

Regional Water Strategy

Far North Coast

June 2023



Published by NSW Department of Planning and Environment
dpie.nsw.gov.au

Title Regional Water Strategy

Sub-title Far North Coast

First published June 2023

Department reference number PUB23/410

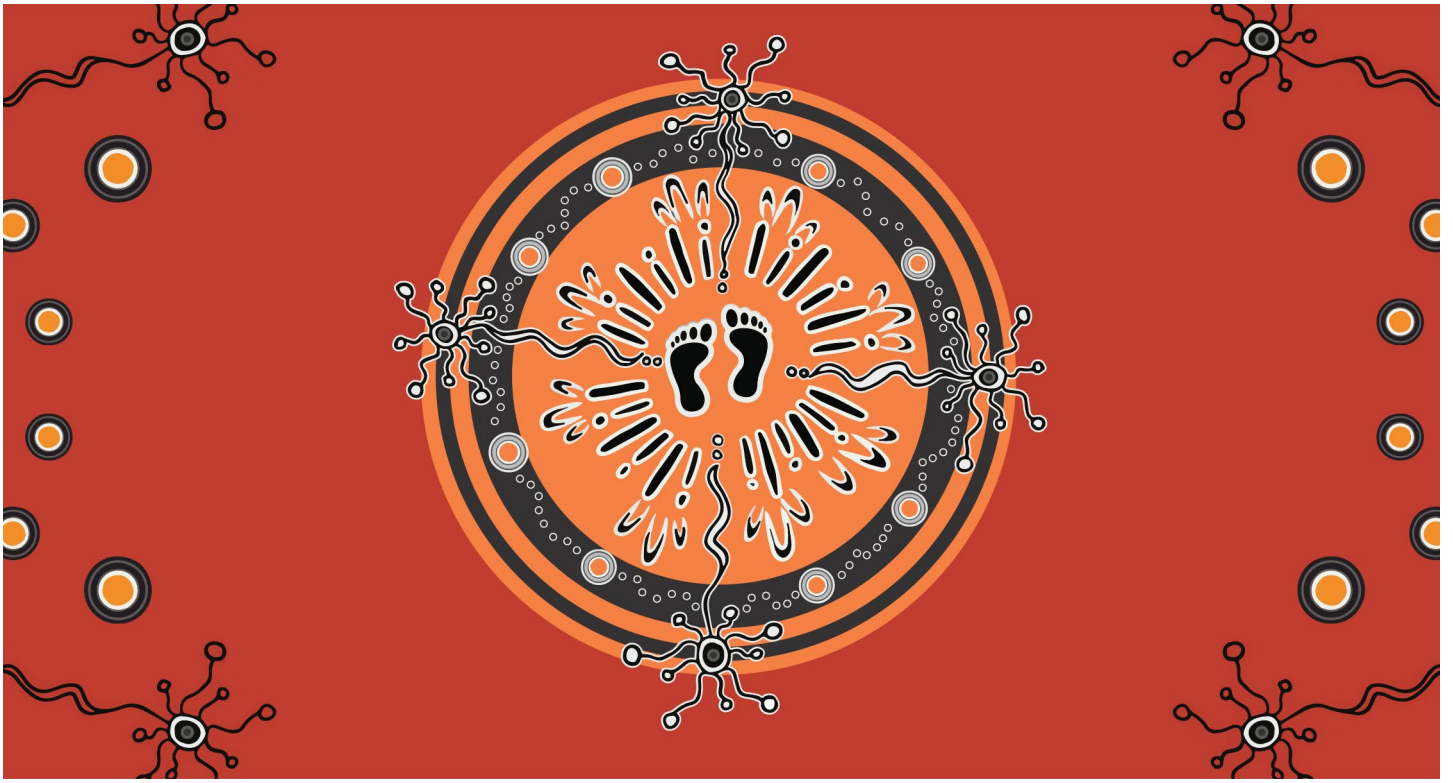
Cover image Image courtesy of Destination NSW. Tweed Valley, Murwillumbah.

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Acknowledging First Nations people

The NSW Government acknowledges First Nations people as the first Australian people and the traditional owners and custodians of the country's lands and water. First Nations people have lived in NSW for over 60,000 years and have formed significant spiritual, cultural, and economic connections with its lands and waters.

