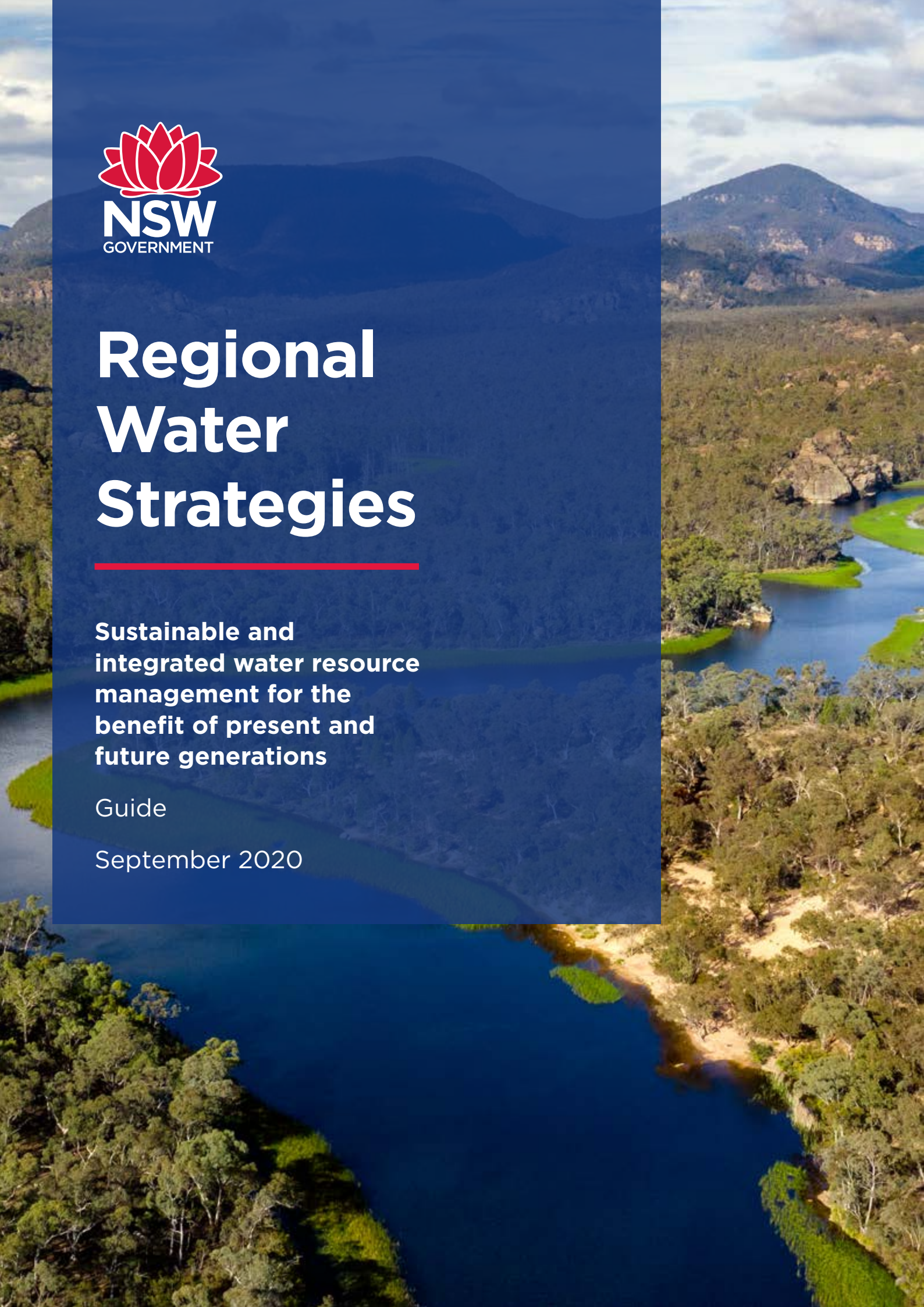

NSW GOVERNMENT

Regional Water Strategies

Sustainable and integrated water resource management for the benefit of present and future generations

Guide

September 2020

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The NSW Government acknowledges Aboriginal people as Australia's first peoples practising the oldest living culture on earth and as the Traditional Owners and Custodians of the lands and waters. The waterways in NSW hold great areas of 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 regional water strategies.

NSW Department of Planning, Industry and Environment understands the need for consultation and inclusion of Traditional Owner knowledge, values and uses in water strategies 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 and representatives and Aboriginal community members who provided their knowledge throughout the regional water strategy development process.

Contents

Chapter 1

Overview

The NSW Government is taking action to improve the security, reliability, quality and resilience of the State's water resources. We are investing in new and upgraded water infrastructure and delivering significant water reforms to address the water challenges currently facing NSW and better prepare for the future.

As part of our program of investment and reform, we are preparing new 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 the water needs in each NSW region over the next 20 to 40 years.

1.1 Purpose of regional water strategies

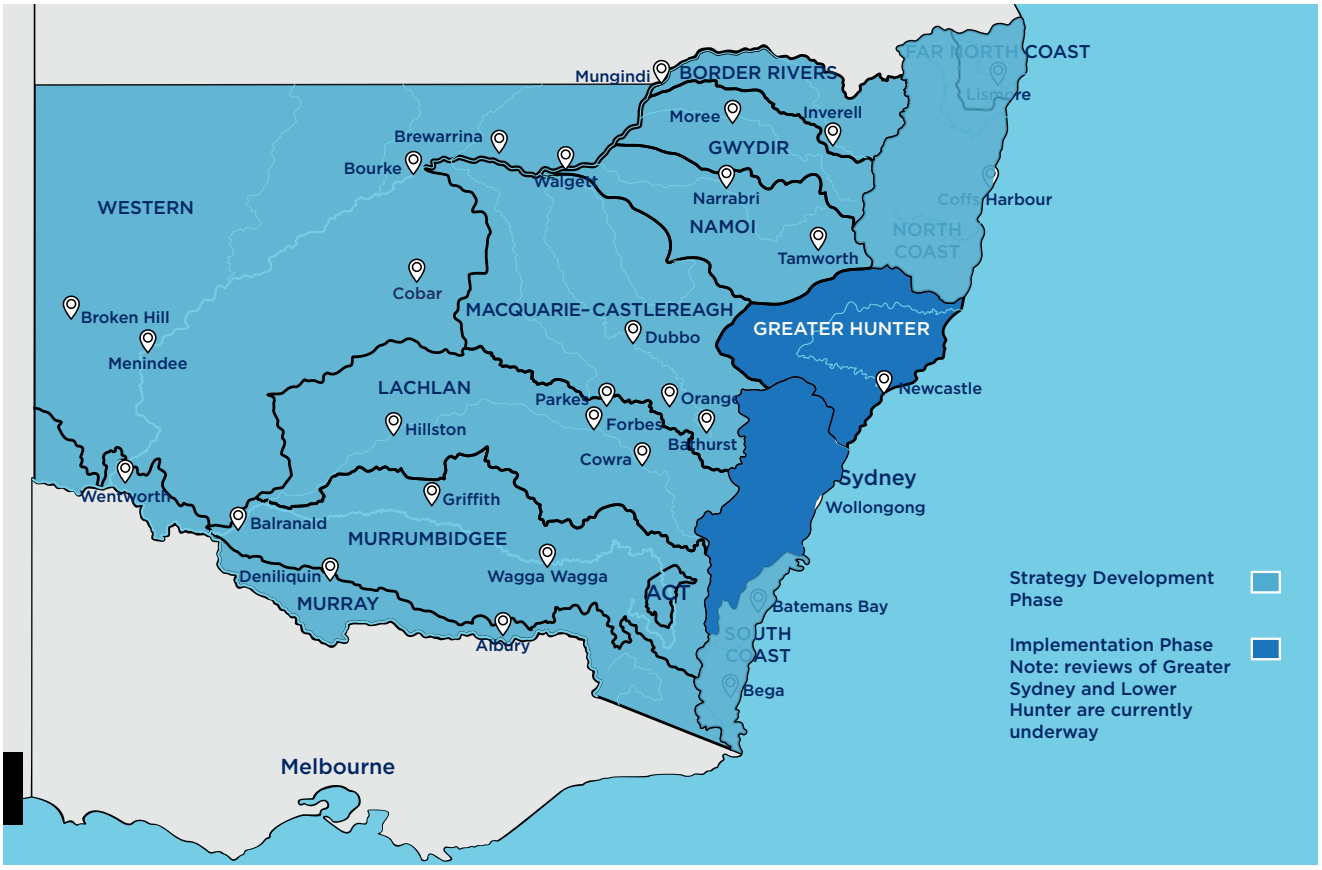
Regional water strategies bring together the most up-to-date information and evidence with all the tools we have—policy, regulatory, educational, technology and infrastructure solutions—in an integrated package. The strategies are based on the best evidence, and will aim to balance different water needs and deliver the right amount of water, of the right quality, for the right purpose, at the right times.

The strategies look out over the next 20 to 40 years to understand how much water a region will need to meet future demand, the challenges and choices involved in meeting those needs, and the actions we can take to manage risks to water availability.

Through better strategic planning around water and in partnership with local government, the NSW Government aims to achieve resilient water resources for towns and communities, Aboriginal communities, industry, and the environment.

Led by the Department of Planning, Industry and Environment, we are preparing 12 regional water strategies and a Greater Sydney Water Strategy (Figure 1) in partnership with water service providers, local councils, communities, Aboriginal people, Aboriginal peak bodies, and other stakeholders across NSW.

Figure 1. 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 (Figure 2).

Options included in the final strategy for each region will address at least one of these objectives. We aim to develop a balanced package of options that achieves all of these objectives.

Figure 2. Regional water strategies: 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.

During extreme events, such as the recent drought, our focus needs to be on ensuring we can secure water for 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.[1]

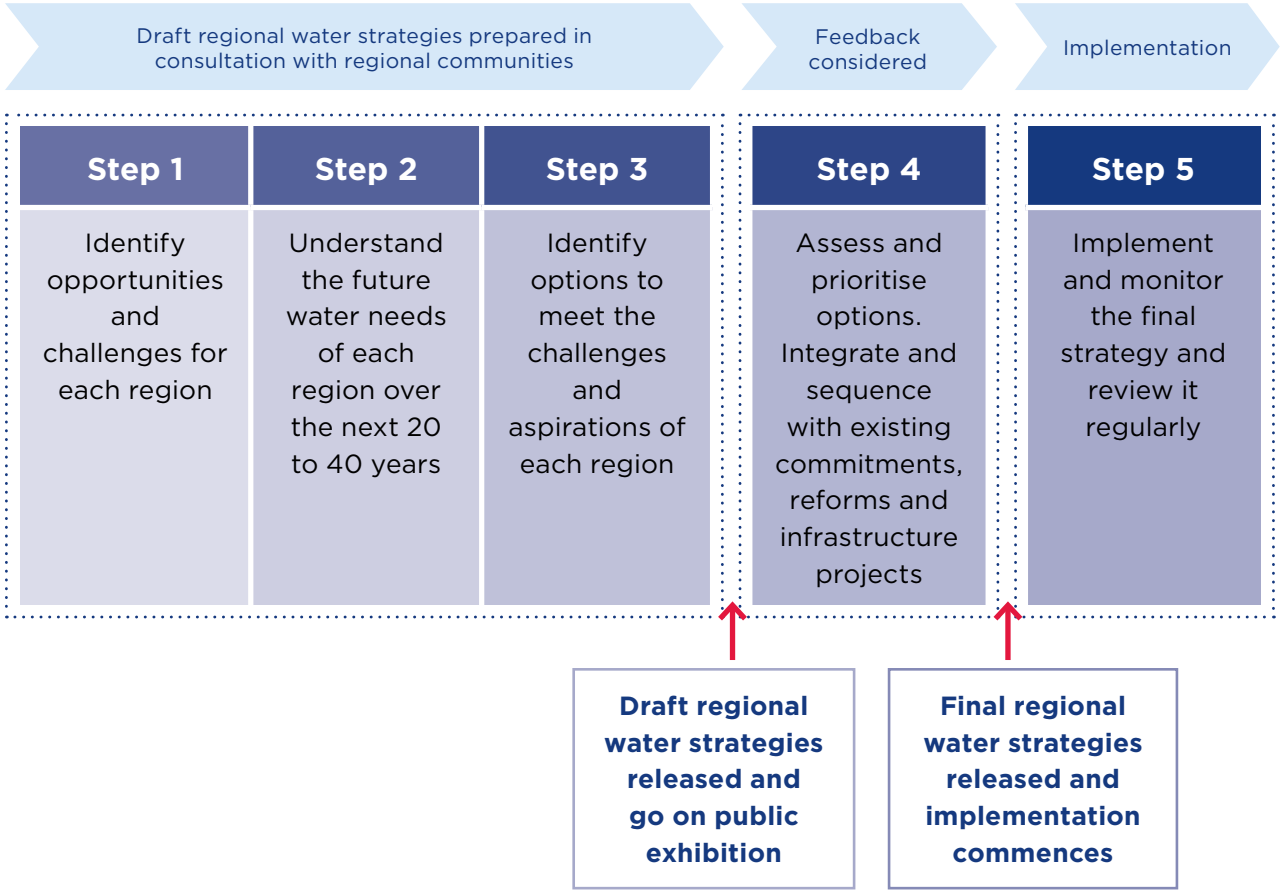
1. Subsections 9(1)(b), 5(3)(a) and 5(3)(b) of the NSW *Water Management Act 2000*

1.3 Approach to regional water strategies

The NSW Government is working with communities across the State in a five-step approach to preparing and implementing regional water strategies (Figure 3).

Draft strategies will be prepared for each region and exhibited publicly. Following consideration of community feedback and further consultation, final strategies will be prepared and released.

Figure 3. Regional water strategies: five-step approach



Regional water strategies are being developed in stages, commencing with the Greater Hunter and then the three priority regions of Macquarie-Castlereagh, Gwydir and Lachlan. The 2014 Lower Hunter Water Plan is being implemented and updated. A Greater Sydney Water Strategy will be developed and delivered in 2020/21 replacing the 2017 Metropolitan Water Plan.

In addition to this Guide (which is common to all strategies), each draft regional water strategy will be accompanied by a detailed long list of options specific to the region (Figure 4). These options will cover a wide range of actions, including investment in infrastructure, adjustments in how we manage surface water and groundwater, initiatives to better use our sources of water through recycling, and further policy changes and reforms.

Figure 4. Draft regional water strategies

Regional Water Strategies Guide

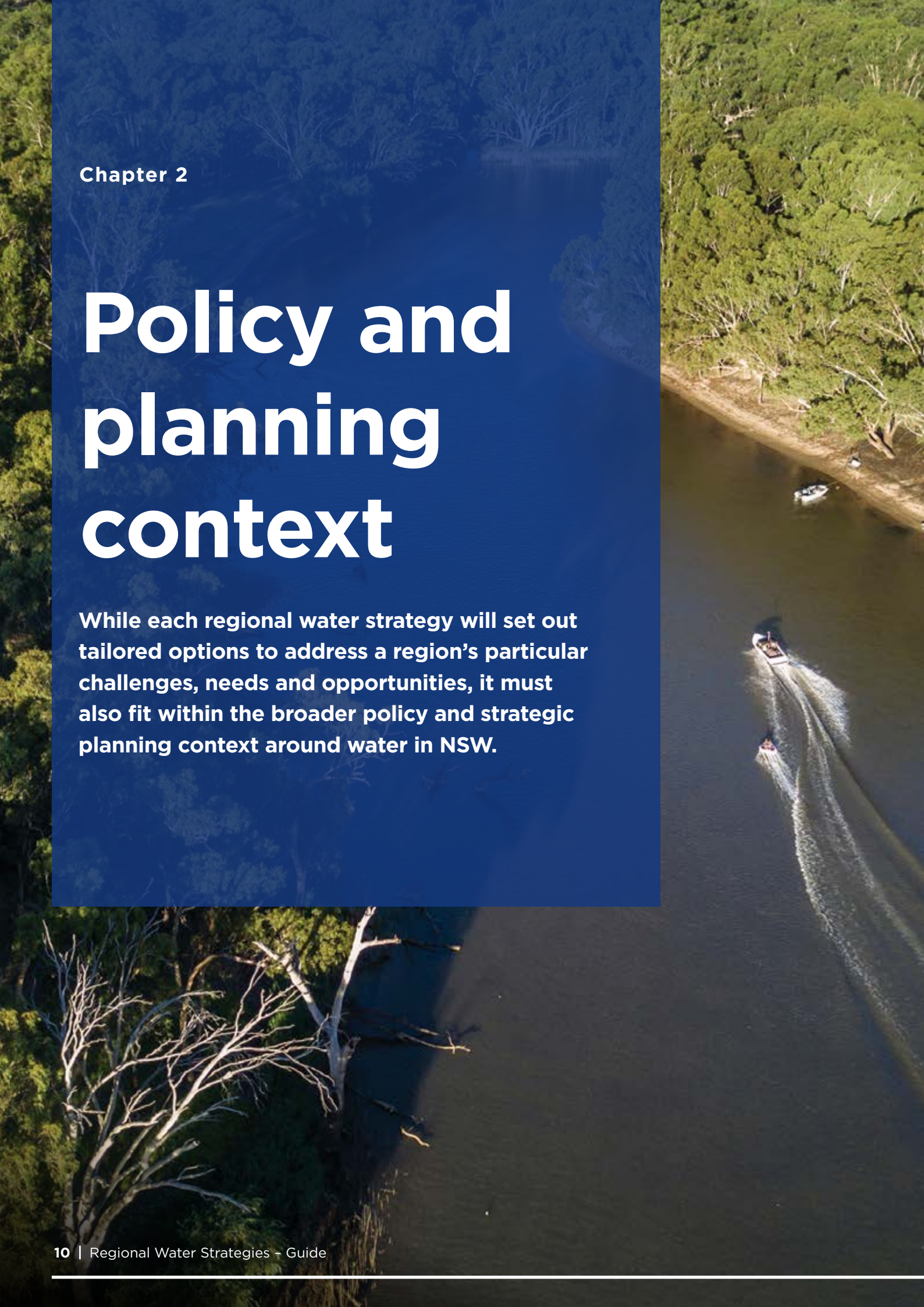
Describes the context for regional water strategies, gives information about how the strategies are being developed, provides more detail about better understanding climate risks using new data, and shows how the strategies fit with current water management policies and plans, ongoing water reforms and regional development and land use strategies. The Guide also outlines the options assessment process, community and Aboriginal communities engagement approaches and the existing studies and programs that have informed the strategies.

Draft regional water strategy for each region

Sets out the regional context for the strategy, presents the results of new climate modelling and data relevant to the region and describes each region, its water resources and current and future water needs. The strategy also includes a summary of the long list of options.

Long list of options for each region

Describes each option being considered for the region, including its objectives, challenges addressed, potential combinations with other options and further work required to progress the option.



Chapter 2

Policy and planning context

While each regional water strategy will set out tailored options to address a region's particular challenges, needs and opportunities, it must also fit within the broader policy and strategic planning context around water in NSW.

2.1 Water policy and plans

Regional water strategies will work within, or recommend changes to, the policies and plans (Figure 5) that guide how we manage our water resources in NSW:

- The **NSW *Water Management Act 2000*** establishes the framework for sharing water, and provides priorities for how water is shared and allocated.
- **NSW water sharing plans** set the rules for water sharing and water priorities for licence categories over a 10-year period, and implement limits on water extraction.
- **Integrated water cycle management plans** prepared by local water utilities provide an integrated approach to local planning for water supply, sewerage and if relevant, stormwater services.

The NSW Government is developing a 20-year State Water Strategy. This will set overarching directions for managing water resources and services to ensure future water security, reliability and resilience. It will 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, technology and Aboriginal communities.

In addition, the NSW Government is supporting the development of Regional Town Water Strategies. Regional Town Water Strategies are led by Joint Organisations. They are intended to assess and plan for regional solutions to town water supply and treatment across multiple local water utility boundaries and inform strategic urban water service planning in individual Local Water Utility Integrated Water Cycle Management Plans. There are currently no Regional Town Water Strategies in NSW in place, however, Department of Planning, Industry and Environment—Water is working with a number of Joint Organisations on the development of and funding for regional town water supply strategies.

