

Topic	Comment
Engagement and partnership (continued)	- expressed concern about the number of government agencies wanting to engage on water and suggest that better coordination is needed - stated that it is hard for Traditional Owners to meet all the different needs and advisory groups shouldn't be replicated - stated that it is unclear which water agency is responsible for the different elements of water planning and delivery - stressed the importance of providing hard copy information, including maps, in a timely manner to discuss water issues and help with decision making - expressed concern about representation by Aboriginal peak groups - stated that the Northern Basin Aboriginal Network doesn't represent the whole state and is not elected by the people - expressed concern about the notice period for meetings and suggested that meetings need more lead time so that people don't have to change plans and that invites should include background information - suggested that timeframes should allow for meetings to occur on Country - suggested that corporate knowledge needs to be transferred between Aboriginal people and the government in a way that's understood - suggested that more engagement is needed with Elders before putting the Gwydir Regional Water Strategy on public exhibition and suggested that Elders could be involved in decision-making processes - suggested there are opportunities to build social licence and capacity using collaboration - stated that 'social return on investment' research could help describe the impacts for Aboriginal people - stated that Aboriginal people can review and refine submission content - recommended an engagement register to keep track of issues and ideas.
Regional Water Strategy development	Attendees are interested to learn more about the Gwydir Regional Water Strategy and want cultural knowledge to be included in these documents: - stated the drought is impacting on cultural flows and rules for extreme events may not consider cultural knowledge - expressed concern that proposed water infrastructure could have unintended impacts on cultural flows - stated that some areas are being damaged by regulation of flows - suggested Aboriginal participation is needed in the Gwydir Regional Water Strategy approval process - expressed a desire for the Gwydir Regional Water Strategy to be specific about risks to cultural heritage and also recommended the strategy - tell Aboriginal stories - include cultural site mapping and cultural heritage benefits - include a review process with Aboriginal people - include information on cultural governance - include access to water at Maayu Mali for Aboriginal communities and clear information about how Aboriginal water needs will be catered for - stressed the need for the Gwydir Regional Water Strategy to have clear outcomes and alignment with other government priorities and water plans - suggested that supplementary plans could be developed to support the Gwydir Regional Water Strategy - suggested that climate modelling should also include Aboriginal knowledge.

Topic	Comment
Aboriginal knowledge	Attendees want to retain information written about them: - expressed concern that Aboriginal knowledge is given to government agencies and not returned to communities - stressed the importance of data use agreements and want clarity on who (for example, government agencies or consultants) holds Aboriginal cultural information - suggested that people's time and knowledge should be paid for, noting that Aboriginal knowledge is valuable from an intellectual property perspective - suggested that every Nation should have a Research and Knowledge Centre - stated that the skills of Aboriginal people could be better captured - expressed concern that regional decisions are being made without people getting to know more about Country - stated that story telling should be included in the decision-making process.
Water management	Attendees are concerned about water management practices and their impact on Aboriginal culture: - stressed the need for more information on cultural flows, noting that communities have differing views of what cultural flows mean to them - stated that the difference between cultural flows and environmental flows needs explaining - stated that cultural practices have been affected and reparations should be considered - expressed concern for the management of and access to groundwater - expressed concern about water use by irrigators and for mining purposes and want to know if the impacts on Aboriginal people are considered - expressed concern about water legislation matters, including rules regarding access to the 10 ML right and relationship to water sharing plans - suggested a 'Plan B' needs to be developed to recognise there may permanently be less water in the system - suggested that cultural water should be tradeable, to have an economic benefit - stressed the need for more information on water licences including licence costs, rights in relation to regulated and unregulated water, and access rights for all water users during drought.
Self-determination and community wellbeing	Attendees want self-determination in water planning and want to be part of the decision-making process: - stressed the need for Aboriginal communities to be empowered to make decisions on water - strongly expressed the need for sovereignty and for control of their own information - stated that historical events in the region have had an impact on the local voice of Aboriginal people - expressed concern that too many decisions have been made without Aboriginal input - expressed frustration and feeling powerless, believing engagement sessions are 'tokenistic' - stated the need for community meetings on Country and ideally facilitated by local people - stressed the importance of self-determination on overall wellbeing - stated that people would rather work on Country than be on welfare - stressed the importance of access to water for wellbeing - stated that 'when there is water in the river, the crime rate decreases. People are engaged, they can fish'.