Today, they practise the oldest living culture on earth.

The NSW Government acknowledges the Bundjalung and Githabul people from the Far North Coast region as having an intrinsic connection with the lands and waters of the Far North Coast Regional Water Strategy area. The landscape and its waters provide the First Nations people with essential links to their history and help them to maintain and practise their traditional culture and lifestyle.

We recognise the First Nations people/Traditional Owners as the first managers of Country. Incorporating their culture and knowledge into management of water in the region is a significant step towards closing the gap.

Under this regional water strategy, we seek to establish meaningful and collaborative relationships with First Nations people. We will seek to shift our focus to a Country-centred approach, respecting, recognising and empowering cultural and traditional Aboriginal knowledge in water management processes at a strategic level.

We show our respect for Elders past and present through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places where First Nations people are included socially, culturally and economically.

As we refine and implement the regional water strategy, we commit to helping support the health and wellbeing of waterways and Country by valuing, respecting and being guided by First Nations people/Traditional Owners, who know that if we care for Country, it will care for us.

We acknowledge that further work is required under this regional water strategy to inform how we care for Country and ensure First Nations people/Traditional Owners hold a strong voice in shaping the future for First Nations communities.

Artwork by Nikita Ridgeway.

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Image courtesy of Destination NSW. Koonyum Retreat, Mullumbimby.

About the Far North Coast Regional Water Strategy

1

Image courtesy of Destination NSW. Murwillumbah district, Northern Rivers.

Secure, reliable and resilient water sources are critical to regional communities in NSW. They contribute to the appeal and prosperity of rural areas, and regional towns and cities. They create cultural connections to Country and support community wellbeing. They create healthy rivers, healthy farms and healthy communities. Water in the right places at the right times is also vital for healthy regional landscapes and sustainable ecosystems.

Changing water demand, increased climate variability and shifting community expectations mean we need to plan for and invest in improved long-term regional water security. The Far North Coast Regional Water Strategy identifies the key regional challenges we need to tackle over the coming decades and outlines the actions we will undertake to respond to those challenges. The best and latest climate evidence, along with a wide range of tools and solutions, has been used to chart a progressive journey for our water needs for the next 20 years and beyond.



Image courtesy of iStock. Mullumbimby, NSW.

The regional water strategies

Across NSW, valuable and essential water resources are under pressure. A more variable climate, as well as changing industries and populations, mean we face difficult decisions and choices about how to balance the different demands for this vital resource and manage water efficiently and sustainably into the future.

The Far North Coast Regional Water Strategy is one of a suite of catchment-based strategies across the state (Figure 1). The strategies clarify the water-related risks and challenges facing each region in NSW and outline how we can best prepare for the future. The strategies identify critical challenges that we need

to tackle over the coming decades and outline the priorities and actions that we will undertake to respond to those challenges.

The aim is for each regional water strategy to have a comprehensive, balanced package of options that delivers on a clear set of objectives. There is a natural synergy between these objectives, which we understand more fully after engaging with primary producers, local communities, Aboriginal people and environmental stakeholders. The actions in the Far North Coast Regional Water Strategy include complementary actions across all stakeholder groups and aim to deliver benefits to all of these groups.

Figure 1. Map of NSW regional water strategy regions



Objectives of regional water strategies

Regional water strategies set out long-term ‘roadmaps’ of actions to deliver 5 key objectives (Figure 2). Each regional water strategy describes the key challenges that affect our ability to achieve the objectives and identifies priority actions that address the challenges. Our aim is that each regional water strategy has a comprehensive, balanced package of options that delivers on all the regional water strategy objectives and aligns with the priorities and actions of the NSW Water Strategy.

When formulating plans to share water, the NSW Government must take all reasonable steps to prioritise the protection of water sources and their dependent ecosystems.¹ During extreme events, such as drought, our focus is on securing water for critical human needs. At these times, under section 60 of the *Water Management Act 2000*, critical human needs are the first priority and the environment is the second priority. Outside of these extreme events, we have greater flexibility to deliver across all the objectives.

Figure 2. Regional water strategy objectives



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

The regional water strategy's response to flooding

The role of regional water strategies is to support the delivery of healthy, reliable and resilient water resources that sustain a liveable and prosperous region.