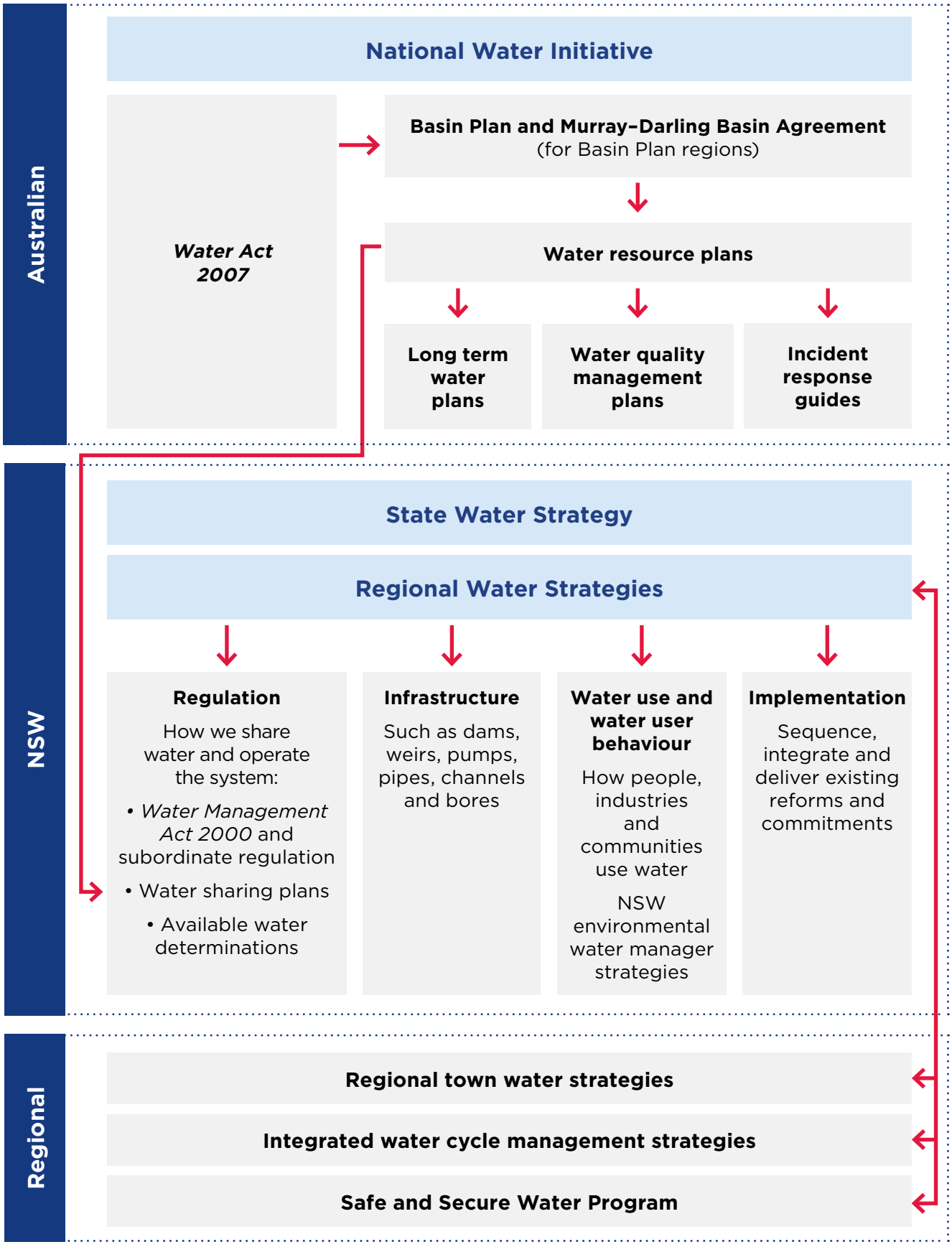
In the Murray-Darling Basin, the regional water strategies will need to consider a number of additional regulatory requirements:

- The **Murray-Darling Basin Plan** sets the limits on how much water can be extracted from water sources in the Basin over the long-term, requirements for no net reduction in planned environmental water and no growth in water use, and water sharing arrangements between states.
- **Water resource plans** play an integral role in implementing the Basin Plan and set out arrangements for sharing water, meeting environmental and water quality objectives and taking into account potential and emerging risks to water resources. Water sharing arrangements in NSW are implemented through water sharing plans.
- **NSW long term water plans** show how we will meet our environmental water objectives for aquatic dependent assets and species.
- **Water quality management plans** provide a framework for how we will meet our water quality and salinity objectives.
- The **NSW Extreme Events Policy** and **incident response guides** establish the principles by which all water resources within the NSW Murray-Darling Basin are managed during an extreme event (such as drought).

In coastal areas, there are additional considerations for regional water strategies:

- The **NSW Sea Level Rise Policy Statement** and the **NSW Coastal Policy** provide guidance on how to address the effects of rising sea levels.
- The **Marine Estate Management Strategy** considers the influence of river flows and water quality on estuaries and coastal environments.

Figure 5. NSW water policy and planning context

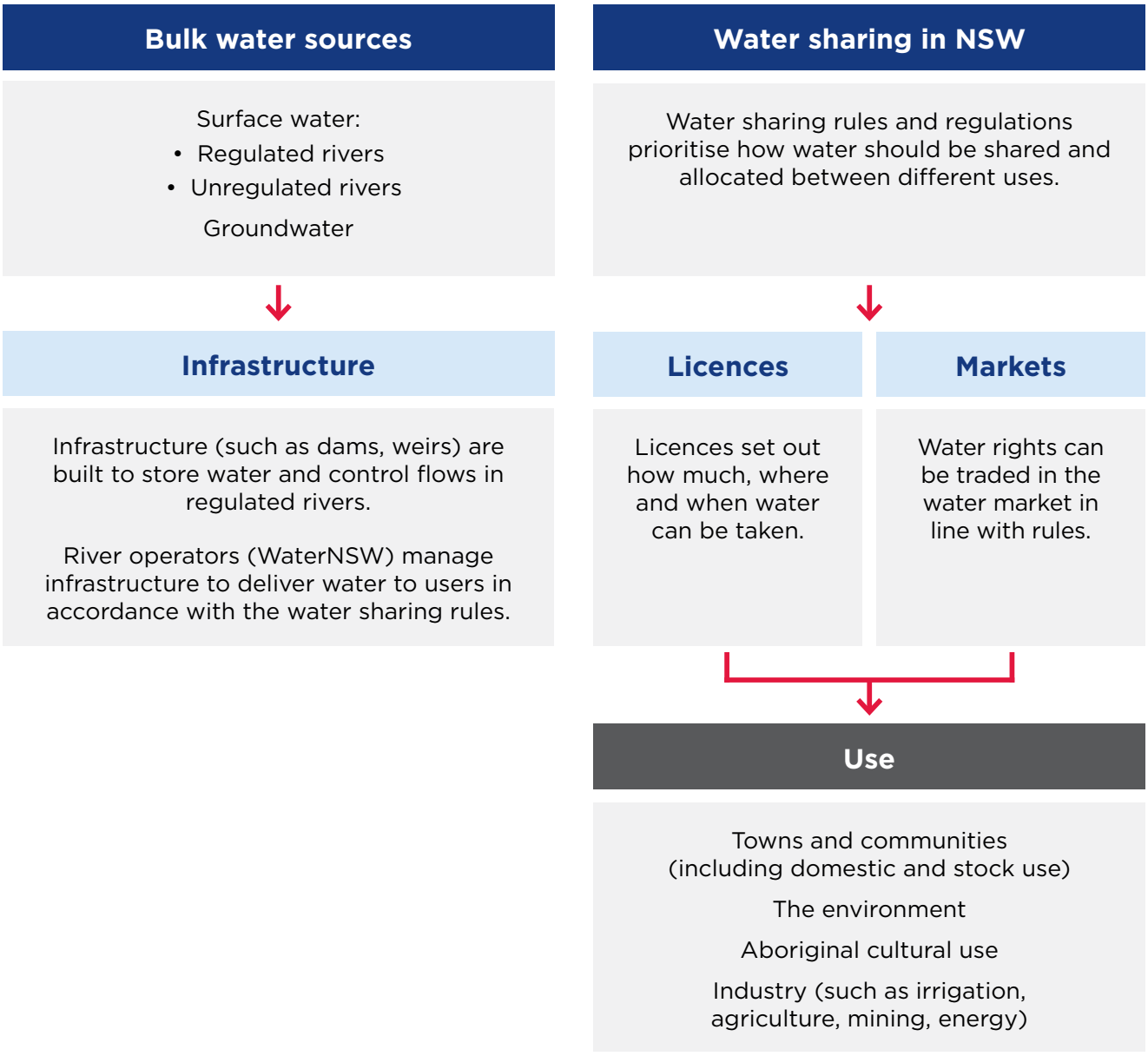


2.2 Water markets and licences

How water is provided to regional communities depends primarily on the amount of water available, and the rules around how that water must be shared. Water sharing arrangements are supported by (Figure 6):

- **infrastructure**—such as dams and weirs, which help store water, control water flows and deliver water to users in regulated rivers
- **water licences and allocations**—which set out the rules around how much, when and where water can be taken by licence holders. More information on water licences is available on the Department of Planning, Industry and Environment's website. Water rights can also be traded on the water market.[2]

Figure 6. How water is provided to regional communities



2. Further information on the water market can be found on the Department of Planning, Industry and Environment website at: www.industry.nsw.gov.au/water/licensing-trade/trade

2.3 Water reforms

The NSW Government has also been implementing a range of water reforms (Figure 7), including:

- **improving water and sewage services for Aboriginal communities and rural communities**
  Together, the NSW Government and the NSW Aboriginal Land Council are investing more than $200 million over a 25-year period to fund the maintenance, operation and repair of water supply and sewerage systems in 62 discrete eligible Aboriginal communities. In addition, the $1 billion Safe and Secure Water Program co-funds eligible projects to address key risks to regional water safety and security, and aims to provide safe, secure and sustainable water and wastewater services to regional NSW towns.

- **implementing the Murray-Darling Basin Plan**
  The Basin Plan, which aims to rebalance water sharing between the environment and other water users, has limited the amount of water that can be used by towns, communities, farmers, mining and industry to make sure there is enough left for a healthy environment. Water sharing between states is also governed by Basin level agreements. We continue to work with other jurisdictions and communities on the implementation of the Basin Plan.

- **improving compliance and transparency**
  We have established a tough new regulator, the Natural Resources Access Regulator, to crack down on illegal water use and rebuild trust in the community around water use and access. The Natural Resources Access Regulator is using new technologies, including remote sensing and satellite monitoring, as part of its efforts to detect breaches in our water rules and deter water users from breaking the rules.

- **introducing new metering laws**
  We are implementing robust new laws to accurately meter water taken from rivers, creeks and groundwater in NSW. This will mean that 95% of all water use is metered, helping to reduce the overuse of water, increase water available to downstream users and better manage water for the environment.

- **fast-tracking the NSW approvals process**
  The *Water Supply (Critical Needs) Act 2019* provides an alternative authorisation pathway for emergency water supply projects required for certain towns and localities declared to be in critical need of water due to the current drought. The Act also supports the delivery of certain dam projects, which are being delivered in partnership with the Commonwealth to enhance future water security and supply.

We are committed to **improving how we manage environmental water** in the NSW Northern Murray-Darling Basin to maximise environmental outcomes, improve our water systems and make sure that communities across NSW continue to enjoy the many benefits associated with healthy, productive rivers, streams and wetlands.

We recognise the need to **improve the recognition of Aboriginal people's water rights, interests and access to water** and have clearer guidelines around cultural water access licences. We are also exploring options to improve outcomes for Aboriginal peoples at the state-wide level and to improve the representation of Aboriginal water rights, interests and access to water in water resource management. We are working with peak Aboriginal groups on what needs to change.

Options raised through the regional water strategies, such as those related to Aboriginal outcomes, may be delivered through this state-wide policy.

Regional water strategies will build on these reforms and help to identify and address any outstanding gaps. The strategies will play a key role in the ordering, sequencing and integration of these reforms within each region.

Regional water strategies also provide an opportunity to coordinate the state-wide implementation of these reforms (where possible) and to explore how we can better integrate and shape them to improve water supply, security and quality.

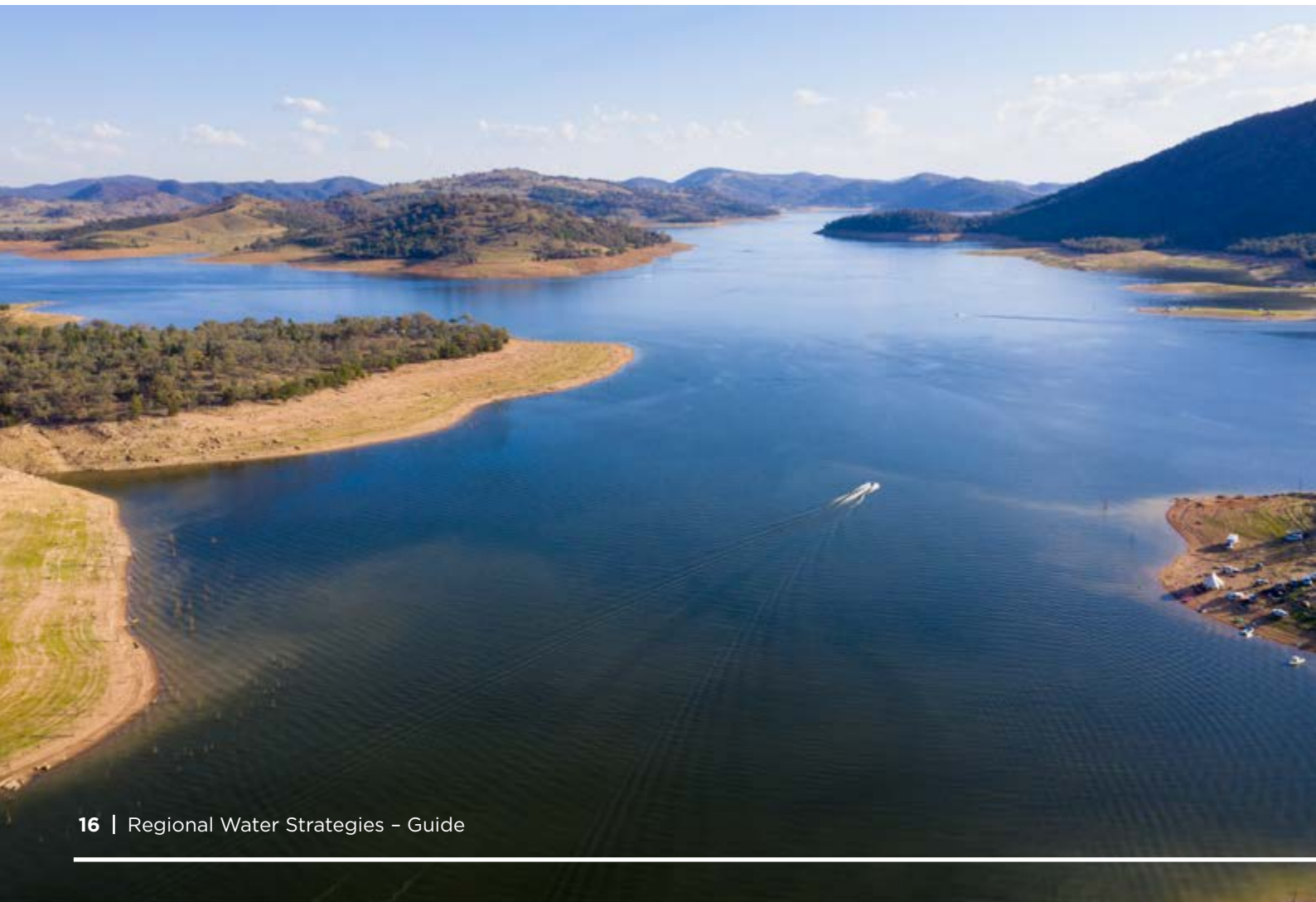
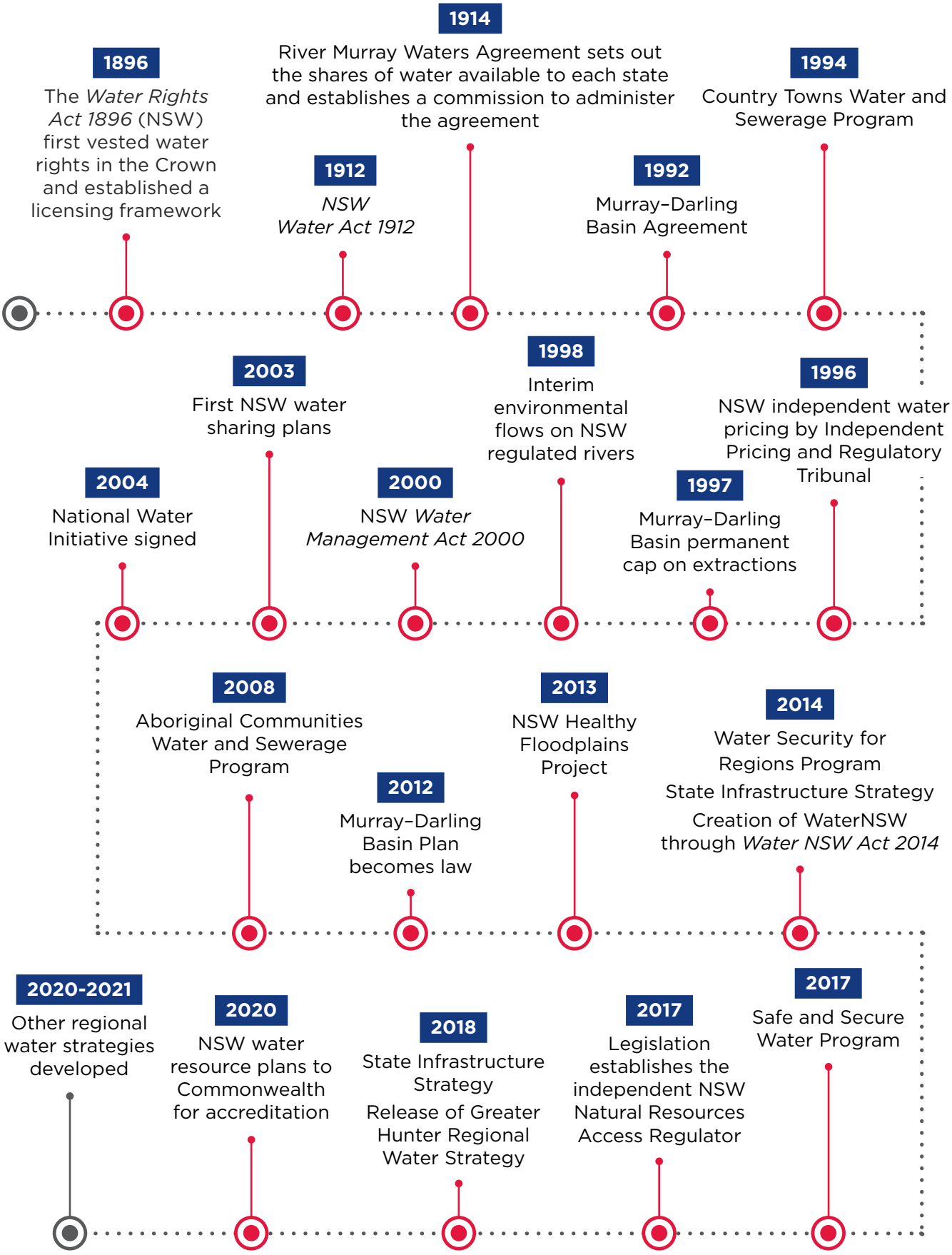


Figure 7. Timeline of NSW water reforms

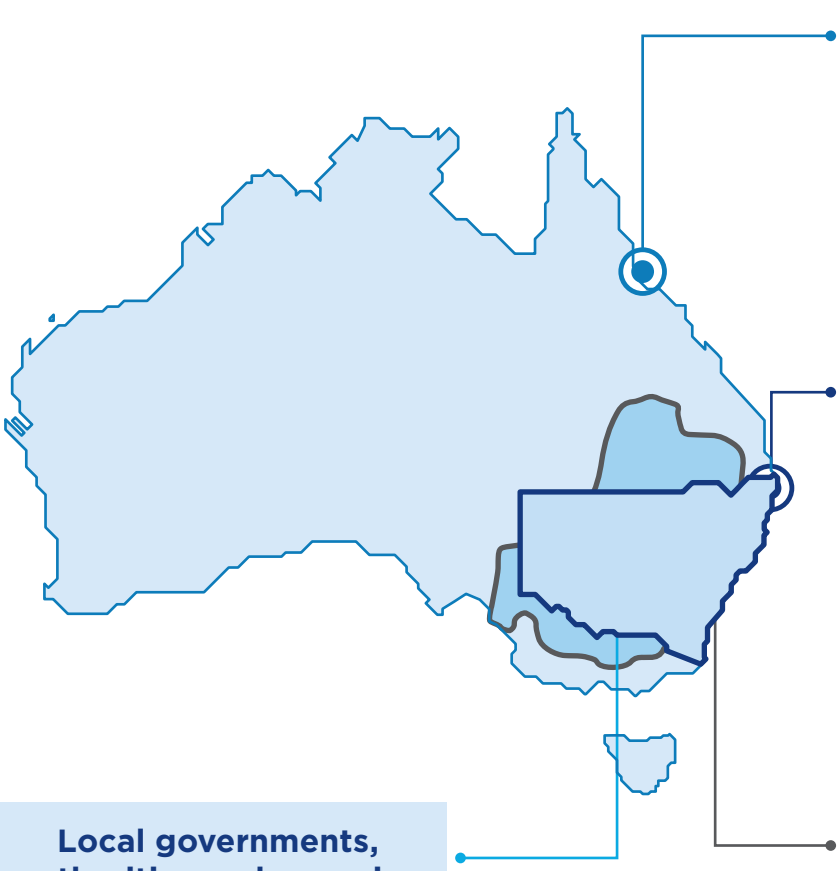


2.4 Roles and responsibilities in the water sector

Responsibility for water management in NSW is shared between Commonwealth, State and local governments, authorities and agencies (Figure 8).