Topic	Comment
Draft options	Attendees provided a number of comments and suggestions on draft options: • Aboriginal Cultural Access Licence – suggested more information is needed • Aboriginal Water Advisory Committee – provided general support and made suggestions for the role and make-up of the committee • Cultural Water Officers employment program – suggested that Cultural Water Officers would need to know laws and cultural practices – suggested this role needs to be more than education and should include compliance and collaboration across government • culturally appropriate knowledge program – provided general support and made suggestions for improving the program • identification of water-dependent cultural practices and sites – provided general support, identified potential issues and made suggestions for improving the option – stated that Aboriginal people should be paid for cultural mapping work – suggested the need for a knowledge centre – stated that Aboriginal people need ownership of physical and natural sites • River Ranger Program – provided general support and suggested the role needs to be proactive in the waterways and riparian zones but with clarity needed to distinguish the Ranger role from that of Fishery Officers • shared benefit program – provided general support, but suggested that economic outcomes should also be considered (for example, employing Aboriginal people is both a cultural and economic outcome) • water quality mitigation measures – supported this option – suggested that landowners who access water should fence their land to stop cattle accessing the river – suggested that choice of fish stock and native plants can help with water quality.

All feedback has been considered in developing the Draft Gwydir Regional Water Strategy and stakeholders will continue to be engaged throughout the public exhibition process and the finalisation and implementation of the regional water strategy.

Next steps

The Draft Gwydir Regional Water Strategy will go on public exhibition from 25 September 2020 for a six-week period. During this period, additional targeted and general public engagement will take place and written submissions will be accepted regarding the strategy.

Following the review of the public exhibition period, further targeted engagement will be undertaken before the final regional water strategy documents are published.

Attachment 2

Glossary

Term	Definition
Access licence	An access licence entitles its holder to take water from a water source in accordance with the licence conditions. Key elements of an access licence are defined in section 56(1) of the NSW <i>Water Management Act 2000</i> as: (a) <i>specified shares in the available water within a specified water management area or from a specified water source (the share component), and</i> (b) <i>authorisation to take water:</i> (i) <i>at specified times, at specified rates or in specified circumstances, or in any combination of these, and</i> (ii) <i>in specified areas or from specified locations (the extraction component).</i> An access licence may also be referred to as a water access licence or a WAL.
Allocation	The specific volume of water licence holders can access. The amount of water allocated to licence holders varies from year to year based on the type of licence, size of their individual entitlement, dam storage levels, river flows and catchment conditions.
Aquifer	Geological structure or formation, or landfill, that can hold water.
Basic landholder rights	Where landholders can take water without a water licence or approval under section 52, 53 and 55 of the NSW <i>Water Management Act 2000</i>. There are three types of basic landholder rights under the NSW <i>Water Management Act 2000</i>: - domestic and stock rights—where water can be taken for domestic consumption or stock watering if the landholder's land has river frontage or is overlying an aquifer - harvestable rights—where landholders can store some water from rainfall runoff in dams - Native Title Rights—anyone with a native title right to water, determined under the Commonwealth's <i>Native Title Act 1993</i>.
Catchment	A natural drainage area, bounded by sloping ground, hills or mountains from which water flows to a low point. Flows within the catchment contribute to surface water sources as well as to groundwater sources.
Cease to pump rule	A requirement in water sharing plans that licence holders stop pumping when the river flow falls below a certain level.
Climate-independent water source	A source of water that does not depend on rainfall or streamflows for replenishment. Includes seawater desalination and recycled water.
Climate variability	Describes the way key climatic elements, such as temperature, rainfall, evaporation and humidity, depart from the average over time. Variability can be caused by natural or man-made processes.
Cold water pollution	An artificial decrease in the temperature of water in a river. It is usually caused by cold water being released into rivers from large dams during warmer months.