Local councils are primarily responsible for managing flood risks in their local government areas. The Department of Planning and Environment is the lead NSW flood risk management agency. It provides technical advice and financial support to assist councils' flood risk management activities.

Further improvements to flood risk mitigation have been considered through the 2022 NSW Flood Inquiry and the NSW Government's response to the inquiry.²

The actions in the Far North Coast Regional Water Strategy can complement holistic flood management taking place through these channels. Actions such as improving flood risk management (Action 4.4) will support Far North Coast councils to meet the challenges associated with flooding.

Flooding and flood risk management are discussed under *Challenge: Flood risks to individuals, businesses and communities*.



Image courtesy of iStock. Flooding near Lismore, NSW.

2. Available at www.nsw.gov.au/nsw-government/projects-and-initiatives/floodinginquiry

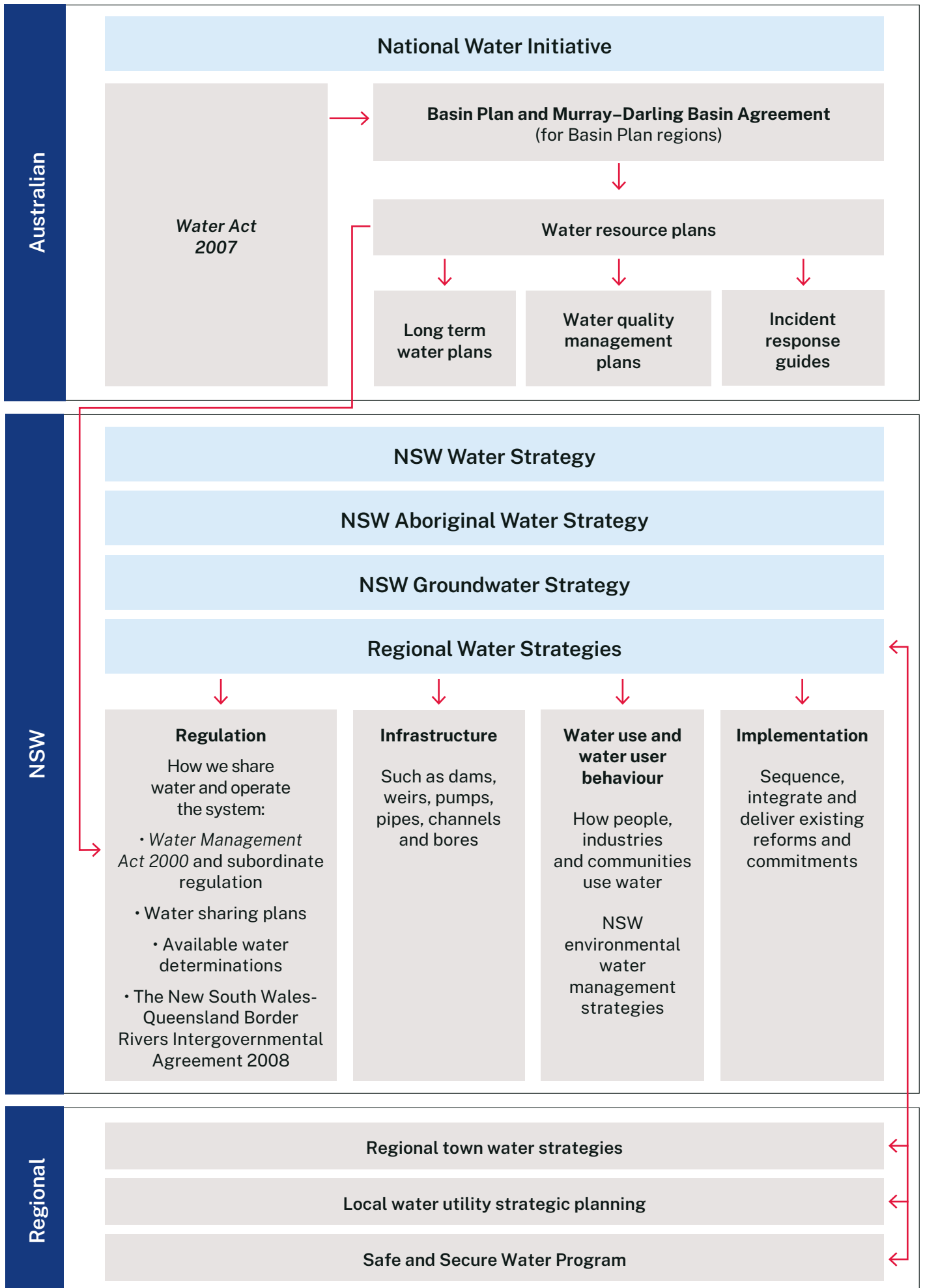
How regional water strategies interact with other water plans and policies