A number of inter-jurisdictional bodies[3], independent statutory bodies[4] and corporations[5] also play roles in managing water resources and providing advice to governments. Effective planning and delivery of water security solutions relies on cooperation and coordination between all of these organisations. Regional water strategies will support this cooperation and coordination, and give the community confidence that all water managers are working towards agreed goals.

Figure 8. Key government organisations with responsibility for water management



Australian

Department of Agriculture, Water and Environment

Commonwealth Environmental Water Holder

Australian Competition and Consumer Commission

NSW State

Department of Planning, Industry and Environment

Natural Resources Access Regulator

WaterNSW
Sydney Water
Hunter Water

NSW Independent Pricing and Regulatory Tribunal

Murray Darling Basin

Murray–Darling Basin Authority

Local governments, authorities and agencies

Local water utilities

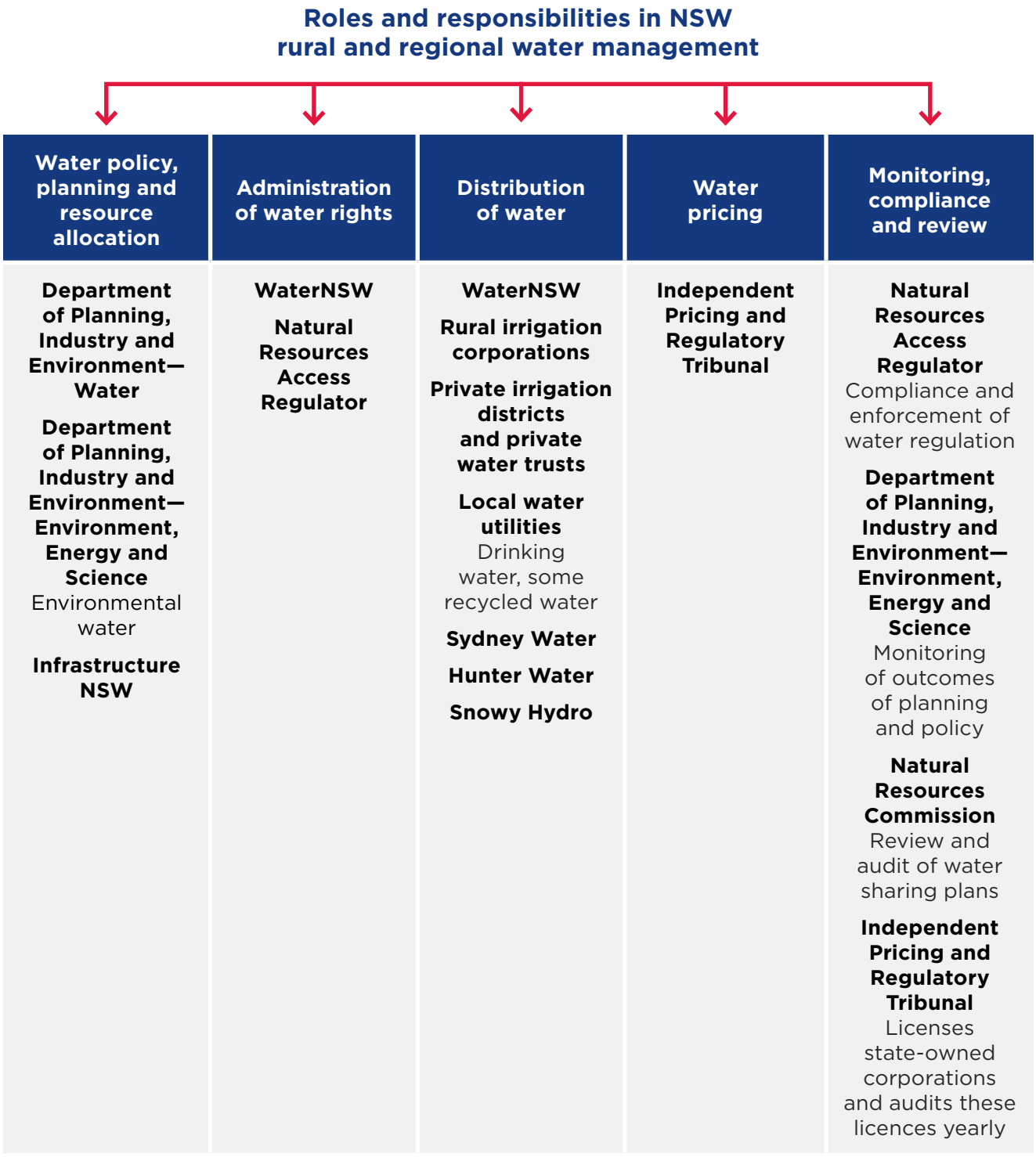
3. For example, the Murray-Darling Basin Authority and the Dumaresq-Barwon Border Rivers Commission
4. Including the Australian Competition and Consumer Commission and the Independent Pricing and Regulatory Tribunal
5. Including state-owned corporations, such as Sydney Water Corporation and WaterNSW

At the national level:

- the **Department of Agriculture, Water and Environment** undertakes national water policy and coordination
- the **Commonwealth Environmental Water Holder** manages a large portfolio of environmental water holdings acquired by the Australian Government
- the **Australian Competition and Consumer Commission** enforces water market rules, water charge rules and the *Competition and Consumer Act 2010*
- the **Murray-Darling Basin Authority** implements and reviews the Murray-Darling Basin Plan, and oversees water resource planning in the Murray-Darling Basin
- the interim **Inspector-General of Murray-Darling Basin Water Resources** helps to deliver the Basin Plan and improve transparency, accountability and community confidence in the Basin Plan.

At the State level, the NSW Government's water reforms have clarified roles and responsibilities for managing water in regional NSW, as shown in Figure 9.

Figure 9. Roles and responsibilities in NSW rural and regional water management



Source: www.industry.nsw.gov.au/water/what-we-do/how-water-is-managed

At the local level, in regional NSW, local water utilities play a key role in water delivery, providing water supply and sewerage services to local communities.

2.5 Strategic planning

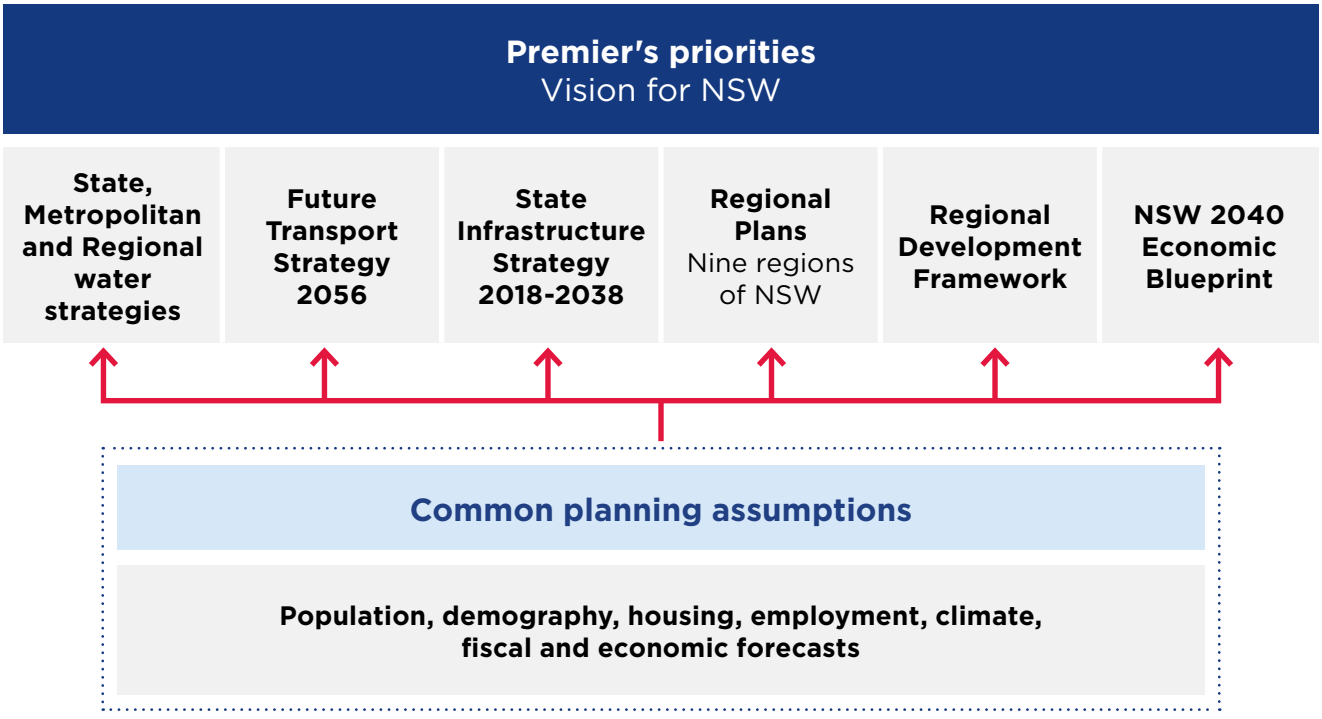
In our targeted consultation on regional water strategies (section 3.3), people generally saw merit in a long-term strategy for water. However, many stressed that these strategies should be linked with existing regional development and local planning activities to ensure that decisions and choices about water support these plans.

Regional water strategies will match-up with the following NSW Government strategies to make sure that policy and investment decisions are aligned (Figures 10 and 11):

- the **Future Transport Strategy 2056**, the NSW Government's long-term transport masterplan
- prioritised infrastructure policies and projects identified in the NSW **State Infrastructure Strategy 2018-2038**
- the nine **Regional Plans**, which set out long-term land use plans for regional NSW
- economic development directions set out in the NSW **Regional Development Framework**
- the **NSW 2040 Economic Blueprint**, which sets the direction for our continued success in a changing world and expanding global economy
- the **Marine Estate Management Strategy.**

This will ensure that regional water strategies use the same set of planning assumptions as other strategies focused on regional NSW, and do not incorporate options that run counter to these strategies or undermine their effectiveness. In the future, when these other strategies are updated, they will also take into account the objectives and options included in the regional water strategies.

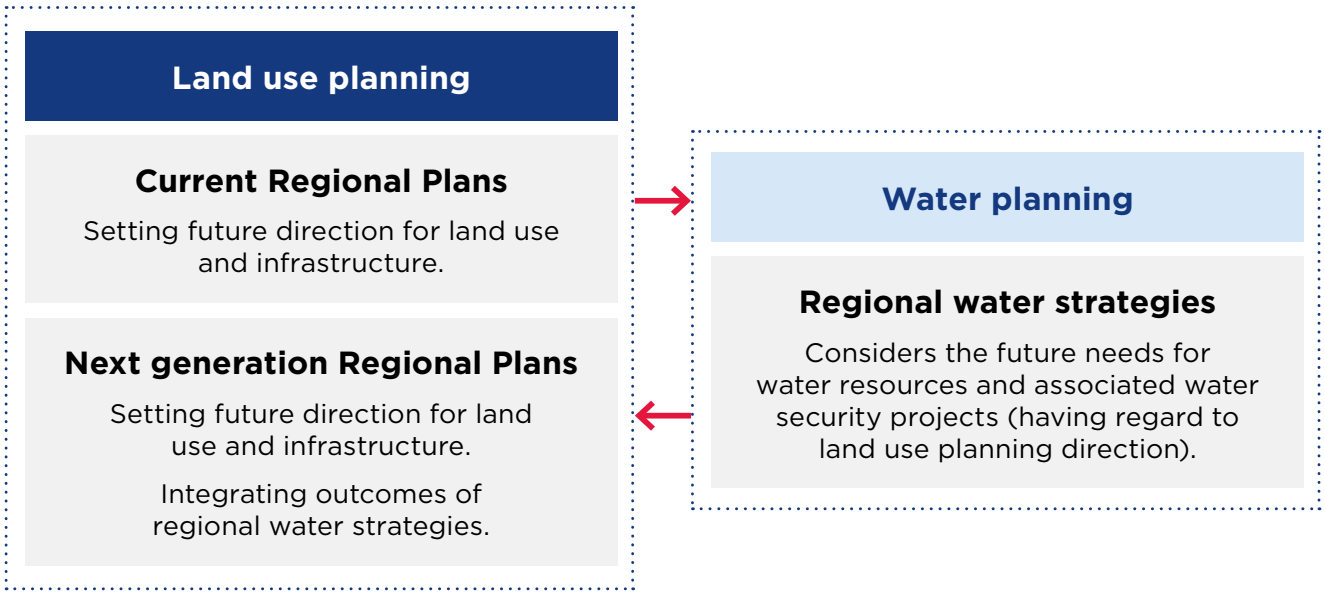
Figure 10. Strategic planning hierarchy

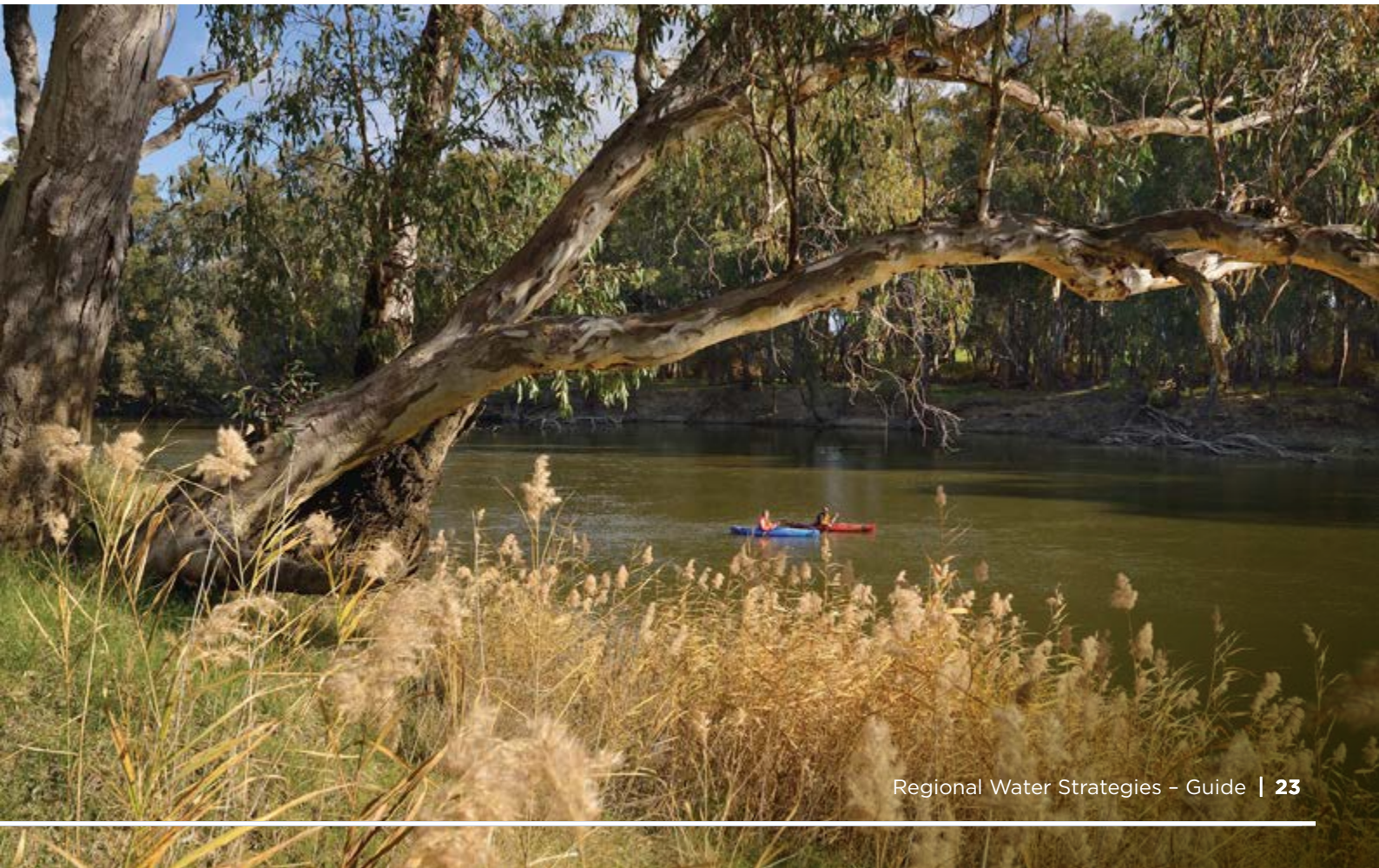


Source: Infrastructure NSW, State Infrastructure Strategy 2018-2038, adapted by Department of Planning, Industry and Environment

The final regional water strategies will set out how we will plan and manage water resources to help achieve the vision and goals outlined in these other strategies.

Figure 11. Integrating regional land use and water planning





2.6 Existing commitments and investment

The NSW Government has made significant commitments to improve water resilience and reliability. Much of the work we are already undertaking is directed towards addressing the risks currently facing regional NSW and setting the regions up for the future. This includes investing in dams and water saving infrastructure in the current drought, and preparing for the next drought.

Our water commitments and investment include, in partnership with the Australian Government:

- $650 million for an upgrade of Wyangala Dam in the Lachlan region
- $484 million for a new Dungowan Dam near Tamworth in the Namoi
- $24 million for a final business case for a new dam on the Mole River in the Border Rivers region of NSW.

In September 2020, the Australian Government announced an extra $283.5 million to progress the Wyangala and Dungowan Dam projects.

We have invested over $2 billion as part of a drought emergency relief package, and are now fast-tracking vital infrastructure projects in regional NSW to help local industries, councils and communities rebuild and recover from the impacts of drought, bushfire and COVID-19.

We are also making improvements to water supply and sewerage infrastructure in regional centres and country towns through the Safe and Secure Water Program. As at April 2020, we have funded more than $1 billion in water infrastructure projects since 2016 to improve water services for towns and communities, including a new pipeline from the Murray River to Broken Hill.

A range of projects are also the subject of Commonwealth-State agreements under the Murray-Darling Basin Plan Sustainable Diversion Limit Adjustment Mechanism (for example, Menindee Lakes) and the Northern Basin Toolkit Measures (for example, Gwydir constraints).

These commitments and investments will not be screened out during the options assessment shortlisting process conducted for each regional water strategy (section 3.4). They will be considered as part of the options that are recommended in the final strategy. New evidence and data that we are gathering to develop regional water strategies will be available to inform these commitments and investments as well.

Chapter 3

Preparing regional water strategies

To ensure we are using the best available evidence and putting forward the best ideas and options, a wide range of sources has been used to inform the regional water strategies.

3.1 New climate data and modelling

Regional water strategies will be underpinned by new climate data and modelling that improves our understanding of past climate conditions and plausible climate futures, and provides a more accurate picture of the frequency, duration and magnitude of extreme climate events such as extended droughts (Figure 12).