Term	Definition
Cultural flows	While the NSW <i>Water Management Act 2000</i> does not define cultural flows, the Murray Lower Darling River Indigenous Nations Echuca Declaration, 2007, defines cultural flows as: 'water entitlements that are legally and beneficially owned by the Nations of a sufficient and adequate quantity and quality to improve the spiritual, cultural, natural, environmental, social and economic conditions of those Nations.'
Direct employment	Refers to employment directly arising from the demand for a specific product or service.
Effluent	Flow leaving a place or process. Sewage effluent refers to the flow leaving a sewage treatment plant. An effluent stream is one that leaves the main river and does not return.
Endangered ecological community	Ecological communities as listed in 'Schedule I' of the <i>Threatened Species Conservation Act 1995</i> or Schedule 4 of the <i>Fisheries Management Act 1994</i> .
End of system	The last defined point in a catchment where water information can be measured and/or reported.
Entitlement	The exclusive share of the available water that a licence holder can take, subject to allocations.
Environmental asset	Natural features that contribute to the ecosystem of a region. The Murray-Darling Basin Plan defines water-dependent ecosystems with particular characteristics as 'priority environmental assets' for the purposes of environmental watering.
Environmental water	Water allocated to support environmental outcomes and other public benefits. Environmental water provisions recognise the environmental water requirements and are based on environmental, social and economic considerations, including existing user rights.
Evaporation	The process by which water or another liquid becomes a gas. Water from land areas, bodies of water and all other moist surfaces is absorbed into the atmosphere as a vapour.
Extraction limit	A limit on the long-term average volume of water that can be extracted from a source.
Fish passage	The free movement of fish up and down rivers and streams.
Floodplain	Flat land bordering a river or stream that is naturally subject to flooding and is made up of alluvium (sand, silt and clay) deposited during floods.
Floodplain harvesting	The capture and use of water flowing across a floodplain.
General security licence	A category of water access licence under the NSW <i>Water Management Act 2000</i> . This category of licence forms the bulk of the water access licence entitlement volume in NSW regulated rivers and is a low priority entitlement (i.e. receives water once essential and high security entitlements are met).
Gross regional product	A measure of the market value of all goods and services produced in a region within a period of time. Gross Regional Product is a similar measure to Gross State Product and Gross Domestic Product.
Gross value added	A measure of the value of goods and services produced in an area, industry or sector of an economy. Gross value added is a similar measure to Gross Regional Product.

Term	Definition
Groundwater	Water located beneath the ground in the spaces between sediments and in the fractures of rock formations.
Groundwater-dependent ecosystem	Ecosystems that require access to groundwater to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services.
High flows	Also called bankfull events, these reshape the channel, creating habitats such as pools, bars and benches.
High security licence	A category of water access licenses in regulated rivers implemented under the NSW <i>Water Management Act 2000</i> . Receives a higher priority than general security licences but less priority than essential requirements in the available water determination process. Many high security licences are held by water users that have inflexible water demands, such as those growing permanent plantings and mining companies.
Indirect employment	Jobs that are created by other businesses to support the primary employment sector.
Inflows	The amount of water coming in to a surface water source or groundwater source.
Joint organisation	An entity formed under the NSW <i>Local Government Act 1993</i> to perform three principal functions in a region: strategic planning and priority setting, intergovernmental collaboration and shared leadership and advocacy. Each joint organisation comprises at least three member councils and aligns with one of the State's strategic growth planning regions.
Local water utilities	Generally these are council owned and operated utilities that provide water supply and sewerage services to local communities.
Managed aquifer recharge	Intentional recharge of water to aquifers for subsequent use or environmental benefit.
Operational rules	The procedures for managing releases and extractions of water (surface and groundwater) to meet the rules of relevant legislation and policy (e.g. water sharing plans, long-term water plans).
Paleoclimate data	Refers to climate records prior to instrumental records. Various environmental indicators can be used to reconstruct paleoclimate variability extending back hundreds of thousands of years in time. These indicators include marine and terrestrial deposits, tree rings and ice cores.
Permanent plantings	Crops that are not replanted after a growing season. These crops generally require more than one growing season to be productive. Examples include grapes, citrus fruits and almond trees. These are different from annual (or broadacre) crops, which are harvested within 12 months of planting and require replanting to produce a new crop.
Ramsar Convention	The Convention on Wetlands of International Importance (Ramsar Convention) is an international treaty to halt the worldwide loss of wetlands and conserve those that remain. Australia has 66 Wetlands of International Significance listed under the convention.
Recharge	Groundwater recharge is a hydrologic process where water drains downward from surface water to groundwater. Groundwater is recharged naturally by rain, floods and snow melt and to a smaller extent by drainage directly from surface water (such as rivers and lakes).