Each regional water strategy across the state sits within a broader policy and planning context, including a range of policies and plans that guide the management of water resources in NSW (Figure 3).



Image courtesy of Destination NSW. Cape Byron Lighthouse, Byron Bay.

Figure 3. NSW water policy and planning context



The strategic planning framework for water management in NSW includes the NSW Water Strategy,³ which is underpinned by a range of catchment-based regional and metropolitan water strategies. The NSW Water Strategy was developed in parallel with these strategies and guides the strategic, state-level actions that we need to take. The regional water strategies prioritise how those statewide actions, as well as other region-specific, place-based solutions, are to be staged and implemented in each region.

As part of delivering the NSW Water Strategy, the NSW Government is delivering other statewide strategies and programs including:

- the NSW Aboriginal Water Strategy – co-designed with Aboriginal people to identify a program of measures to deliver on First Nations’ water rights and interests in water management

- the NSW Groundwater Strategy – to ensure sustainable groundwater management across NSW⁴
- the Town Water Risk Reduction Program – to identify long-term solutions to challenges and risks to providing water supply and sewerage in regional towns in collaboration with local councils⁵
- a new statewide Water Efficiency Framework and Program – to reinvigorate water use efficiency programs in our cities, towns and regional centres.⁶

The NSW Water Strategy and the Far North Coast Regional Water Strategy also complement other whole-of-government strategies, including the *20-Year Economic Vision for Regional NSW*,⁷ the *State Infrastructure Strategy*⁸ and the *North Coast Regional Plan 2041*.⁹



Image courtesy of iStock. Brunswick River, NSW.

3. Department of Planning, Industry and Environment 2021, *NSW Water Strategy*, dpie.nsw.gov.au/water/plans-and-programs/nsw-water-strategy/the-strategy

4. Department of Planning and Environment 2022, *NSW Groundwater Strategy*, dpie.nsw.gov.au/water/plans-and-programs/nsw-groundwater-strategy

5. More information is available at: dpie.nsw.gov.au/water/plans-and-programs/town-water-risk-reduction-program

6. More information is available at: dpie.nsw.gov.au/water/plans-and-programs/water-efficiency/framework

7. NSW Government 2021, *A 20-Year Economic Vision for Regional NSW*, nsw.gov.au/a-20-year-economic-vision-for-regional-nsw-refresh

8. Infrastructure NSW 2022, *Staying Ahead: State Infrastructure Strategy 2022–2042*, infrastructure.nsw.gov.au/expert-advice/state-infrastructure-strategy

9. More information is available at: www.planning.nsw.gov.au/Plans-for-your-area/Regional-Plans/North-Coast

Local water utility strategic planning

Regional water strategies are region- or catchment-wide strategic plans. They set regional strategic direction to achieve water security across multiple councils and the entire catchment.

Local water utility strategic planning identifies the local risks to water services and options to address those risks. The Far North Coast Regional Water Strategy acknowledges that Rous County Council as a bulk water supplier has developed the Future Water Strategy¹⁰ with an outlook until 2060 that services multiple councils. The Future Water Strategy includes:

- immediate actions – to increase the system secure yield from 2024
- ongoing actions – business as usual actions including reducing potable water demand, improving knowledge of future demand and secure yield, and drought management planning
- innovative actions – to investigate the increased use of recycled water
- long-term actions – to confirm and develop the most appropriate long-term water supply scheme components to be implemented.