This improved climate data will be used in our river system models to gain a better understanding of the water security and reliability risks faced by water users and the environment within each region, and to investigate the potential benefits and impacts of options identified through the regional water strategy process.

Until now, water management decisions in NSW and across the Murray-Darling Basin have been based on adaptive management principles and on the historical record of climate conditions going back to the 1890s—about 130 years of rainfall, temperature and evaporation data. This data has been the main input into river system models used by the Department of Planning, Industry and Environment for many years to understand the effects of operational rules and water-related infrastructure, to set requirements for storing water in dams to provide a secure supply of water for regional towns and communities during drought, and to inform the setting of sustainable diversion limits under the Murray-Darling Basin Plan.[6]

Now, as concerns grow that changes in climate arising from higher greenhouse gas emissions may make droughts more severe, and increasing evidence of longer droughts in the last millennium, there is increasing recognition that using a relatively short period of historical data alone provides a limited understanding of extreme events.

New scientific methods have been developed that augment the historical record and provide a much improved basis for characterising future climate risks to our ongoing water security.

To prepare the regional water strategies, the NSW Government has invested in new methods and data to develop a more sophisticated depiction of climatic conditions, including the likely frequency and duration of future droughts. This new data is synthetic: created by integrating recorded historical data with paleoclimate data (data reconstructed from before instrumental records began, using sources such as tree rings, ice cores, cave deposits and coral growth). Combining these two elements gives us 500 years of climate data.

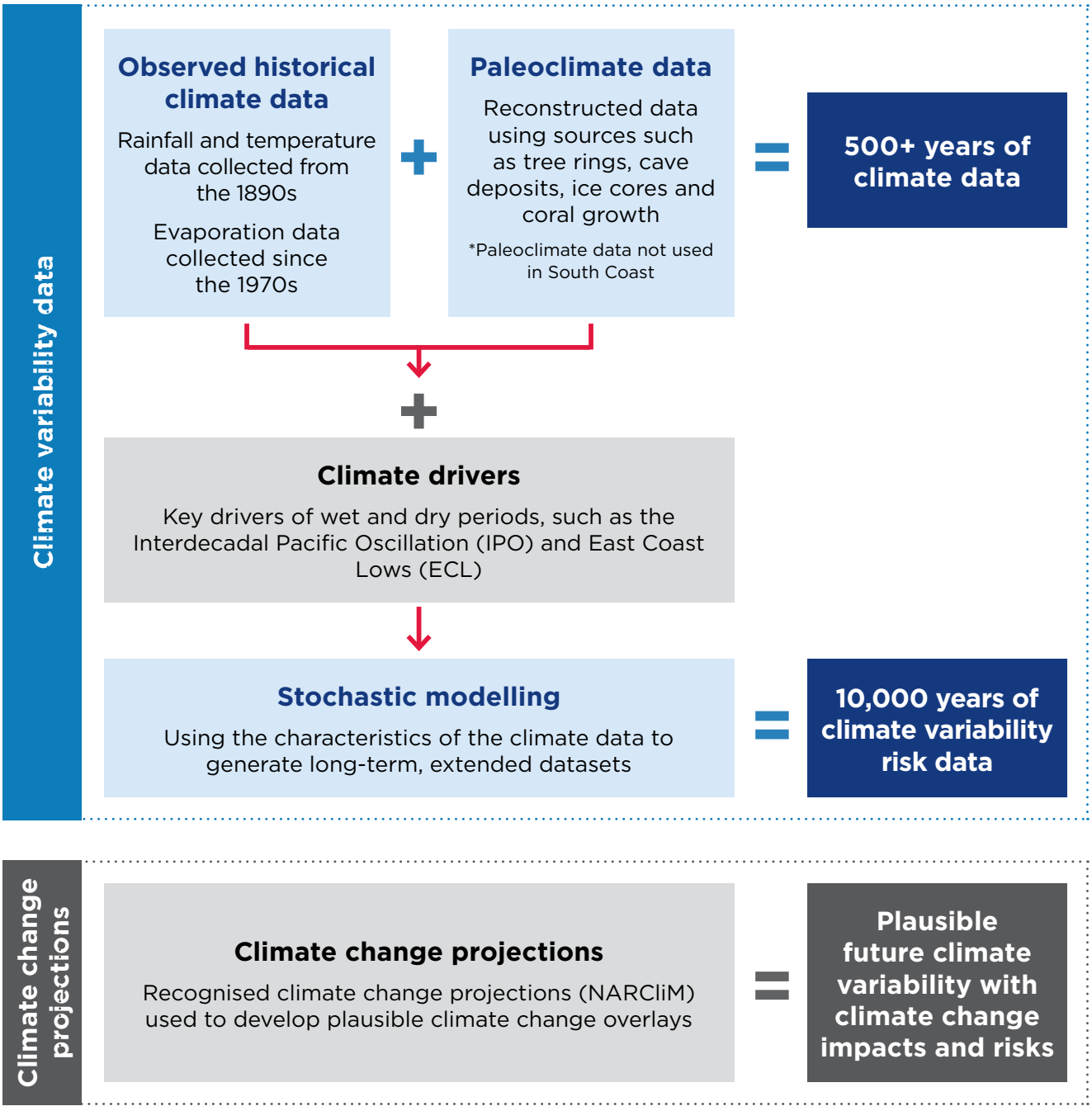
We can then apply a stochastic modelling method (based on the statistical characteristics of the extended data) to get a dataset covering up to 10,000 years.[7] This enables us to quantify the natural variability and extremes (drought and flood) in our regions since the last major global climate shift with more certainty than was previously possible. We have combined this with an understanding of key climate drivers and the use of existing climate projections to provide guidance on how these extended synthetic datasets may be influenced by future climate changes.

6. These limit how much water on average can be used by towns and communities, farmers and industries while still keeping rivers and environment healthy. See www.mdba.gov.au/basin-plan-roll-out/sustainable-diversion-limits
7. Stochastic modelling forecasts the probability of various outcomes under different conditions. It presents data and predicts outcomes that account for certain levels of unpredictability or randomness, giving a view of a variety of outcomes under multiple factors and conditions.

Bringing together climate variability data and climate change projections in this way greatly enhances our ability to identify plausible future climate impacts and risks, and it represents a significant and important advance in water planning and management for NSW. It means that we have moved from making decisions that are heavily based on single 'worst-case' scenarios drawn from a short climatic record to a much more accurate understanding of extreme events, normal climate conditions and everything in between.

We can now better understand future climate characteristics (such as the frequency, duration and severity of droughts and floods in each NSW region), better understand how to mitigate these risks and better assess the benefits of medium and long-term solutions.

Figure 12. Illustration of new climate data and modelling approach



This updated climate information has informed the development of the regional water strategies. Attachments 2 and 3 provide further information about this new modelling.

Our investment in more sophisticated climate modelling means we now have an extended dataset that gives a better understanding of the risks to the regions. This dataset is being incorporated into updates of river system models and will be used by the Department of Planning, Industry and Environment—Water and other agencies to assess the merits of existing and new projects, plans and programs.

The method was developed by the Department of Planning, Industry and Environment—Water with advice from the University of Newcastle and University of Adelaide. The importance of getting this right led us to commission a review of the method and its implementation by an independent panel of experts, coordinated by the Office of the Chief Scientist and Engineer. A final report from this panel has been completed.

We also recognise that Aboriginal peoples have unique traditional ecological knowledge about the Australian climate, and we are seeking ways to build this knowledge into the regional water strategies and future water management.

3.2 Existing strategies, studies and inquiries

A significant amount of work has been undertaken to understand the risks affecting water resource management in regional NSW, the drivers influencing these risks and potential options that could address these drivers. This work includes:

- **NSW State Infrastructure Strategy 2014 and 2018**
  The Catchment Needs Assessment Framework developed for the State Infrastructure Strategy 2014 identified the highest priority inland river catchments as the Gwydir, Macquarie–Castlereagh and Lachlan. The State Infrastructure Strategy 2014 noted that all three catchments have low irrigation drought security due to low or variable rainfall, high rates of evaporation and limited government-owned water storages.

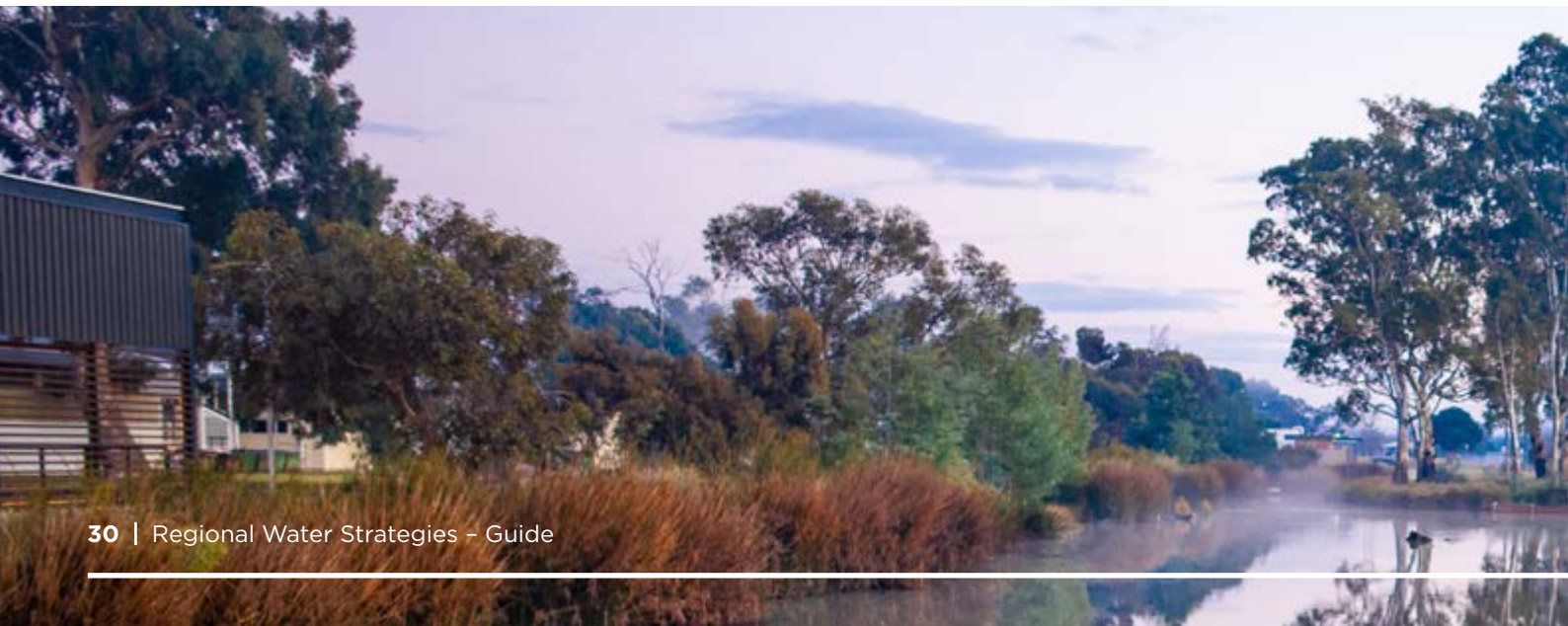
- **WaterNSW water security investigations**
  Water security investigations undertaken by WaterNSW for the Gwydir, Macquarie–Castlereagh and Lachlan catchments are an important source of information in the development of regional water strategies.

- **Long term water plans**
  These plans are part of the NSW Government's commitment to implementing the Murray-Darling Basin Plan. The plans draw together local, traditional and scientific knowledge to improve the way water is managed to maximise river and wetland health outcomes within and between catchments.

- **Water resource plans and water sharing plans**
  These plans, which are also part of implementing the Murray-Darling Basin Plan, will show how NSW will comply with the limits set on the volume of surface water and groundwater that can be taken and used in catchments.

- **Regional economic development strategies**
  These strategies, developed by local councils, set out a clear economic development strategy for each NSW region.

- **NSW Government Safe and Secure Program**
  Established in August 2017, this program addresses key risks to regional water safety and security, and aims to provide safe, secure and sustainable water and wastewater services to regional NSW towns.



- **Integrated water cycle management strategies**
  Local water utilities develop integrated water cycle management strategies under the NSW Government's best-practice management guidelines. These evidence-based resourcing approaches aim to provide appropriate, affordable, cost-effective and sustainable urban water services that meet community needs and protect public health and the environment.

- **NSW Fish Passage Strategy**
  This 20-year state-wide strategy seeks to proactively restore unimpeded fish passage to 165 high priority weirs, which will significantly improve native fish access to mainstream rivers and important off-channel habitats below all major storage dams.

- **Change to Australian Competition and Consumer Commission (ACCC)—Murray-Darling Basin water markets inquiry**
  On 7 August 2019 the Australian Government announced that the ACCC will conduct an inquiry into markets for tradeable water rights in the Murray-Darling Basin. The ACCC will recommend options to enhance markets for tradeable water rights, including options to enhance their operations, transparency, regulation, competitiveness and efficiency. The ACCC gave the Australian Government Treasurer an interim report in May 2020 and will complete the inquiry and provide a report to the Treasurer by the end of February 2021.

- **Independent Pricing and Regulatory Tribunal (IPART) Strategic review of water prices**
  In 2020-21, IPART will commence a strategic-level review of its approach to regulating water prices. This will be a public review, with opportunities for all stakeholders to provide input, and will inform IPART's approach to regulating water prices beyond 2021.

More information is available on many of these strategies, studies and inquiries in Attachment 5.

The Australian Government requested an independent panel undertake an assessment of social and economic conditions in communities across the Murray-Darling Basin. The panel's final report was released in September 2020.[8] This will be an important source of information as we assess options for the final regional water strategies.

8. The report is available here: www.basin-socio-economic.com.au

3.3 Community engagement

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

We are also talking with local councils, joint organisations, local water utilities, Aboriginal peak bodies and Aboriginal community groups about regional water strategies. These discussions are informing the development of regional water strategies and options for each region.

An extensive engagement program supports the regional water strategies, with four phases planned for the development of each strategy:

1. initial discussions with Aboriginal peak bodies as well as councils, local water utilities, joint organisations and Aboriginal communities in each region

2. public exhibition of the draft regional water strategy

3. further targeted engagement with Aboriginal peak bodies, councils, local water utilities and joint organisations and Aboriginal communities in each region

4. public release of the final regional water strategy.

In some regions, COVID-19 has impacted our ability to engage with Aboriginal communities in a culturally appropriate way prior to the public exhibition of the draft regional water strategy. We are committed to engaging with Aboriginal people and including their voice and their views in the strategies. For these regions, engagement will happen with Aboriginal communities concurrently with the public exhibition process and throughout the development of the regional water strategies.

Descriptions of targeted engagement activities within each region—and the ideas, concerns and issues raised during this consultation—are provided in each draft regional water strategy.

3.3.1 Aboriginal communities: engagement approach

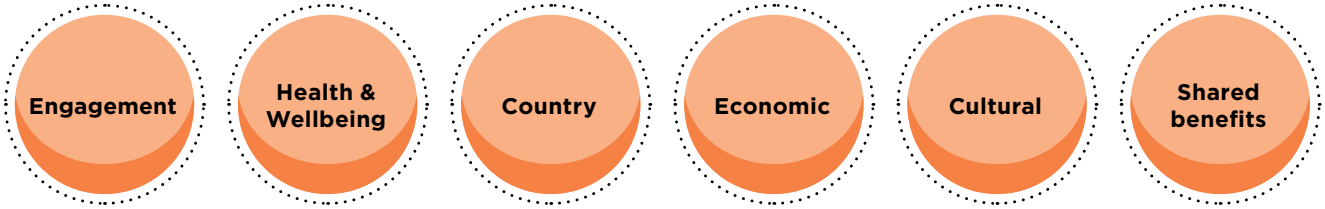
One of the objectives of regional water strategies is to recognise and protect Aboriginal water rights, interests and access to water, including Aboriginal heritage assets. We recognise that our engagement with Aboriginal people and communities on water issues has not been adequate in the past. To change this, we are starting a new partnership approach for the development and implementation of the regional water strategies.

We have been working with an Aboriginal water coalition (the group) to provide advice during development of the strategies. The group has representatives from peak Aboriginal organisations including the NSW Aboriginal Land Council, NTSCORP, Northern Basin Aboriginal Nations and Murray Lower Darling Rivers Indigenous Nations, along with representatives from Aboriginal Affairs and the Department of Planning, Industry and Environment.

Our engagement principles[9] for regional water strategies are:

- a planned approach is taken to properly engage Aboriginal people (for example, allowing adequate time, choosing appropriate venues and allocating resources)
- identification and involvement of appropriate Aboriginal people (including cultural knowledge holders) is undertaken throughout all stages of the strategies process
- Aboriginal people are properly notified of the opportunity to be involved in the strategies process (by print, phone, electronic and personal media, and meetings)
- information about the strategies planning processes and content is clear to Aboriginal people
- appropriate tools and mechanisms are used for recording, understanding and incorporating Aboriginal objectives and outcomes
- processes are as inclusive of Aboriginal people and organisations as possible.

We are also building on our prior work with Aboriginal communities. For example, Basin Aboriginal nations have expressed their aspirations through the water resource plans First Nations engagement process, identifying six pillars that underpin the plans' key objectives and outcomes.



These pillars have been a starting point for discussions with Aboriginal communities about the regional water strategies.

9. These principles are modelled on those used by the Murray-Darling Basin Authority when engaging with Aboriginal communities. The authority's Aboriginal Partnerships Action Plan is available here: www.mdba.gov.au/publications/mdba-reports/aboriginal-partnerships-action-plan-building-partnerships-traditional-owners

3.4 Identifying and assessing options

The purpose of the regional water strategies is to deliver resilient water resources for towns and communities, Aboriginal communities, industry and the environment.

Options in the draft strategies have been identified through a range of different means including:

- previous studies and reports—such as WaterNSW water security studies, joint organisation water studies and long term water plans
- engagement with councils, joint organisations and Aboriginal communities
- expert advice from government agencies.

Attachment 5 provides information on the studies that have informed the regional water strategies.

The public consultation process will provide another opportunity to identify options and seek feedback on the long list of options.

All options need to meet one or more of our objectives (see section 1.2).

We have developed a decision-making process for the strategies to help assess the options and then combine them in a way that maximises the value of the region's water resources, now and for the future. This process will use the best and latest evidence, and a range of assessment tools to identify risks and opportunities associated with each option and assess individual options and packages of options in a transparent and consistent way.

The process is consistent with the NSW Government's policies for evidence-based decision-making and economic analysis. It is also consistent with the objectives of the NSW *Water Management Act 2000* and with other policy obligations, including the Murray-Darling Basin Plan.