Term	Definition
Recycled water	Water that has been treated to a 'fit for purpose' standard for a specific application as per the Australian Guidelines for Water Recycling.
Regulated river	A river system where flow is controlled via one or more major man-made structures (e.g. dams and weirs). For the purposes of the NSW <i>Water Management Act 2000</i> , a regulated river is one that is declared by the Minister to be a regulated river. Within a regulated river system, licence holders can order water which is released from the dam and then taken from the river under their water access licence.
Resilience	Resilient water resources as those that are able to withstand extreme events, such as drought and flood, and/or adapt and respond to changes caused by extreme events.
Riparian	The part of the landscape adjoining rivers and streams that has a direct influence on the water and aquatic ecosystems within them.
Salinity	The concentration of sodium chloride or other dissolved minerals in water.
Special activation precinct	A dedicated area in a regional location identified by the NSW Government to become a thriving business hub.
Stochastic climate datasets	Stochastic climate datasets are extended climate sequences that are synthesised using statistical methods applied to observed data of rainfall and evapotranspiration and can include paleoclimatic data. These extended sequences include a more complete sample of climate variability, part of which describes more severe drought sequences.
Storage	A state-owned dam, weir or other structure which is used to regulated and manage river flows in the catchment. There are also a range of storages owned by local water utilities. Also refers to the water bodies impounded by these structures.
Stormwater	Flow generated from rainfall falling on hard (impervious) surfaces.
Supplementary licence	Where a surplus flow from rain events cannot be captured in storages or weirs, and this water is not needed to meet current demands or commitments, then it is considered surplus to requirements and a period of Supplementary Access is announced. Supplementary Water Access Licence holders can only pump water against these licences during these announced periods. Other categories of licence holders may also pump water during these periods.
Surface water	All water that occurs naturally above ground including rivers, lakes, reservoirs, creeks, wetlands and estuaries.
Sustainable diversion limit	Sustainable diversion limits are how much water, on average, can be used in the Murray-Darling Basin by towns, communities, industry and farmers in a particular surface water or groundwater source. The limit is written into law in NSW through water sharing plans.
Transmission losses	Water, from an accounting perspective, that is considered lost. This water has been lost through surface water seeping into the ground or evaporation.
Transpiration	The process where plants absorb water through their roots and then evaporate the water vapour through pores in their leaves.
Tributary	A smaller river or stream that flows into a larger river or stream. Usually a number of smaller tributaries merge to form a river.

Term	Definition
Unregulated river	These are rivers or streams that are not fully controlled by releases from a dam or through the use of weirs and gated structures. However, in some catchments there are town water supply dams that control flows downstream. Water users on unregulated rivers are reliant on climatic conditions and rainfall. For the purpose of the NSW <i>Water Management Act 2000</i>, an unregulated river is one that has not been declared by the Minister to be a regulated river.
Wastewater	Water that is an output of or discharged from a particular activity; for example, from domestic, commercial, industrial or agricultural activities. The chemical composition of the wastewater (compared to the source) will be contaminated.
Water accounting	The systematic process of identifying, recognising, quantifying, reporting, assuring and publishing information about water, the rights or other claims to that water, and the obligations against that water.
Water reliability	Refers to how often an outcome is achieved. It is often considered to be the likelihood, in percentage of years, of receiving full water allocations by the end of a water year for a licence category. For example, a 60% reliability means that in 60% of years a licence holder can expect to receive 100% of their licensed entitlement by the end of the water year. Other measures of volumetric reliability could also be used; for example, the percentage allocation a licence holder could expect to receive at a particular time of the year as a long-term average. Reliability may also refer to how often an acceptable water quality is available. A reliable water supply gives some clarity to water users and helps them plan to meet their water needs.
Water resource plan	A plan made under the <i>Commonwealth Water Act 2007</i> that outlines how a particular area of the Murray–Darling Basin's water resources will be managed to be consistent with the Murray–Darling Basin Plan. These plans set out the water sharing rules and arrangements relating to issues such as annual limits on water take, environmental water, managing water during extreme events and strategies to achieve water quality standards and manage risks.
Water rights	The legal right of a person to take water from a water source such as a river, stream or groundwater source.
Water security	Water security in the context of regional water strategies refers to the acceptable chance of not having town water supplies fail. This requires community and government to have a shared understanding of what is a 'fail event' (for example, no drinking water or unacceptable water quality) and the level of acceptability they will pay for.
Water sharing plan	A plan made under the NSW <i>Water Management Act 2000</i> which sets out the rules for sharing water between the environment and water users, and between different water users, within whole or part of a water management area or water source.
Water source	Defined under the NSW <i>Water Management Act 2000</i> as 'The whole or any part of one or more rivers, lakes or estuaries, or one or more places where water occurs naturally on or below the surface of the ground and includes the coastal waters of the State.' Individual water sources are more specifically defined in water sharing plans.
Water trade	The process of buying and selling water entitlements and water allocations.
Water year	The annual cycle associated with the natural progression of hydrological seasons: starting with soil moisture recharge and ending with maximum evaporation/transpiration. In NSW (as for all of the southern hemisphere), the water year runs from 1 July to 30 June.
Wetland	Wetlands are areas of land where water covers the soil—all year or just at certain times of the year. They include swamps, marshes, billabongs, lakes, and lagoons. Wetlands may be natural or artificial and the water within a wetland may be static or flowing, fresh, brackish or saline.





dpie.nsw.gov.au