The Far North Coast Regional Water Strategy continues to offer value to local councils in:

- Action 4.1: Provide better information about water availability and climate risks
- Action 4.2: Support local councils to provide a secure and affordable water supply for towns
- Action 4.3: Support regional-scale, adaptive decision-making for town water supplies in the Far North Coast
- Action 4.4: Support local councils to improve flood risk management in the Far North Coast
- Action 4.8: Develop a recycled water plan for the Far North Coast.

The modelling undertaken through development of the Far North Coast Regional Water Strategy does not replace any analysis undertaken as part of councils' existing strategic planning.

Through the Safe and Secure Water Program, the NSW Government is co-funding:

- development of local water utility strategic planning across the state, recognising the importance of strategic planning to finding solutions to address risks and provide services at adequate standards
- investment in infrastructure to address high-priority water security risks for local water utilities
- joint organisation-led regional water supply strategies to help councils identify, analyse and plan regional town water supply solutions.

From 1 July 2022, a new regulatory and assurance framework applies to local water utilities in regional NSW. It covers local government councils exercising water supply functions under Division 2 of Part 3 (Chapter 6) of the *Local Government Act 1993*, and utilities exercising water supply functions under the *Water Management Act 2000*. The regulatory and assurance framework is designed to ensure local water utilities manage risks effectively and strategically.

In 2021, the Department of Planning and Environment–Water committed to ensuring that those local water utilities progressing an Integrated Water Cycle Management strategy would not be disadvantaged by the new strategic planning assurance framework. We continue to engage with all local water utilities that are currently developing an Integrated Water Cycle Management Strategy, including those funded under the Safe and Secure Water Program.

10. More information is available at: rous.nsw.gov.au/future-water-for-our-region

What informed the Far North Coast Regional Water Strategy

We used feedback from the community, and the most recent data taken from a wide range of sources, to inform the regional water strategy and ensure it is founded on a robust evidence base. This information has been used to help identify the challenges that need to be tackled first, and the measures that will best support the region over the next 20 years.

Information used to develop the strategy included:

- new climate data
- extensive community consultation across a broad range of interests
- economic, ecological and hydrological analyses
- a range of existing studies
- existing commitments and reforms.

Climate data in the regional water strategies

The regional water strategies are underpinned by ground-breaking new climate data. Our new climate datasets and modelling give us a more sophisticated understanding of past and future climatic conditions. These improved datasets integrate recorded historical data with paleoclimate data¹¹ to inform a modelling tool that generates 10,000 years of synthetic climate data. This information provides a much better understanding of the natural climate variability under current climate conditions. When combined with climate change projections, we can better understand how this natural climate variability will be influenced by human-induced climate change. We use both scenarios to assess risks to future water availability in each region.

This updated climate information has been used to help develop the regional water strategy and compare the effectiveness of the actions.

The section *What the future climate could look like in the Far North Coast region* summarises the results from the analysis of the new climate data for the region. We will continue to use the best and latest evidence about the future climate to help develop solutions for water challenges in the region. This will support all water users to make more informed decisions and better plan and prepare for climate risks.¹²

Independent review by the CSIRO

In response to the complexity of the Far North Coast's regional challenges and significant community interest about proposed water management infrastructure, the Department of Planning and Environment–Water engaged the CSIRO to provide an independent review of the Draft Far North Coast Regional Water Strategy.

The review considered the strategy in the context of water security, flood risk management and river health. It took a systems approach and considered how the department can start to build systems thinking into the regional water strategies program. The review was published alongside the department's response in June 2022. Of the 41 recommendations in the CSIRO review, 20 were supported, 13 were partially supported and 8 were not supported.¹³

The department generally supported the recommendations aimed at building in a systems approach and improving the clarity of the strategy documents. The department generally did not support the recommendations to revise hydrological model performance assessment and to develop new integrated flood models.

The review recommended an adaptive approach to town water supply planning and that no options are taken off the table yet. This means that preferred options will be identified at a later stage as we develop a better understanding of future population growth, water demands and climate change.

The department has already addressed some of the supported recommendations by publishing technical reports on its website. These reports provide greater transparency and clarity to the regional water strategies modelling and assessments. The Far North Coast Regional Water Strategy will continue to respond to the recommendations in the CSIRO review throughout the implementation phase. This includes implementing actions such as supporting regional-scale, adaptive decision-making for town water supplies in the Far North Coast (Action 4.3).