The decision-making process has four broad stages:

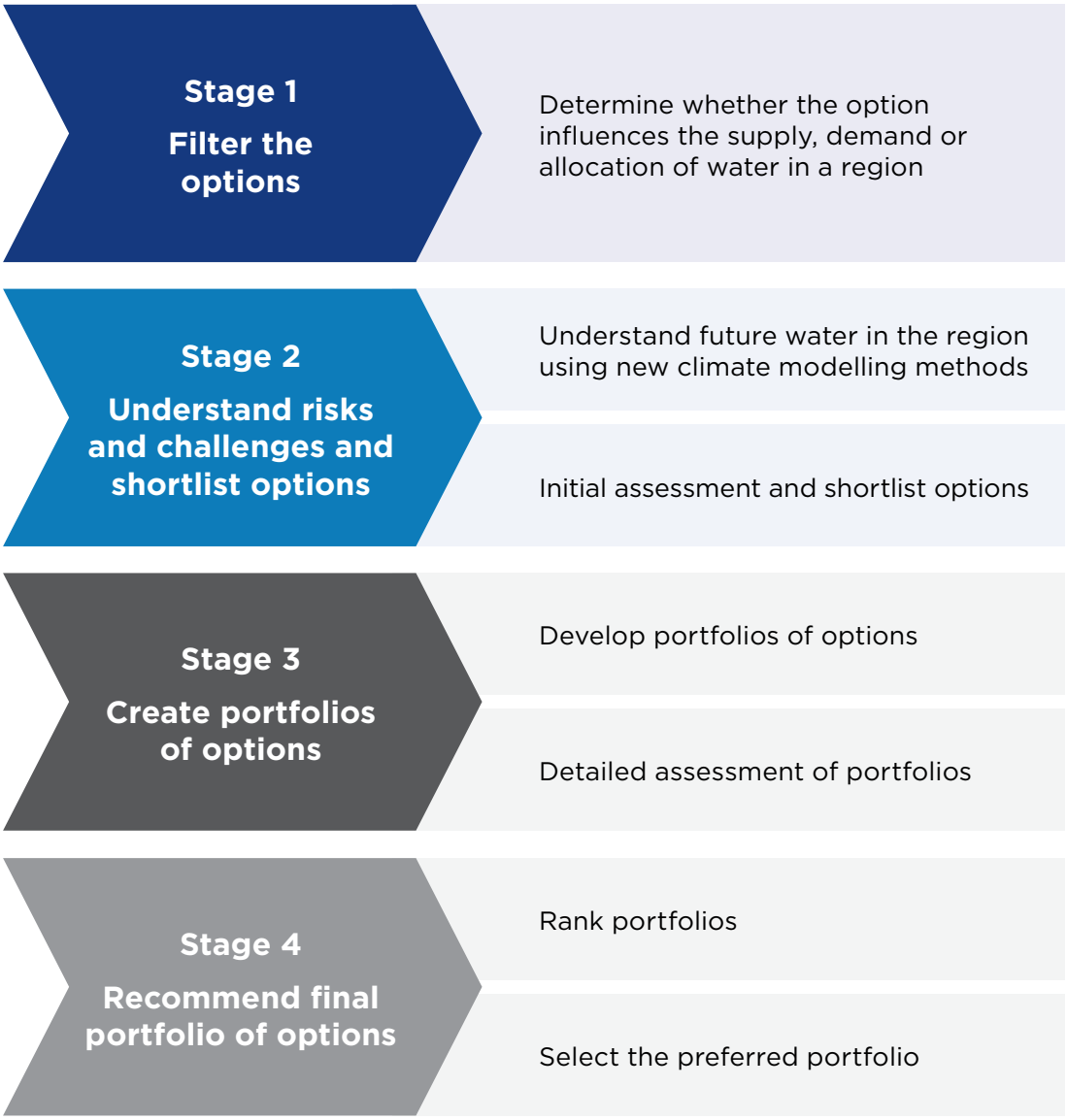
1. Filter the options.
2. Understand risks and challenges and shortlist options.
3. Create portfolios of options.
4. Recommend a final portfolio of options.

Across these stages, the process requires:

- understanding the challenges in each region in relation to the objectives
- undertaking water modelling to establish the best possible understanding of the amount of water available in the region in the future, including the probability of the region experiencing more severe climate conditions than have occurred in the historic climate record (see section 3.1)
- assessing the social, environmental and cultural effects of options
- conducting economic analysis to compare the costs and benefits of packages of options
- considering diverse stakeholder views and making trade-offs between objectives.

Figure 13 summarises the decision-making process. Additional information is in Attachment 4.

Figure 13. Summary of regional water strategies' decision-making process



3.5 Final regional water strategies

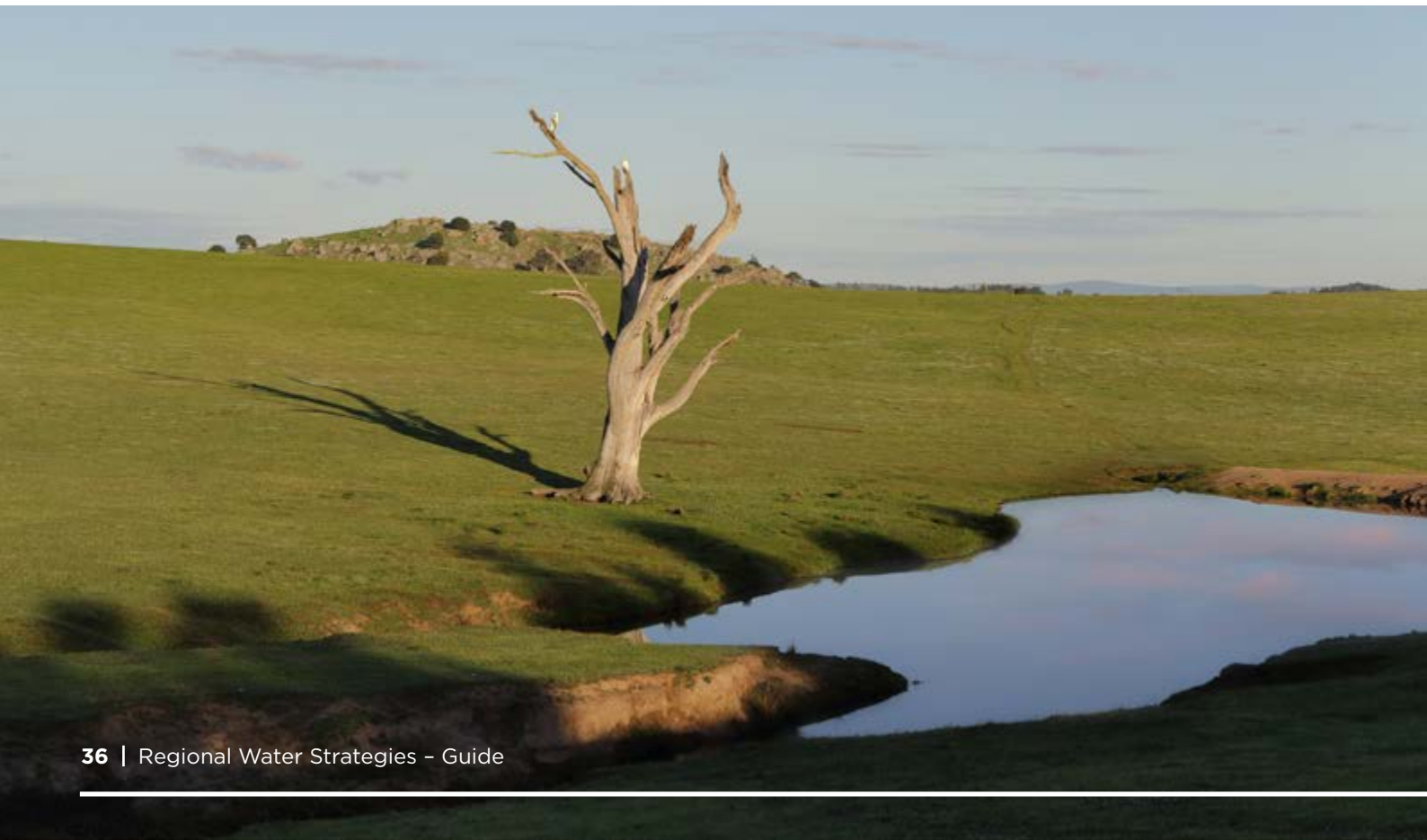
Each draft regional water strategy will go on public exhibition, with opportunities provided for written submissions, as well as feedback at community sessions. During the COVID-19 pandemic, these community engagement sessions will be conducted through webinars and phone calls.

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

The objectives, challenges, opportunities and options identified in the draft regional water strategies will be tested, evaluated and refined based on these inputs. The final strategy for each region will include:

- a final portfolio of actions approved by the NSW Government
- a plan for implementing the strategy within clear timeframes that 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 monitoring and review program will identify if any key underlying assumptions in the strategy are no longer valid, and when a revision is required. This process will require regular reevaluation of the strategy outcomes against any updates in the available climate data.

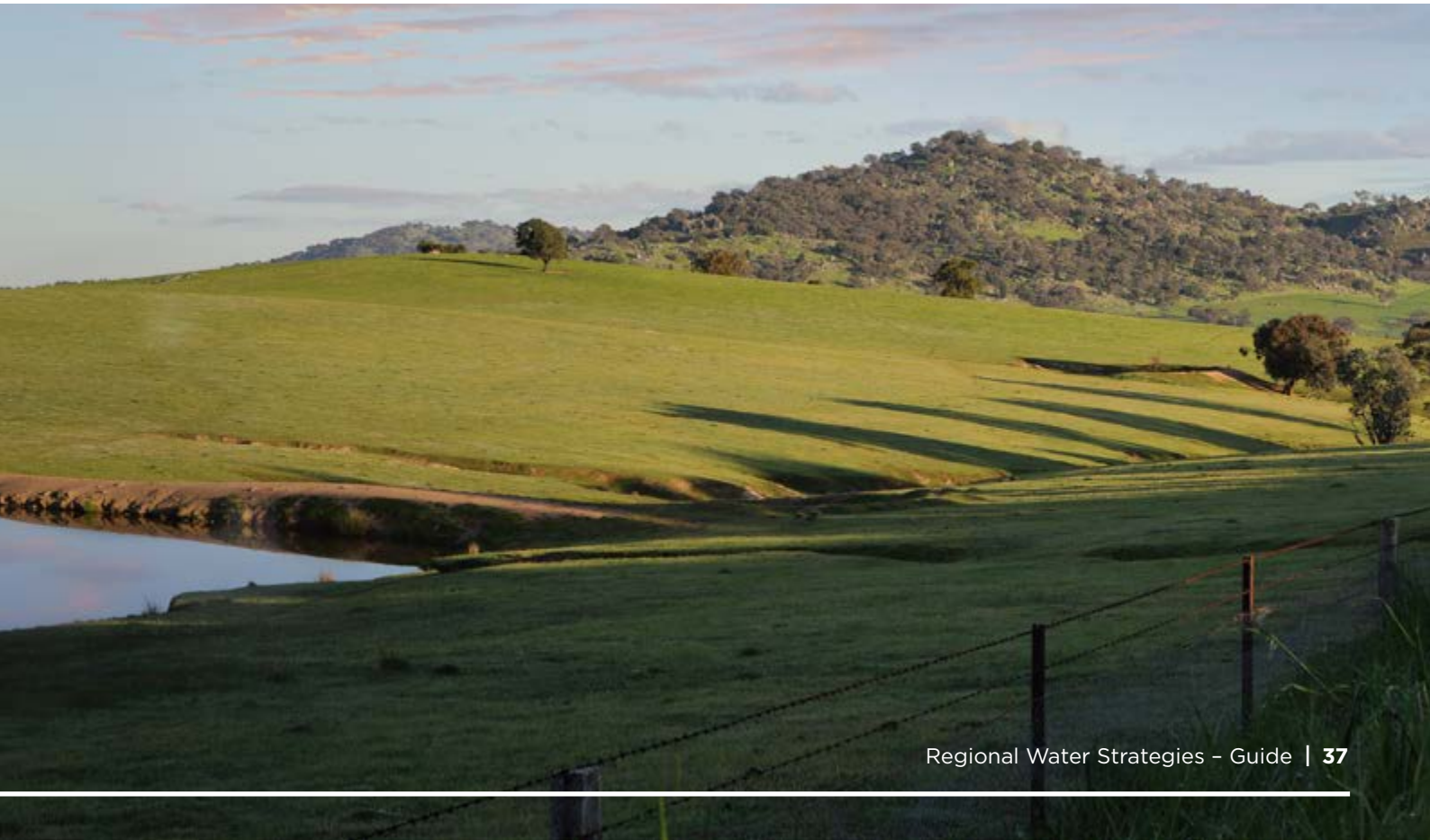


3.6 Monitoring and evaluating the strategies

Once the regional water strategies are finalised, the Department of Planning, Industry and Environment will develop a monitoring and evaluation program to support their implementation. Effective monitoring, evaluation and review will help to ensure the strategies adapt to changing circumstances and needs, provide information on emerging issues, respond to new evidence, improve the State's performance in water planning and management, and ensure accountability. Councils have raised the need for effective monitoring and review of the strategies.

The monitoring and evaluation program will include:

- **Monitoring progress** of actions and recommendations. Adjustments will be made as required to ensure the overarching objective and outcomes of the regional water strategies are achieved.
- **Evaluating outcomes** against baseline information. Data will be collected and analysed to help evaluate the outcomes.
- **Reporting outcomes.** The findings and recommendations of the program will be publicly released at regular intervals and then used to improve implementation of the regional water strategies.



Attachments

Attachment 1

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 *Water Management Act 2000* as: (a) specified shares in the available water within a specified water management area or from a specified water source (the share component), and (b) authorisation to take water: (i) at specified times, at specified rates or in specified circumstances, or in any combination of these, and (ii) in specified areas or from specified locations (the extraction component). 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, amount of share component, dam storage levels, river flows and catchment conditions.
Basic landholder rights	Where landholders can take water without a water licence or approval under section 52, 53 and 55 of the NSW *Water Management Act 2000*. There are three types of basic landholder rights under the NSW *Water Management Act 2000*: • 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 *Native Title Act 1993*.
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.
Climate variability	Describes the way key climatic elements, such as temperature, rainfall, evaporation and humidity, differ from the average over time. Variability can be caused by natural or man-made processes.
Evapotranspiration	The combined effect of evaporation and transpiration.
Environmental water	Water allocated to support environmental outcomes and other public benefits. Environmental water provisions recognise 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.
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 is the collection or capture of water flowing across floodplains.

Term	Definition
Groundwater	Water located beneath the surface of the ground in the spaces between sediments and in the fractures of rock formations.
Inflows	The amount of water coming into a surface water source or groundwater source.
Joint organisation	An entity formed under the *NSW Local Government Act 1993* 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.
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 to thousands of years in time. These indicators include marine and terrestrial deposits, tree rings and ice cores.
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 *Water Management Act 2000*, 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 are those that are able to withstand extreme events, such as drought and flood, and/or adapt and respond to changes caused by extreme events.
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 regulate 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.
Surface water	All water that occurs naturally above ground including rivers, lakes, reservoirs, creeks, wetlands and estuaries.
Sustainable diversion limit	Sustainable diversion limits define 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.
Synthetic datasets	Data that is artificially created using algorithms and not obtained by direct measurement or generated by actual events.
Transpiration	The process where plants absorb water through their roots and then evaporate water vapour through pores in their leaves.

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 purposes of the NSW *Water Management Act 2000*, 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 security	Water security in the context of regional water strategies refers to the acceptable chance of 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 resource plan	A plan made under the *Commonwealth Water Act 2007* 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 sharing plan	A plan made under the NSW *Water Management Act 2000*, 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 *Water Management Act 2000* 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.
Wetland	Wetlands are areas of land where water covers the surface of the ground, either 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.

Attachment 2

New climate datasets

The NSW Government is developing new climate datasets to gain a more complete understanding of past and future climatic conditions. These improved datasets bring together data from a range of sources and combine them to provide more extensive sequences of climatic conditions based on past climatic behaviours, as well as a range of plausible climate futures. This data will be used in our river system models to investigate the impacts of likely future climates and to compare the effectiveness of the options developed as part of the regional water strategies.

This new approach represents an important advance compared to previous climate data used. In particular, it enables the development of datasets specific to different regions that can be used to inform water planning and management. These improved regional datasets are a major step forward in understanding the level of climatic risk to water users, the environment and social, economic and cultural outcomes across NSW.

What data have we used in the past?

Up until now, many decisions about water-related development and planning in NSW river valleys has been based on a lived experience of climate conditions—that is, what communities going back several generations have experienced and recorded in hydroclimatic data (recorded river flows, rainfall and evaporation).

This historical hydroclimatic data has been used as a primary input to computer models of our river systems. This data, combined with modelled representations of the physical and management features of our river systems, can be used to test arrangements to share water between different users and to provide water to the environment. The rules for distribution are guided by legislation and policy, with input from the community. The models are used in this process to determine overall water availability under different sharing and infrastructure scenarios. More detail on the hydrologic models used is presented in Attachment 3.

Observed rainfall and temperature data collected from the late nineteenth century and evaporation data collected since the 1970s have been used in our river models to understand the likely outcomes when determining current water sharing arrangements. However, the data collected during recent droughts has increased concerns that more severe droughts are likely to occur in the future—not only naturally, but also because of changes in climate arising from increased greenhouse gas emissions.

Increasingly, using observed climate data alone is considered to provide a limited understanding of extreme events and to be insufficient to characterise future climatic risk to water security. For example, using the 125-year climate record by itself often amounts to testing against just one severe drought and we are unable to be certain how likely this drought is: is it a 1-in-50-year drought event or a 1-in-200-year event?

What datasets are we developing?

To gain a better understanding of these events and their implications for our ongoing water security, we need to expand on the observed historical climate data. There are three separate considerations involved in expanding on this data:

- understanding key climate drivers
- better representing natural climate variability
- incorporating climate change.

The first consideration requires us to understand the broadscale atmospheric and oceanic drivers that are responsible for seasonal, short-term variability and long-term variability in climatic conditions. This understanding provides guidance on which of these key drivers should be used in the development of the datasets.

The second consideration recognises the increasing body of paleoclimatic evidence[10] that there have been much longer drought periods in the more distant past than in our observational data since the late 1890s—and if these have happened before, they could happen again. We are adopting a statistical approach to represent this.

The third consideration is necessary as we are aware that the climate is changing. While there is a consensus that temperatures are increasing, there is still some debate as to how rainfall is changing. We will be adopting the results from climate models, directly and indirectly.

The natural variability of the climate is considered independently in our risk assessment, then combined with climate change projections to further test plausible risks. This is discussed at the end of this attachment.

Key climate drivers

Combinations of large-scale, recurring features of oceanic and atmospheric circulation have a large influence on seasonal, short-term and long-term climate variability. While the most commonly referenced of these features is the El-Nino/Southern Oscillation (ENSO), which has a large bearing on drought or wet conditions in eastern Australia, several other important drivers also affect our climate. These include the Indian Ocean Dipole, Interdecadal Pacific Oscillation (IPO), East Coast Lows (ECL) and Southern Annular Mode (SAM).

The relative importance of these climate drivers varies across NSW. ECLs are more important near the coast, and SAM is more important for southern NSW. In much of northern and inland NSW, there is a strong relationship between long-term average rainfalls and the different phases of the IPO. Analysis has also shown that ECLs are particularly important for water security for coastal catchments in NSW.

Identifying and understanding these drivers means we can factor them into the methods we are using to develop our new climate datasets. Where we have independent records of these drivers, we can use them explicitly in our methods. In other instances, we can see their influence in the observed historical data and can use methods that are able to account for their effects. Each of our IPO and ECL methods uses observed data and a knowledge of climate drivers to generate long-term stochastic climate sequences.

10. Paleoclimatic reconstruction techniques extend our understanding of the likelihood of wet and dry periods from rates of deposition in swamps, tree rings, limestone cave deposits and ice cores. This data allows us to understand climatic conditions over hundreds, or even thousands, of years in the past and produces a much wider range of climatic variability than is available by using the historical record alone.

Climate variability

Better representing natural climate variability is the foundation of our climate risk dataset, as the longer records produced include more extreme events—having a longer duration or being more severe—which are important for understanding risks to water security.

This variability is produced using stochastic modelling. We use methods that can analyse the statistical characteristics of climate time series and then use a statistical model incorporating these characteristics to generate much longer time series. Each period of climate data in this longer time series is equally likely statistically to all other periods of the same length.

The length of the dataset generated for regional water strategies is 10,000 years. These datasets are generated for hundreds of sites across NSW for use in our river system models.

Across inland NSW, and across the NSW North Coast, the Interdecadal Pacific Oscillation (IPO) method for stochastic data generation was adopted, as longer-term (over several decades) wet and dry periods, which can be seen in the observed recorded data, have been shown to correlate to the recorded IPO. This correlation could then be applied to a longer term.

A paleoclimatic IPO dataset stretching back to the mid-1500s allows us to factor this extended dataset into our stochastic method. This means the longer-term wet and dry periods, extending from one to several decades, which are associated with the IPO (and seen in the paleoclimate record) are captured in the datasets, along with shorter-term variability based on observed data alone.

For the south coast of NSW, the IPO was not identified as a dominant climate driver. As a result, the stochastic dataset was generated based simply on observational rainfall and evaporation records.

For both the South Coast and the remainder of the State, the development of this stochastic dataset represents an advance in our understanding of the likelihood of events under current climatic conditions and provides a baseline that we can then use to take account of expected climate change outcomes.

Climate change

Understanding of likely changes in climate resulting from global greenhouse gas emissions comes from a large body of work undertaken by climate scientists around the world, many working under the International Panel on Climate Change collaborative arrangements. While much of this work is analysing a range of climate and related datasets, and applying meteorologic principles to this work, more of our understanding comes from developing and analysing climate models.

These Global Climate Models (GCMs), of which there over forty, have been developed around the world and simulate the changes in climate resulting from increasing greenhouse gas emissions, using principles of physics. These complex models have strengths and limitations (as do all models) and our use of them factors in their uncertainty. While they are good at predicting temperature changes and potential percentage changes in rainfall, they are not as good at representing the variability of rainfall. However, there are ways to make use of these results despite their uncertainty.

Another limitation is their spatial resolution. GCMs represent the global circulation at a broad scale—each calculation point in the GCM represents climate over a land area in the range 10,000 to 50,000 km^2. In reality, considerable actual variation in rainfall would happen within that area. This issue has been effectively addressed by the NARCliM regional climate modelling project undertaken by the Environment Energy and Science Division of Department of Planning, Industry and Environment and the University of NSW

Climate Change Research Centre. NARCliM uses results from the broad scale GCMs as an input to a finer resolution Regional Climate Mode (RCM) to produce results for areas of 100 km^2 or 100 to 500 times more detail than the GCMs.

IPO method: monthly factors

For those areas of NSW where we applied the IPO method, we have used the results from NARCliM as the base of the climate change component of our climate risk dataset. Climate models show a large variation in changes to rainfall, such that some predict increases in rainfall and some predict decreases in rainfall. This is partly because of the inherent limitations of these models and because the short samples of modelled results available do not fully account for impacts of natural climate variability in describing changes to rainfall.

A design decision was made to select the average of three RCMs for the driest GCM to factor monthly rainfall and evapotranspiration data into our stochastic data sets. The reason for this is discussed further at the end of this attachment.

East Coast Low (ECL) method: changes to ECL frequency

For the NSW south coast, ECLs have been shown to be important for water security. We have used a database developed by the Bureau of Meteorology, which provides information on the historical occurrence of ECLs. In addition, NARCliM provides data on the potential changes in the frequency of ECLs as a result of climate change. Using these two sources of information, the number of ECL-associated rain events was both increased and decreased at different frequencies, and rainfall in the observed record adjusted accordingly. This adjusted dataset was then used to stochastically create a set of potential future climate datasets. This method gives a wide range of potential climate futures that can be used in analysis.

Using natural variability and climate change in our risk assessment

Our focus in developing these climate datasets has been to respond to the known limitations of using historical data alone for water planning and to answer the question ‘what is the climate we should be planning for?’. If we plan for a climate that is wetter or drier than occurs, we risk making bad decisions. We want to be able to account for all climatic conditions that may reasonably occur and to understand how likely those conditions are to occur.

The following description outlines how we use this climate data in the context of the risk of any event occurring.

The stochastic methods present a more comprehensive dataset with more extreme events, allowing us to ascertain using our river system model how vulnerable particular water security outcomes are and how frequently these outcomes are not met. We have confidence in this stochastic method as it is statistically robust and has been applied to water resources around the world for several decades. Simply by considering natural climate variability, we are better able to detect vulnerabilities in our regional water sources and formulate options to address these.

The impacts of climate change on rainfall are still highly uncertain, as shown by the wide variation in projections of changes in rainfall from GCM results. While NARCliM represents the best source of information of climate change impacts on rainfall at the level of spatial detail required in our modelling, it does not fully resolve other GCM limitations representing rainfall changes. Processes to deal with this uncertainty are complex and would take further research to resolve satisfactorily, which is not possible at this stage of the regional water strategies.

We have chosen to select the most conservative result from NARCliM, using the GCM results that represent the greatest reduction in the mean of the three RCMs' monthly rainfall for the 2060-2079 period compared to the 1990-2009 period. While the results of the other three GCMs used in the current version of NARCliM are arguably equally appropriate, our intent is to stress test the water system. If the NARCliM results we use are plausible, then these combined with the more frequent extreme events from the stochastic dataset approximate a worst-case climate scenario for strategic water planning. This is particularly useful in testing the resilience of options proposed in the regional water strategies.

In summary, we are undertaking a two-stage risk assessment:

- **Stage 1: Natural climate variability**, where we run our river system models with the stochastic datasets. In the south coast regions, this stochastic dataset is derived solely from the observed climate data; in the rest of NSW, this stochastic dataset is derived from the observed climate and paleoclimate data. This stage identifies vulnerabilities and formulates and assesses options to address these vulnerabilities.

- **Stage 2: Natural climate variability combined with climate change**, where we run our river system models with the stochastic dataset adjusted for climate change. For all parts of NSW, we are using the same datasets as were used in Stage 1, adjusted using monthly factors derived from NARCliM modelled results. For the south coast, an additional approach will use stochastic datasets generated from the historical rainfall records, with the frequency of rainfall producing ECL events altered (as described above). This stage tests the resilience of the options assessed for Stage 1.

Expert review of method

To ensure the validity of the methods used, the NSW Minister for Water, Property and Housing commissioned the Office of the Chief Scientist and Engineer to convene an expert panel to review the method. The expert panel found that the method of using observational, paleoclimatic and stochastic modelled data, combined with an understanding of climate drivers and the factoring in of NARCliM projections is fit for purpose, consistent with best practice in this field and a major advance over the use of historical records and climate models alone. The expert panel noted that as this is an area where the science is still developing, an ongoing work program will be needed to continuously improve the method and keep up-to-date with new scientific findings.

Conclusion

This new data provides a much more accurate understanding of the frequency, duration and magnitude of extreme events. By using this data in our established computer models of NSW river systems, the effectiveness of existing water sharing arrangements can be tested and risks can be identified. This includes identifying risks such as urban centres running out of water for extended periods, insufficient water to maintain ecosystem health and a decline in the reliability of water supply for agriculture. These models can then be used to quantify the benefits of options identified to address these risks.

While this new approach provides a more comprehensive representation of future climate, it is important to note that there is always a level of uncertainty with this type of modelling, which needs to be taken into account as part of our decision-making and planning around water security. In some instances, it may mean focusing on managing risk through general preparedness and resilience, rather than firm predictions. As the science develops further, it may be possible to reduce or quantify some of these uncertainties.

Two-stage process for developing climate datasets

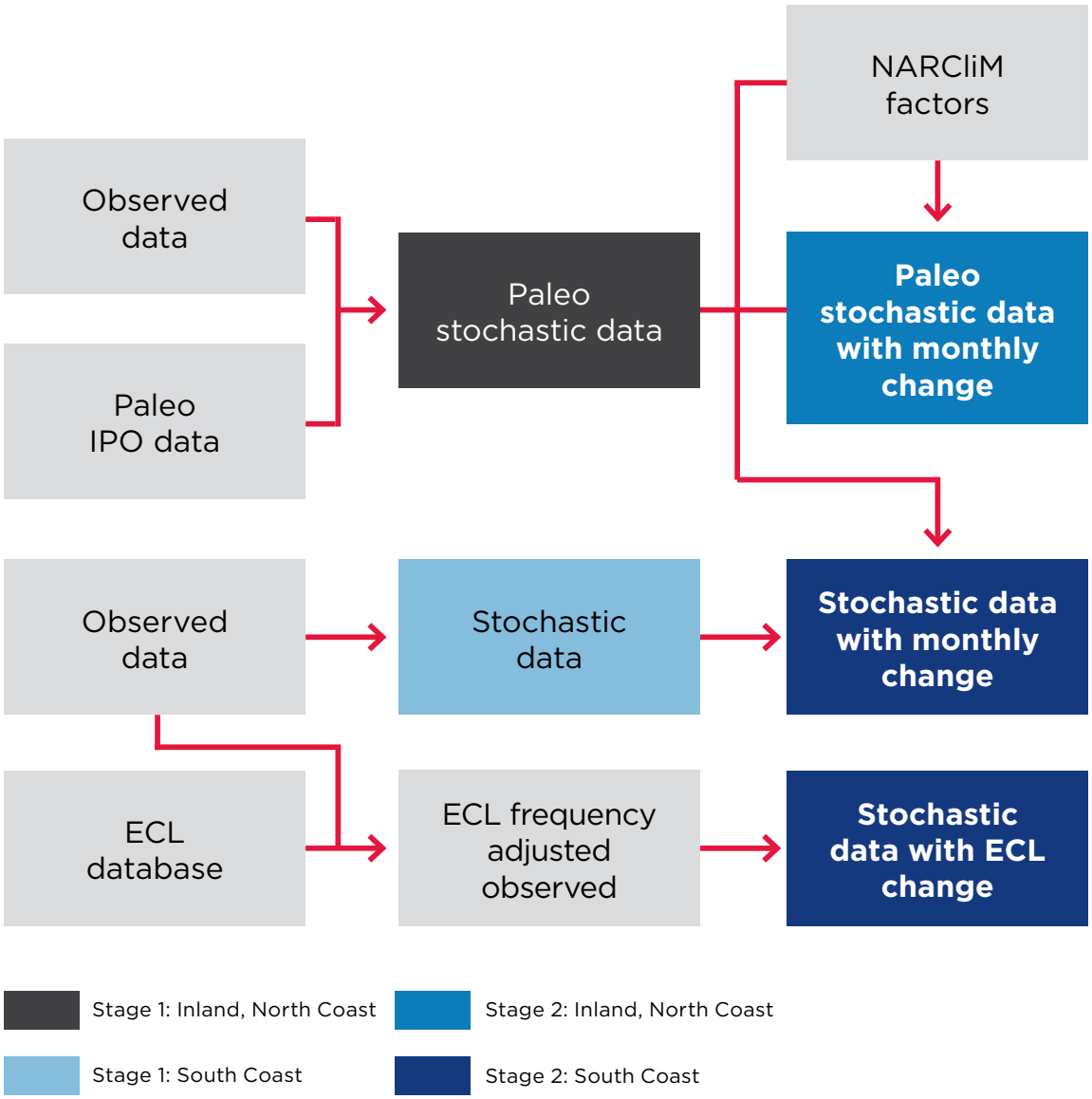


Image courtesy of Destination NSW.

Attachment 3

Hydrologic modelling approach

This attachment outlines the hydrologic modelling approach used to inform the regional water strategies. The new climate datasets described in Attachment 2 are used in these models to determine the expected behaviour of the river system.

How do models work?

Computer models of river systems are set up to reproduce the behaviour of the system over a long-term for planning purposes. They allow the physical and management aspects of a system to be represented enabling testing of management options.

The flows in, and diversions of water from, major river systems are the result of the:

- inter-relationships between the climatic conditions that produce inflows
- physical layout and behaviour of water in river channels
- infrastructure that controls and diverts river flows and the management rules that govern access to water
- behaviour of water users (including the environment).

Software packages with mathematical representations of these physical and management processes are used by modellers to build computer models for a river system.

Development of computer models (hereinafter referred to as hydrological models) involves a process of calibration where the modelled behaviour is matched as closely as possible

to recorded information. Initially, as much recorded information is used as possible and the model is calibrated to match river flow behaviour. The calibration process involves steadily replacing each piece of recorded data with a modelled representation, which aims to match the recorded data as closely as possible; in this way, the behaviour of dam storage is calibrated, then the behaviour of water users and finally the operation of water sharing rules. When the model is fully calibrated, it relies only on the input of rainfall and evaporation data to provide a representation of a full river system.

The Department of Planning, Industry and Environment has developed valley-scale hydrologic models for all of the major river systems in NSW. These models, which enable the assessment of water management reforms and infrastructure proposals, have been continually improved over the last 25 years in response to changing requirements, the availability of more data and improved methods of process representation, data collection and analysis.

The models used for the regional water strategies update the existing daily time-step modelling software used by the department since the 1990s, when it replaced older monthly time-step software. In addition to updating models to reflect current conditions as closely as possible, the regional water strategies program has invested in the development of an extended set of climate inputs, allowing a better understanding of the frequency and severity of drought, and the likely implications of future climate change (see Attachment 2).

Murray-Darling Basin states also agreed to have all models developed using common modelling software (Source) by 2024 to support integrated modelling across the Basin, adopt a consistent approach to modelling and foster a wider community of practice for hydrologic modelling. As a result, some of the models used for the regional water strategies are built using Source software, and some still use the earlier Integrated Quantity and Quality Model software.[11]

A hydrological model of a physical and management system (such as a river system) is never perfectly matched with recorded information. There are errors in data and constant changes in the natural behaviour of the system, the decisions made to manage the system and the behaviour of water users. To minimise the effect of any errors, options for analysis are compared against a baseline model, which aims to match the way the river is currently operated as closely as possible.

Selection of a baseline model

Models are configured to simulate water-related outcomes from various scenarios. A scenario is described by the climatic inputs (historic, future and stochastic), the physical systems (inflows, rivers, channels, storages, infrastructure, farms, floodplains and extractions) and the management system (water sharing, user behaviour, accounting, water trade and operational rules).

To support the assessment of major changes to water management, valley-scale models are configured to agreed scenarios that represent defined arrangements of the physical and management systems. These agreed scenarios represent arrangements at a particular point in time. They serve as a reference point for changes in both the scenario itself (such as a new dam or a change in policy) and the estimates of modelled outcomes (for example, long-term average increases by 2%).

Historical climate has traditionally been used when comparing scenarios. Using the same climatic sequence in both baseline and comparison models allows the analysis to identify changes in outcomes based on development and management only, not on whether the climate was wetter or drier. However, for each baseline scenario, a different climate input can also be used to assess outcomes across a wider range of climatic conditions.

11. Further information on surface water and groundwater models is provided here: www.industry.nsw.gov.au/water/science/modelling/surface-groundwater-models

Baselines used in NSW

New baselines have been developed over the last 25 years to deal with physical, economic and management system changes (such as changes in operation rules).[12] The following baselines have been developed over time[13] for the Murray-Darling Basin:

- The **1993/94 Cap** scenario was the first daily time-step model developed to manage compliance with the Cap set on diversions of water from the Basin.
- The 1993/94 Cap scenario, stripped of water management and water use details, provided a **pre-development** scenario: an approximation of natural conditions used to help understand and design environmental water requirements.
- The **water sharing plan limit** scenario was developed to support the implementation of water sharing plans from 2004. It is based on the 1993/94 Cap scenario and includes water management rules, reflected in the water sharing plans, designed to ensure long-term average annual diversions comply with the Cap.
- The Murray-Darling Basin Authority used NSW's water sharing plan limit models to determine how much water needed to be recovered for environmental purposes as part of the Basin Plan. This established the **baseline diversion limit** scenario. Revised baseline diversion limit scenarios are currently being reviewed by the Murray-Darling Basin Authority as part of the water resource plan process and will confirm final baseline diversion limits.
- At the time of the commencement of the Basin Plan in 2012, development and management conditions in the valley had changed considerably compared to those defined in the water sharing plans, and various components of the model were updated in the **pre-basin plan** scenario to account for more recent developments, user behaviour and system operational characteristics. Significantly, the pre-basin plan scenario recognises environmental water recovery—although the way in which this water is used was not clear when the models were developed, so the use of this water is not accurately modelled.
- The **sustainable diversion limit** scenario being submitted as part of the water resource plans is an updated version of the pre-basin plan model, reflecting environmental water recovery and water sharing plan rules.
- The **current conditions** scenario is an update of the sustainable diversion limit scenario, with most recent development and behaviour represented. The current conditions scenario will continue to evolve to represent ongoing changes in development and behaviour.

Status of baselines in NSW

The models are continually developing in response to current and emerging requirements. Most of the baselines described above were finalised some time ago and the later ones are still under development. Current status is as follows:

- 1993/94 Cap scenario: completed and approved by Ministerial Council for all valleys.
- Pre-development: completed for all valleys; no external approval required.
- Water sharing plan limit: completed for all valleys; updated for baseline diversion limit review.

12. Baselines are also updated to reflect improvements in model conceptualisation, data and understanding of the river system. Continuous improvement in models reduces uncertainties and increases functionality.
13. These baselines are essentially a logical progression that follows the evolution of physical, economic and management systems.

- Baseline diversion limit: updated plan limit models completed and under review by the Murray-Darling Basin Authority as a step to accepting revised baseline diversion limit estimates.
- Pre-basin plan: completed for all valleys; no external approval required.
- Sustainable diversion limit: at or near completion and reporting for submission of water resource plans to the Murray-Darling Basin Authority for accreditation.
- Current conditions: at various stages of development.

Ongoing model development

Major issues for finalising models are the representation of floodplain harvesting, improvement of modelling of environmental water use and the collection of data and modelling of contemporary development and operation.

In Northern Murray-Darling Basin valleys, floodplain harvesting needs to be represented in the baseline diversion limit, sustainable diversion limit and current conditions models.[14] This work is a multi-step process, with a representation of likely approvals and licences required to inform the floodplain harvesting decision process, and subsequent representation of the final configuration of licences and approvals when these are issued.

Environmental water use needs to be represented in the sustainable diversion limit and current conditions modelling runs. At present, environmental water recovered under the Murray-Darling Basin Plan is recognised in the models, but the rules governing the use of this water to achieve environmental outcomes are not accurately modelled. Improving the modelling of environmental watering decisions will allow a more accurate assessment of the options from an environmental point of view. Including this information requires getting an understanding from environmental water managers of how they make decisions regarding the use of held environmental water and discretionary planned environmental water.

The Water and Environment, Energy and Science areas of the Department of Planning, Industry and Environment are working together on this.

Changes to current conditions will continue to be required, as changes in operational decisions, economic conditions and climate result in changes to the way water users operate. This may take the form of changes in irrigation practices or changes in trading behaviour.

This work will continue to ensure appropriate information is available for options analysis as part of the regional water strategies process.

Relationship to Sustainable Diversion Limited Adjustment Mechanism Program (SDLAM)

A range of projects are under consideration in the Murrumbidgee, NSW Murray and lower Darling as part of the SDLAM Program. NSW executed a pre-construction stage funding agreement with the Australian Government in February 2019 to progress these projects. The projects, including modifications to Menindee Lakes and constraints, are in the early design phase with stakeholder engagement as the first priority. As further detail becomes available, models being used for regional water strategies will continue to be updated.

14. See: www.industry.nsw.gov.au/water/plans-programs/healthy-floodplains-project/harvesting

Coastal models

Coastal catchments have not been part of the Murray-Darling Basin Plan process and have not required the complex range of models prepared for inland catchments. In many coastal unregulated systems, water sharing plans were developed without models. The preparation of regional water strategies now requires the development of models for these catchments.

There are existing models in regulated coastal catchments and in some unregulated systems such as the Clarence and Bega Bemboka.

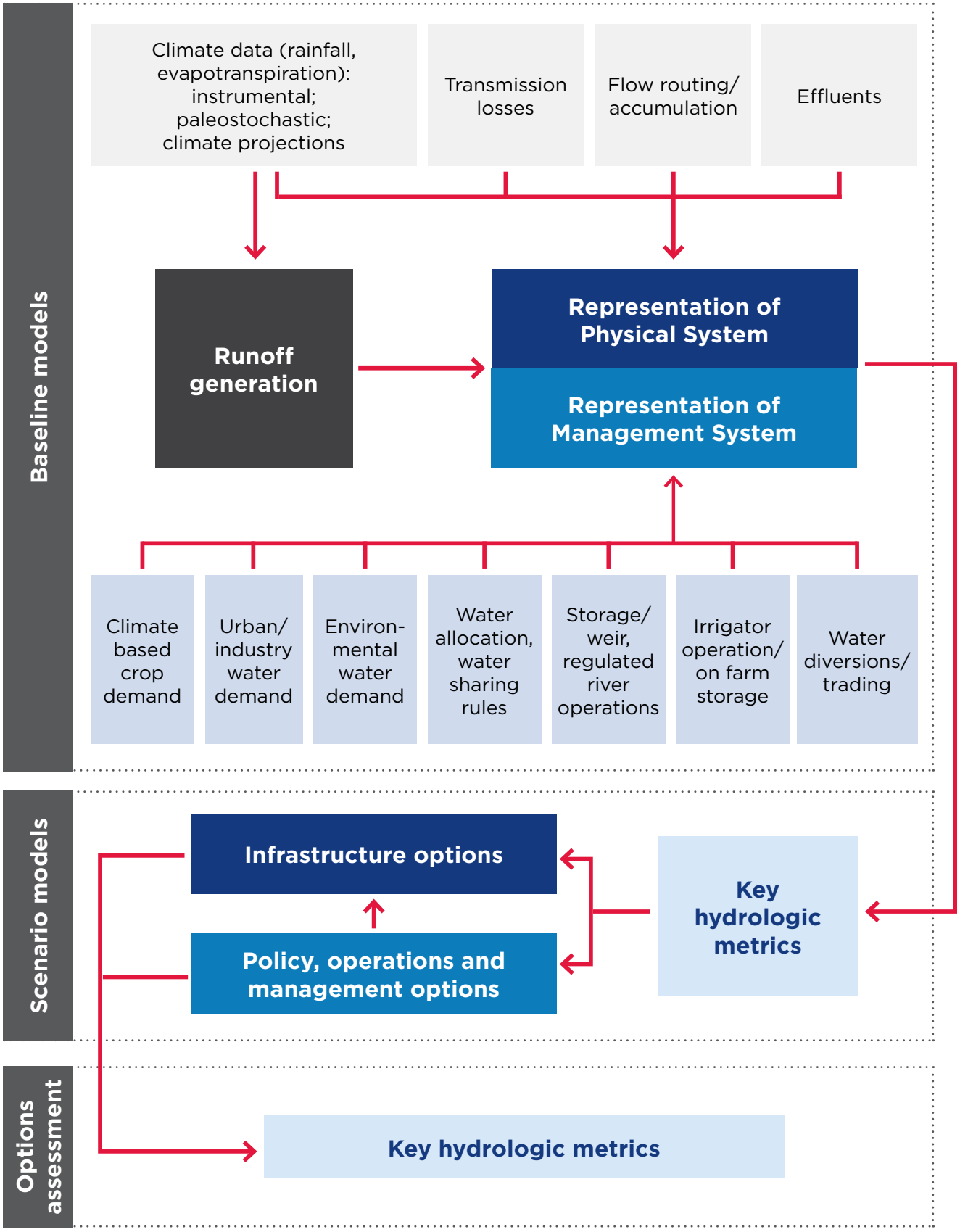
For all coastal catchments, a current conditions model will be prepared that represents current levels of irrigation development and existing water sharing plan rules. Unlike regulated inland systems, irrigation extraction data is often not available in these areas due to a lack of meters. As a result, it is expected that the confidence in modelling overall take volumes will be lower than for inland systems. However, the preparation of models will still allow a comparison between the current conditions base case and models established to test options identified through the regional water strategies process.