11. Data reconstructed from before instrumental records began, using sources such as tree rings, cave deposits and coral growth. The dataset is available at: datasets.seed.nsw.gov.au/dataset/water-modelling-stochastic-climate-data

12. More information about these updated and new climate datasets and how they are being used in our river system models is in the *Regional Water Strategies Guide*, water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies

13. The published CSIRO review and NSW Government Response are available at: water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies/what-we-heard/far-north-coast-regional-water-strategy

Extensive community consultation

Developing an effective and lasting regional water strategy requires input from Aboriginal people, landholders, community members, local councils, and industry and environment groups. We acknowledge and thank all these groups and individuals for the time and effort they contributed to providing input into the strategy.

We sought feedback on the Far North Coast Regional Water Strategy through 2 public consultation periods, and a range of targeted engagement sessions. Community feedback was critical in shaping the final regional water strategy and implementation plan.¹⁴

Figure 5 summarises the consultation activities undertaken for the development of the Far North Coast Regional Water Strategy.

Figure 5. Stakeholder engagement that informed the strategy

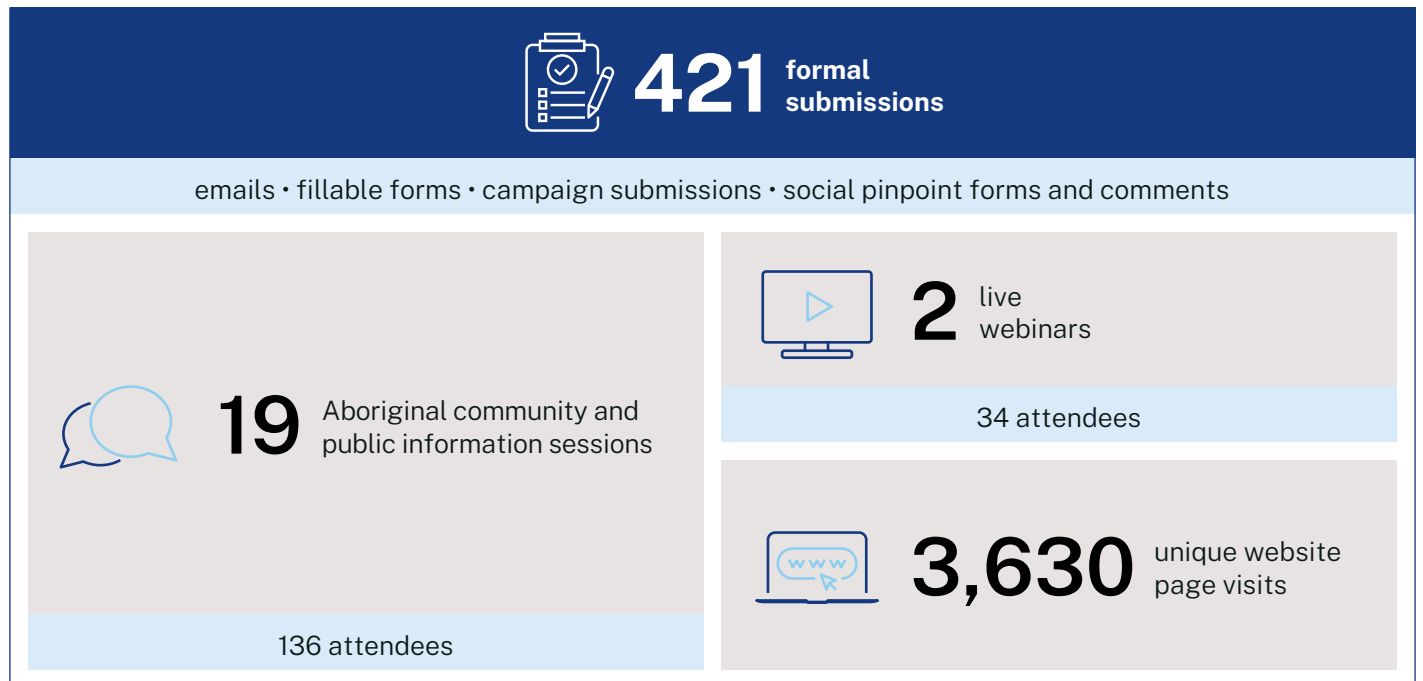


Image courtesy of Destination NSW. Townships, Casino.