Baseline for regional water strategies

The **sustainable diversion limit** baseline scenario will be used for regional water strategies in the Murray-Darling Basin, as this is the most recent baseline scenario that conforms with statutory requirements.

New **current conditions** models will be developed for the coast.

Source modelling software for rivers: inputs



Attachment 4

Options assessment process

The draft regional water strategies include a comprehensive long list of options that could address identified challenges in the region and help to achieve the objectives of the strategies (see Figure 2 in this Guide).

This long list of options needs to be assessed and prioritised into a recommended portfolio of options to be presented in each final regional water strategy, along with an analysis of how these options will help to meet the region's challenges and maximise opportunities for towns and communities, industries and Aboriginal people. The options also need to be considered within the context of existing government commitments and reforms.

The challenges in assessing and prioritising the long list of options are:

- Some options will benefit one of the strategy's objectives, but conflict with other objectives.
- Not all options will have quantifiable costs and benefits.

The options assessment framework developed for the regional water strategies aims to address these challenges in a transparent, evidence-based and consistent way.

Developing the assessment framework

Expert Advisory Panel

An Expert Advisory Panel was commissioned to provide advice on a consistent, objective and transparent methodology to assess the long list of options. This group included:

- government representatives, including economics and water resource officers from NSW Government departments and agencies (including the Department of Premier and Cabinet, the Department of Planning, Industry and Environment, and Treasury)
- water economists from Frontier Economics, Marsden Jacobs Associates and The Centre for International Economics.

The Expert Advisory Panel considered three broad methodologies for examining the long list of options:

- **Cost effectiveness:** this methodology examines options according to the least cost method to achieve a desired objective. Cost effectiveness does not assign a value to outcomes but recommends options that achieve a desired objective based on their cost. The Expert Advisory Panel did not recommend this approach.
- **Multi-criteria analysis:** this methodology examines options according to a range of objectives. It does not attempt to translate all objectives into a common basis but applies weightings to each key dimension being examined. The Expert Advisory Panel did not recommend the multi-criteria analysis approach due to the arbitrary nature associated with weighting different criteria for the analysis.
- **Cost benefit analysis (CBA):** an evaluation technique that estimates the economic, social and environmental costs and benefits of a project or program in monetary terms. The CBA examines how the present value of total benefits compares to the present value of total costs. The Expert Advisory Panel noted that this methodology is an objective and transparent approach to quantifying the costs and benefits of the options being considered.

The Expert Advisory Panel recommended:

- CBA to evaluate options that relate to industry use of water, the reliability of water supply to towns and communities, and flood management and mitigation, and
- undertaking an ecological likelihood and consequence risk assessment to quantify the influence of an option on environmental outcomes.

The options assessment process aims to identify those options that will enhance the social and economic welbeing of each region. The process will not develop full business cases: these may be developed for individual options after consideration by the NSW Government.

Aboriginal outcomes

We are developing a framework to examine the impact of options on Aboriginal rights, interests and access to water. This process will be developed in consultation with peak Aboriginal groups.

Many of the options in the regional water strategies that aim to improve Aboriginal rights, interests and access to water will be considered through a state-wide package of water measures supported by a business case.

Options assessment process

The long list of options in each draft regional water strategy will be evaluated in four stages:

- **Stage 1:** Filter the long list of options to examine how the options need to be assessed. Options that impact on regional hydrology or other water users will then need to go through a hydrological modelling process.
- **Stage 2:** Set future expectations and shortlist options. Establish the best possible understanding of the amount of water available in the region in the future. Examine the costs and benefits of options, as well as their implications for ecological outcomes, groundwater and Aboriginal water rights, interests and access to water. This stage will result in a number of shortlisted options.
- **Stage 3:** Develop portfolios of the shortlisted options and undertake detailed analysis to understand whether the portfolio advances the objectives of the regional water strategies. This stage repeats Stage 2, but with more detailed hydrologic modelling and analysis.
- **Stage 4:** Recommend a preferred portfolio of options for each region, following advice from an independent Review Committee.

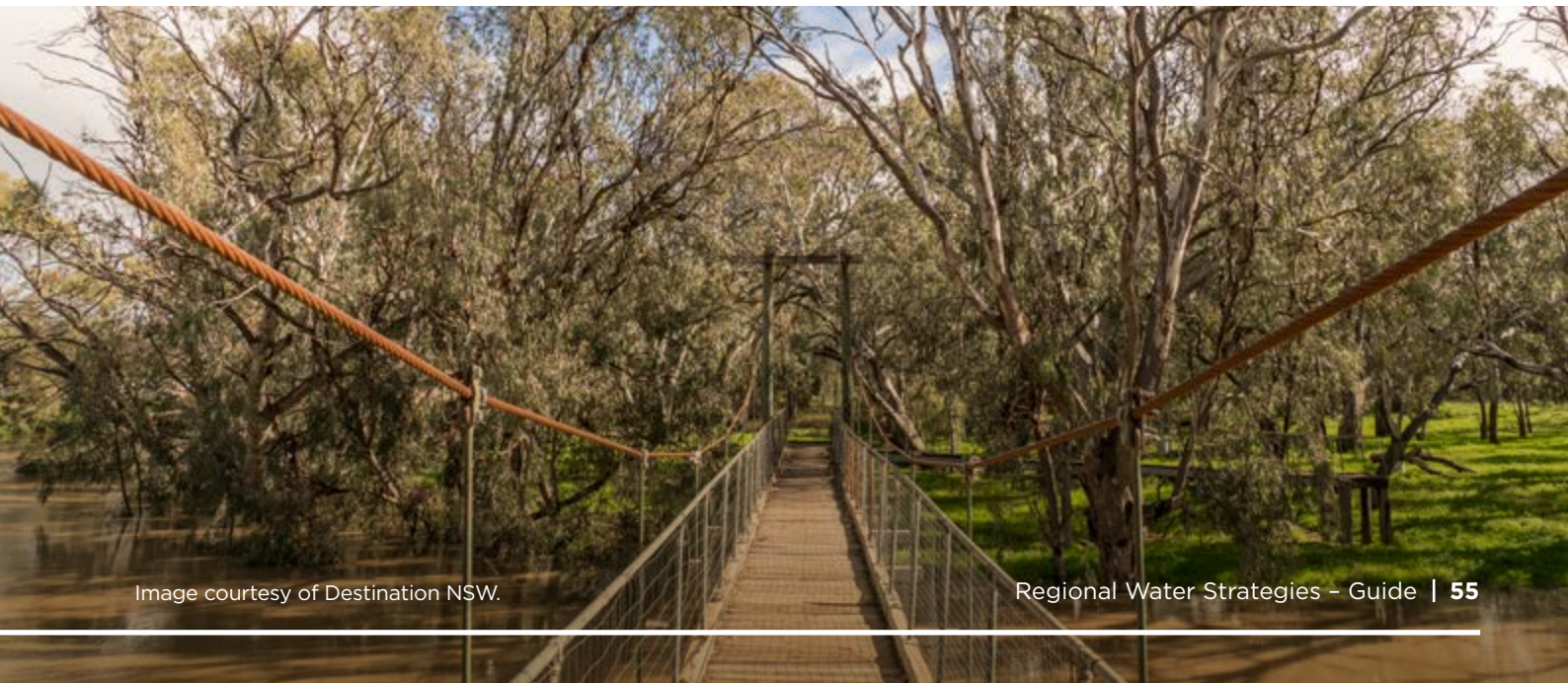


Image courtesy of Destination NSW.

High level options assessment structure

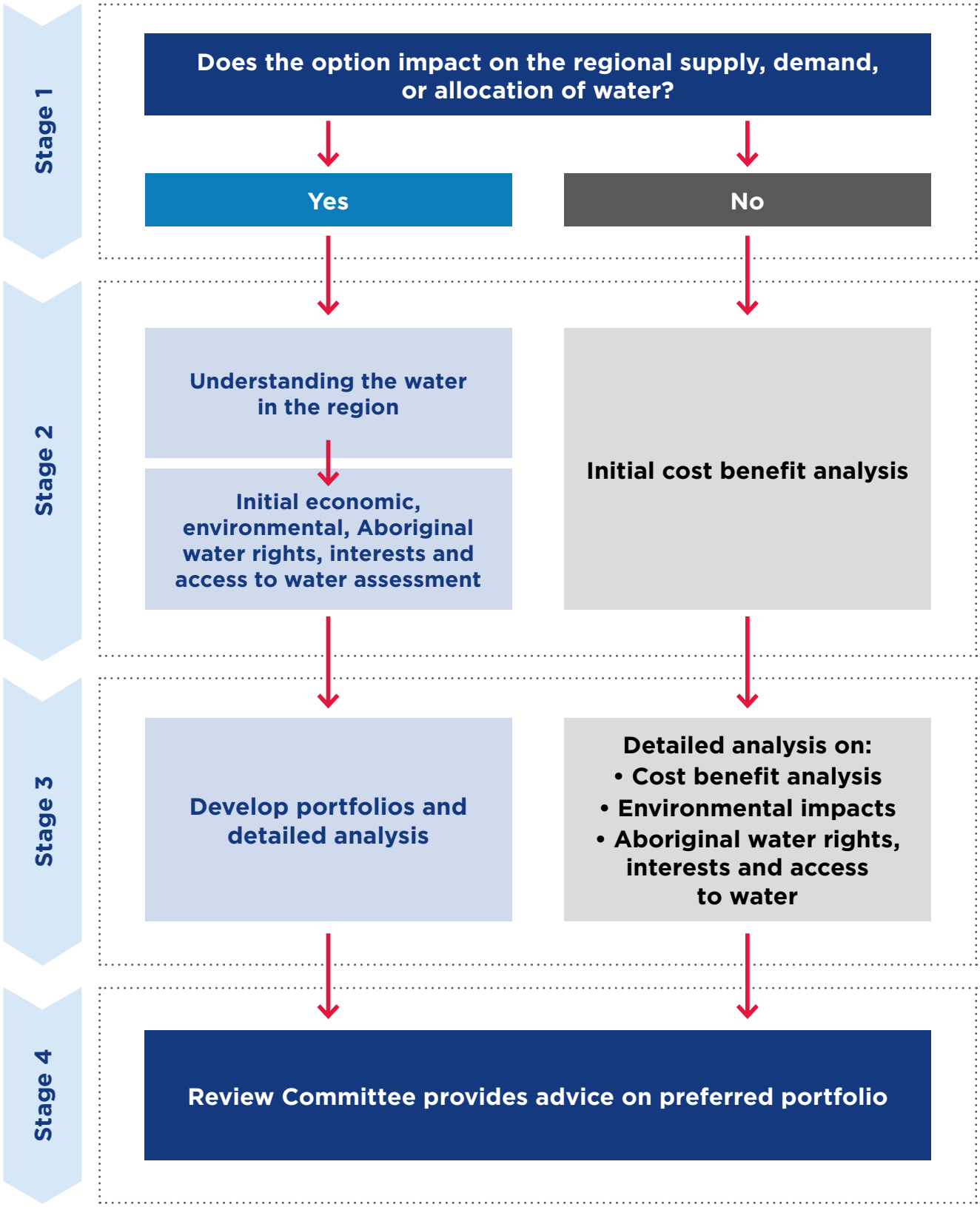


Image courtesy of Destination NSW.

Stage 1: Filtering the long list of options

Purpose: The purpose of this stage is to understand which assessment process each option will need to go through. This will involve understanding whether the option will impact on water availability in the region.

The first stage of the options assessment framework filters the long list of options according to those that have an influence on the amount of water available in a region or on the way in which water is allocated. Most of the water sources in New South Wales are considered to be fully allocated. That means that in these systems, any option that influences the supply of available water, or the use of water, has impacts on other parties—other water users, the community or the environment.

Options that influence the supply and demand for water require extensive hydrologic modelling to determine their influence on the other objectives of the regional water strategies. In Stage 2, the hydrologic 'base case' will be established. The hydrologic modelling being used for this stage is described in Attachments 2 and 3.

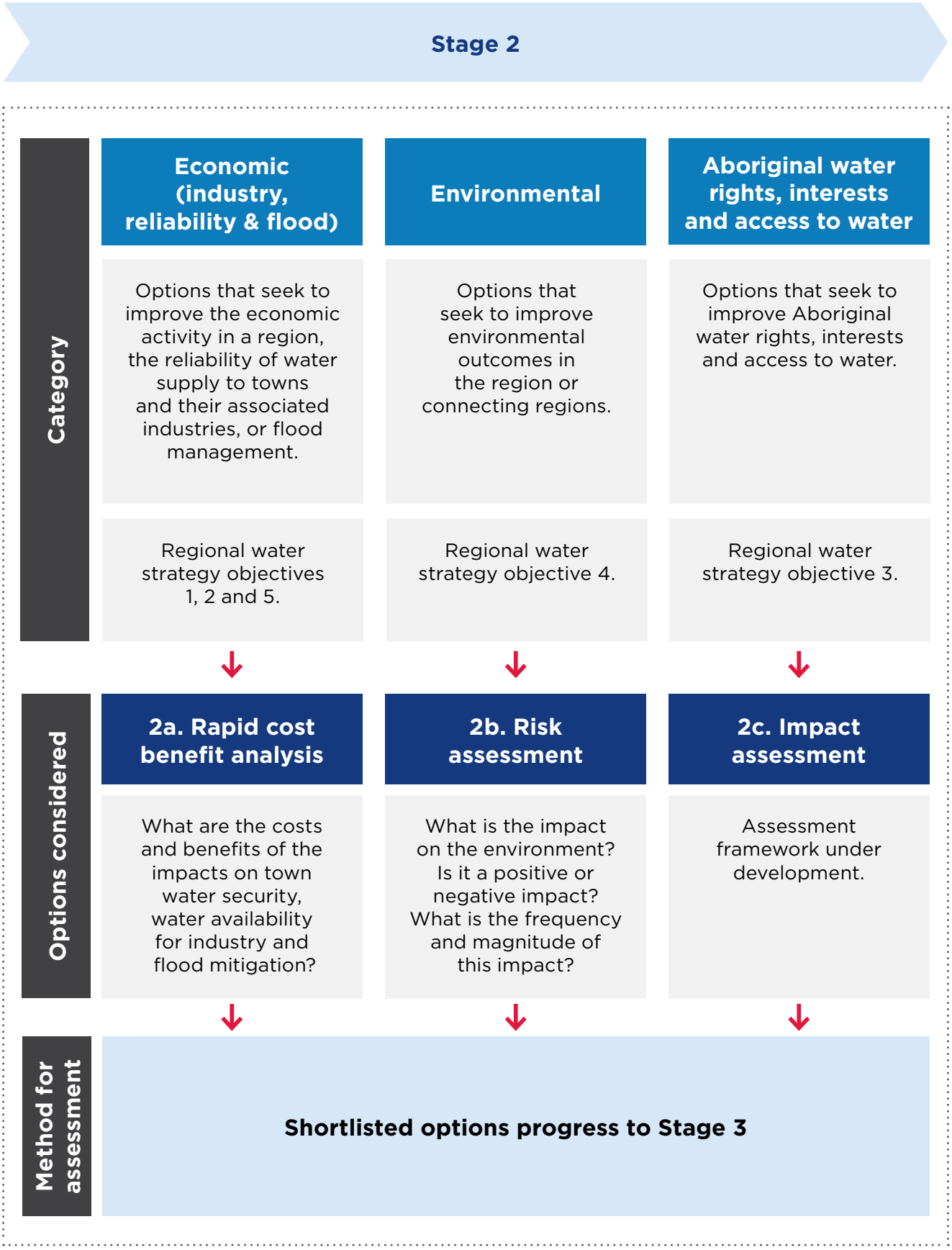
Options that do not influence the supply and demand for water can be assessed individually and do not require hydrologic modelling.

Stage 2: Shortlisting options

Purpose: The purpose of this stage is to understand which options are likely to be feasible. This will consider whether the option meets its main objective in such a way that the benefits it produces outweigh its costs. Detrimental impacts on other objectives will be extensively examined in Stage 3.

All options, irrespective of whether they influence the supply and demand for water or not, will be assessed on the basis of what they are trying to achieve and will be grouped into three broad categories: economic, environmental and Aboriginal water rights, interests and access to water.

Stage 2 of the options assessment process



Economic

A rapid cost benefit analysis will be used to assess options that influence the supply and demand for water in a region and also seek to improve the region's economic activity, the reliability of water supply to towns and communities, or flood management. The rapid cost benefit analysis will examine the cost estimate of the option, plus the benefits it produces, along with the hydrologic forecasts for the region. In addition, these options will be assessed by their:

- **Effect:** to what extent are the options expected to contribute to the objectives over the planning horizon and/or during extreme events (such as droughts, floods and water quality events)?[15]
- **Resource allocation and efficiency:** to what extent are the options likely to deliver efficient outcomes using minimum financial and physical resources?
- **Distribution of benefit:** is there likely to be a widespread community and/or regional benefit from the option, or is the benefit concentrated to a small number of users or localised to a particular area?
- **Feasibility:** to what extent is the option likely to be feasible, including regulatory/policy change, stakeholder acceptance, time to implement, alignment with NSW and Australian Government laws and policies and technical feasibility?

Options that produce positive net present values, or have a benefit cost ratio of greater than 1, will be shortlisted and progress to Stage 3.

Environment

Options that influence the supply and demand for water in a region and seek to improve environmental outcomes will be assessed on the following criteria:

- **Scale of ecological impact:** what is the area, or the number of assets, impacted by the change in water volumes?
- **Likelihood of ecological consequence:** how severely will the ecological assets in the region be affected by a change in the volume of water in the region?
- **Feasibility:** to what extent does the option meet the existing environmental water requirements and other environmental commitments, such as the long term watering plan?

These environmental outcomes will be assessed based on expert opinion and be limited to broad and general ecological impacts because the options are not yet fully developed. However, all options will be considered within the context of the long term watering plan as the basis for assessing whether there are likely to be positive or negative ecological impacts. Options that are likely to improve ecological outcomes will be progressed to the next stage.

Aboriginal rights, interests and access to water

The methodology to assess options that influence Aboriginal rights, interests and access to water is being developed in consultation with peak Aboriginal groups.

Options that do not have hydrological implications

Options that do not influence the supply and demand for water, but may have efficiency, water quality or groundwater impacts, will be assessed where possible using the same process described above. Options that fall into the Economic category will be assessed within the CBA framework and guidelines, and supplemented with ecological likelihood and consequence risk assessments and assessment of the impacts or benefits to Aboriginal water rights, interests and access to water, where applicable.

15. Our new modelling methods outlined in Attachments 2 and 3 of this Guide provide us with a better understanding of the risks of extreme events.

Shortlisting options

Shortlisted options will be those where the benefits they deliver to the region (economically, environmentally or for Aboriginal people) outweigh the impacts or costs of implementing that option.

To shortlist options, it is necessary to build a case that demonstrates why the option is needed and what benefits it will generate when implemented. The reasons and benefits of an option must be explicitly stated so that they can be assessed. Often the options aim to achieve multiple objectives and are competing for the same resources. In other instances, an option will meet its main objective but have negative impacts on other objectives. These options will still be shortlisted: their impacts on other objectives will be considered in Stage 3.

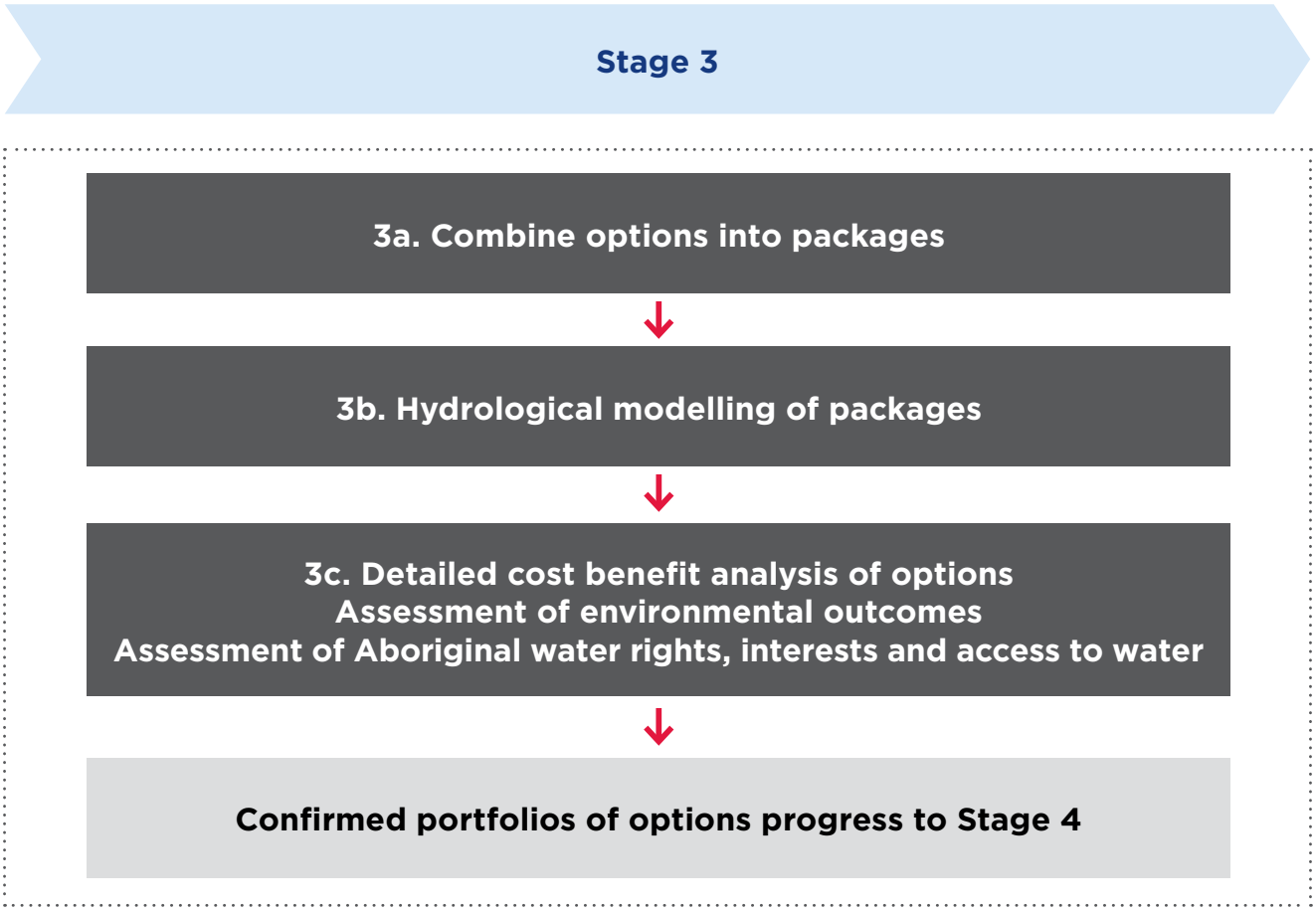
Existing government commitments will be automatically shortlisted.

Stage 3: Detailed analysis of options portfolios

Purpose: This stage will involve grouping options into portfolios and undertaking detailed analysis to understand which portfolios of options can achieve the best outcomes for the region, and offset negative impacts on the regional water strategy objectives.

For those options that influence multiple objectives of the regional water strategies, this stage involves undertaking more detailed hydrologic modelling to understand how the option will influence future conditions. This detailed modelling and further economic analysis is necessary to understand the full impact of each portfolio of options.

Stage 3 of the options assessment process



Combine options into portfolios

Options that have been shortlisted will be combined into portfolios. It is unlikely that a single option will be capable of addressing the identified risks across all the objectives in a region. Given this, the greatest benefits are likely to be realised by combining options that complement each other to improve the efficiency of the system, offset impacts or unlock greater benefits by using both policy and infrastructure levers.

Combining options into portfolios will include consideration of matters such as:

- Are options mutually exclusive or complementary (for example, can a policy option improve the outcomes of an infrastructure option) or substitutes?
- Which combinations minimise trade-offs between outcomes?
- Does the portfolio of options offer improved resilience (such as through diversification of water supplies)?

These portfolios will build on existing government commitments and investments. Existing government commitments will not be screened out through the shortlisting process and will be included in the portfolio of options where relevant.

Consideration will also be given to how the portfolios fit within the broader policy and strategic planning context around water in NSW, including:

- alignment with and opportunities to improve current NSW Government water policy, plans and reforms
- assistance in delivering NSW's commitments under the Murray-Darling Basin Plan
- integration with existing regional development and land use planning across NSW
- support for NSW Government commitments to improve the management of environmental water in the Northern Murray-Darling Basin and improve access to water for Aboriginal people.

Existing government commitments

1. Priority Infrastructure Projects approved by the NSW Government will not be subject to the prioritisation process. Examples of these projects include:
    - the upgrade of Wyangala Dam in the Lachlan valley
    - a new Dungowan Dam near Tamworth
    - a final business case for a new dam on the Mole River in the Border Rivers catchment
    - a final business case for a pipeline from Lake Rowlands to Carcoar Dam
    - a final business case for a re-regulating storage in the Macquarie River
    - drought projects.
2. Projects that are the subject of Commonwealth–State agreements will also not be subject to screening out. This includes Sustainable Diversion Limited Adjustment Mechanism Projects (for example, Menindee Lakes) and the Northern Basin Toolkit Measures (for example, Gwydir constraints).

The regional water strategies will assist with implementing these commitments. However, these projects will be included in the suite of options being assessed to understand whether they could benefit from being packaged with other options proposed as part of the regional water strategies.

Hydrological modelling of portfolios

Detailed hydrological modelling will be undertaken on the portfolios of options to understand:

- how the options change water availability and timing of water availability
- the distribution of costs and benefits resulting from changes
- how these options will perform when assessed against different climate scenarios.

Detailed cost benefit analysis of portfolios of options

This analysis will comply with NSW Treasury's Guide to Cost Benefit Analysis[16] and will include:

- assessing the economic costs and benefits of each portfolio of options using a hydroeconomic modelling framework that reports on the following economic measures:

  - **Expected Net Present Value (NPV)**: this is the Present Value (PV) of economic benefits delivered by the portfolio less the PV of economic costs incurred. NPV measures the expected benefit (or cost) to society of implementing the portfolio expressed in monetary terms

  - **Benefit Cost Ratio (BCR)**: this is the ratio of the PV of economic benefits to the PV of economic costs. The BCR identifies the portfolio that provides the highest benefit per unit of cost

- examining the distribution of benefits across different user groups including the various categories of licence holders such as high security, general security, mines, town water supplies, supplementary users and the environment.

For options that do not influence the supply and demand for water in a region, a more detailed examination of their costs, the distribution of benefits and the effectiveness of the option will be undertaken. Since these options do not influence other objectives of the regional water strategies, their assessment does not require hydrologic modelling and they can be combined with any portfolio of options.

Assessment of environmental outcomes

The analysis will not seek to monetise the costs and benefits of environmental impacts in the timeframe of the regional water strategies because these are difficult and subject to a number of limitations. This means that the environmental likelihood and consequence risk assessment will be quantified in hydrological metrics, which will be used to supplement the economic assessment.

In this stage, each of the shortlisted options will be hydrologically modelled and the results will be compared to the base case to identify changes in the volume of water across indicator sites for a number of relevant flow metrics. This will allow eco-hydrologists to conduct a detailed assessment of the likely ecological impacts of the options and give each option an impact rating. The assessment rating will be based on the criteria listed above under Stage 2: scale, likelihood and feasibility.

Assessment of Aboriginal rights, interests and access to water

The regional water strategies team will engage with peak Aboriginal bodies to determine an appropriate methodology for assessing the influence of options on Aboriginal water rights, interests and access to water.

16. More information is available at: www.treasury.nsw.gov.au/finance-resource/guidelines-cost-benefit-analysis

Stage 4: Recommending a preferred portfolio of options

Purpose: This step will involve determining which portfolios could:

- **generate the most value for the region**
- **be implemented as planned, delivered to time and budget and produce the expected benefits.**

Ranking portfolios

The final step in the assessment process is to identify a preferred portfolio of options for each regional water strategy. Existing government commitments will be included in the recommended preferred portfolio. To do this, the assessments of environmental outcomes and impacts on Aboriginal outcomes undertaken in Stage 3 will be used in conjunction with the analysis and findings of the detailed CBA conducted in Stage 3.

The results of the detailed CBA will be reported as expected net present values (NPV) or benefit cost ratio (BCR). Options with the highest NPV and BCR will be ranked. However, these results then need to be reassessed and adjusted based on the results of the assessments of environmental outcomes and impacts on Aboriginal outcomes.

The assessment of environmental outcomes and Aboriginal outcomes will be incorporated into the economic assessment framework by using a criteria and scoring framework. This approach scores and ranks the environmental and Aboriginal assessment results on a pre-determined scoring scale. Then, the options are compared with the net present value of the economic outcomes.

The preferred portfolios for each region will aim to achieve a balance across all five objectives set for the regional water strategies.

Managing risks from subjectivity

The method of options assessment being used for the regional water strategies has a subjective and qualitative element. An independent Review Committee will be constituted to evaluate the quantitative and qualitative assessments of the different portfolio of options and recommend a preferred portfolio for consideration by the NSW Government. Given the broad range of the regional water strategies objectives, this committee will include people with economic and eco-hydrology expertise, along with members with extensive experience in regional areas to bring regional perspectives, and a member to bring Aboriginal perspectives to the assessment. This will help to ensure that the preferred portfolios of options recommended in each final strategy are robust, address the region's challenges and maximise opportunities.

Image courtesy of Destination NSW.

Attachment 5

Previous and existing studies informing the regional water strategies

State Infrastructure Strategy (SIS) 2014 and 2018

A Catchment Needs Assessment Framework was developed as part of the SIS 2014.[17] The Framework assessed each NSW regulated river valley against the four water management challenge indices:

- Drought Security Index—a likelihood indicator of low water allocations.
- Flow Utilisation Index—a likelihood indicator of annual flow supporting greater use.
- Flood Management Index—a likelihood indicator of dams capturing large flow events.
- Delivery Efficiency Index—a likelihood indicator of water delivery losses being reduced.[18]

These indices are quantitative and were calculated the same way for each of the regulated river valleys based on river modelling using the last 125 years of climatic data and current asset performance.[19] The indices highlighted some broad challenges in the regulated systems, which are the starting point for understanding the challenges that need to be addressed by regional water strategies.

The results of the assessment were used to identify which regions should be prioritised for the development of regional water strategies:

> *In summary, this needs analysis identified the highest priority inland river catchments as the Gwydir, Macquarie-Castlereagh and Lachlan. All three catchments have low Irrigation Drought Security due to low/variable rainfall, high evaporation and limited storages. This combination of climate, topography and existing asset performance indicates the potential need for augmentation of, or investment in, additional storage capacity to improve water security. In both the **Gwydir** and the **Macquarie**, Delivery Efficiency is also a priority; for the **Lachlan**, Flood Management is also a priority, given the lack of airspace in existing dams.*[20]

The regional water strategies objectives build on and extend the Catchment Needs Assessment Framework. Improving the health and integrity of environmental systems and assets (including by improving water quality) and recognising and protecting Aboriginal rights, interests and access to water (including Aboriginal heritage assets) are now key objectives of the strategies.

The SIS 2018 supported the direction of the 2014 SIS with the following strategic objective:

> *Support the growth, productivity and liveability of metropolitan and regional communities by ensuring that water security, quality and wastewater services protect public health and the environment.*[21]

WaterNSW water security investigations

At the request of the NSW Government, WaterNSW has undertaken water security investigations for the priority regions of the Gwydir, Macquarie and Lachlan over the last four years.

As part of these investigations, WaterNSW has produced options and some preliminary studies to manage the risks identified in the SIS 2014 Catchment Needs Assessment Framework. These investigations have been an important source of information in the development of the draft regional water strategies and the preparation of the long list of options presented in each draft strategy.

It is also important to note that we now have access to an extended climate dataset that can be incorporated into updates of the hydrological models used by WaterNSW and other agencies (see Attachments 2 and 3). The new modelling can be used to assess the merits of the infrastructure options explored by WaterNSW in preliminary business cases.

Work to meet Murray-Darling Basin Plan commitments

Under the Murray-Darling Basin Plan, NSW must comply with the long-term limits on extraction—sustainable diversion limits (SDLs)—and ensure that our resource assessment process and allocation framework does not result in a growth in use above the SDLs set for each valley. The enforcement of SDLs commenced on 1 July 2019.[22] NSW also has other obligations under the Basin Plan, including 'no net reduction' in the protection of planned environmental water[23] and no growth in water use in the Murray-Darling Basin in NSW.

Regional water strategies will need to make sure that each valley remains within the SDLs, while still meeting the overarching objectives and addressing water challenges.

Long term water plans

Long term water plans are part of the NSW Government's commitment to implementing the Murray-Darling Basin Plan. The plans aim to improve the way water is managed to maximise river and wetland health outcomes within and between catchments.[24]

The plans set objectives, targets and watering requirements for key plants, waterbirds, fish and system functions. They draw together local, traditional and scientific knowledge to guide the management of water for the environment over the longer term.

Nine long-term water plans are being developed for catchments across NSW, setting objectives for five-, 10- and 20-year timeframes. This process provides an opportunity to take a more strategic, coordinated and catchment-wide approach to water management—improving outcomes for the length of the rivers and delivering Basin-scale benefits over an extended timeframe.

Water resource plans

Water resource plans show how NSW will comply with the limits set on the volume of surface water and groundwater that can be taken and used in catchments. The Basin Plan requires 22 water resource plans to be developed in NSW.

These plans reflect arrangements in NSW for sharing water for consumptive use and the State's rules for meeting environmental and water quality objectives. They also take into account potential and emerging risks to water resources.

17. State Infrastructure Strategy (SIS) 2014, p93
18. SIS 2014, p85 and SIS 2018, p161
19. SIS 2014, p84
20. SIS 2014, p86, emphasis added
21. SIS 2018, p156
22. www.mdba.gov.au/basin-plan-roll-out/basin-wide-compliance-review/sustainable-diversion-limit-reporting-compliance
23. Planned environmental water is water committed for fundamental ecosystem health or other specified environmental purposes. Planned environmental water rules are written into water sharing plans and cannot be taken or used for any other purpose. More information is available at: www.industry.nsw.gov.au/water/plans-programs/water-resource-plans/general-resources
24. www.environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans

Regional economic development strategies (REDS)

The NSW Government has assisted local councils to develop REDS based on the concept of a Functional Economic Region, which usually incorporates more than one local government area.[25]

The REDS provide a clear economic development strategy for the region. They also enable faster access to dedicated state funding, such as the Growing Local Economies Fund, and may also be used to support other types of government grant applications.

NSW Government Safe and Secure Water Program

In the SIS 2018, Infrastructure NSW recommended that the Department of Planning, Industry and Environment (in consultation with NSW Health) develop a risk-based approach to identify priority infrastructure projects that protect drinking water safety for regional NSW towns.[26]

The Safe and Secure Water Program was established in August 2017 to address key risks to regional water safety and security in NSW and to provide safe, secure and sustainable water and wastewater services to regional NSW towns.

The program was established under the NSW Government's Restart NSW Fund. Although the investment so far has delivered significant benefits, reviews of the program identified potential improvements to better target the available funding.[27] In October 2018, the program was relaunched with new criteria designed to:

- prioritise projects that address the highest risks and issues for water services in regional NSW
- ensure a minimum level of service in smaller towns where the cost of critical infrastructure outweighs the economic benefits provided
- provide more flexibility by including non-infrastructure options, where this is cost-effective.[28]

The revised Safe and Secure Water Program uses a prioritisation framework developed in partnership with NSW Health, the Office of Local Government and the Environmental Protection Authority.

Information gathered as part of the program has helped to determine the water security risks for municipalities across regional NSW and also informed the development of options for the draft regional water strategies.

Local water utility integrated water cycle management strategies and plans

Local water utilities are required to develop integrated water cycle management strategies and plans under the NSW Government's best-practice management guidelines.

Since 2004, local water utilities have been completing integrated water cycle management plan studies for the communities within their area of operation. The strategies include 30-year asset management plans, financial plans and drought and emergency response contingency plans. Integrated water cycle management plan strategies:

25. www.dpc.nsw.gov.au/programs-and-services/centre-for-economic-and-regional-development/projects/regional-economic-development-strategies/
26. State Infrastructure Strategy 2018, recommendation 87, p164
27. www.industry.nsw.gov.au/water/plans-programs/infrastructure-programs/safe-and-secure-water-program/about
28. www.industry.nsw.gov.au/water/plans-programs/infrastructure-programs/safe-and-secure-water-program/about

- set a Levels of Service framework , which links objectives, performance standards and associated performance indicators for the utility's water and sewer business
- identify needs and issues with respect to water security, water quality improvement, sewage management and distribution/ collection system works based on evidence and sound analysis
- identify the 'right' water supply and sewerage scheme options and 'right sizes' of the associated infrastructure components and non-build measures
- determine the investment priority in consultation with the community and stakeholders
- identify the 'best value 30-year' integrated water cycle management scenario on a triple bottom line basis.

These evidence-based resourcing approaches aim to provide appropriate, affordable, cost-effective and sustainable urban water services that meet community needs, and protect public health and the environment.

For example, Parkes Shire Council's integrated water management strategy identifies town water supply security risks and regulatory risks related to wastewater discharge as key risks for the town. The Parkes Integrated Water Cycle Management Plan describes climate change as the key issue potentially affecting town water supply security. Other drivers include population growth and ageing infrastructure.

The strategy recognises the opportunity for local councils in the region to improve town water supply security through the development of a water grid.

Regional centres such as Parkes have already embraced water recycling as a non-potable water source. In October 2019, a solar powered water recycling system was launched in Parkes, capable of producing two megalitres of water per day. The system will be used to irrigate parks and public spaces, relieving stress on the town's water supply.

The expansion of water recycling operations will continue to reduce the demand on drinking water sources and support regional communities across NSW. Local evidence and experience related to water re-use and recycling has informed the development of options for the draft regional water strategies.

NSW Fish Passage Strategy

The NSW Fish Passage Strategy aims to deliver a coordinated, strategic approach to fish passage remediation to maximise ecological, social, and economic outcomes decades in advance of the current legislative approach.

The strategy is a coordinated 20-year plan to proactively restore unimpeded fish passage to 165 high priority weirs, which will significantly improve native fish access to nearly 9,000 km of mainstream rivers and key off-channel habitats below all major storage dams in the State.

Marine Estate Management Strategy (MEMS)

The MEMS outlines how to protect and enhance NSW's marine estate over the next ten years.

It has initiatives and actions aimed at addressing priority threats to the marine estate environment and its dependent communities.

Coastal regional water strategies are considering the objectives of the MEMS and the outcomes it is seeking through its management initiatives. They are also drawing on the comprehensive analysis of coastal region threats assessed through the MEMS Threat and Risk Assessment, specifically those that apply to upstream water resources.

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