14. The outputs and outcomes of the consultation process have been compiled into reports titled 'What We Heard'. These reports and the draft strategy documents are available at: www.dpie.nsw.gov.au/water/plans-and-programs/regional-water-strategies/what-we-heard/far-north-coast-regional-water-strategy

The key insights we heard during our most recent consultation with landholders, local councils, Aboriginal communities, stakeholders and the general public are shown in Table 1.

Table 1. Key insights from consultation on the Far North Coast Regional Water Strategy

Theme	Feedback summary
Take a holistic approach to land and water management	<p>Involving Aboriginal people in water planning and management was strongly supported. The importance of using actions rather than words to support Aboriginal involvement was widely noted.</p> <p>There was support for a whole-of-catchment approach to water management and support for river rehabilitation in the region.</p> <p>The significant impact of recent flooding events and responsibility for flood management were raised.</p>
Ensure water resource development and use is sustainable and equitable	<p>Protecting fish and other aquatic animals was acknowledged as a high priority, with concerns about the impact of infrastructure on the ecology and environment and about the declining numbers of some aquatic species.</p> <p>There was support for pursuing Aboriginal business opportunities and for listening to Aboriginal voices to promote positive outcomes for Aboriginal people.</p> <p>Establishing sustainable extraction limits was supported, and it was suggested that groundwater extraction should be restricted to emergencies due to concerns about limited supply.</p>
Prepare for future climatic extremes	<p>There was mixed feedback about the role and responsibility of local government in providing water supply, and concerns about the capacity, capability, trustworthiness and political motivation of councils. Some councils were concerned about the limited understanding within the community of the key functions of local water utilities and how these functions interact with the strategy.</p> <p>Investigating water efficiency measures and alternative supply options was strongly supported.</p> <p>Climate change impacts were a concern, highlighting the importance of adaptive and responsible planning and management approaches.</p>
Implementation	<p>Providing options and appropriate timeframes for Aboriginal engagement were considered important, as was ensuring engagement methods are inclusive and accessible.</p> <p>For effective implementation of the strategy, stakeholders emphasised the importance of establishing governance arrangements and securing significant and sustained financial investment.</p>

Economic, environmental and hydrological analyses

Robust assessments have been used to select the actions in the regional water strategy, including:

- hydrologic analysis of options with the potential to change the supply, demand or allocation of water
- cost-benefit and cost-effectiveness economic analyses through rapid and detailed assessments
- assessment of environmental impacts based on expert opinion, and detailed environmental watering requirement assessments based on hydrologic modelling
- qualitative assessments based on feedback from subject matter experts, Aboriginal people and the community.

More detail on the approach and results of these analyses is available on the Department of Planning and Environment's website.¹⁵

The various analyses in the regional water strategies are based on the best available information at the time. As with all types of analyses, a range of assumptions are made. Significant changes to the critical assumptions used in the strategy may trigger the need to review or amend the strategy.

Critical assumptions adopted within the analyses included:

- **Town water supply risks:** The analyses focused on surface water availability and did not include any existing alternative supply sources such as groundwater or desalination plants.
- **Population changes:** Population increases have been included in accordance with the NSW Government's Common Planning Assumptions medium population growth forecasts and higher growth local government population projections.
- **Water use and industry mix in the region:** The types of industry and water use were assumed to be constant over the model periods. Significant changes to the nature of the crops produced, or to the industry mix in the Far North Coast region, will change the amount of water used. This may trigger a review of the strategy.

Climate variability outside the bounds of the datasets used to inform this strategy may also necessitate a review of the Far North Coast Regional Water Strategy.



Image courtesy of iStock. Lismore, NSW.

15. More information is available at: www.dpie.nsw.gov.au/water/plans-and-programs/regional-water-strategies/what-we-heard/far-north-coast-regional-water-strategy

Existing studies

A significant amount of work has been undertaken to understand the risks affecting water resource management in regional NSW.¹⁶

In the Far North Coast, this includes consideration of catchment studies, water security reports and existing water allocation and drought planning, as well as regional development, infrastructure and environmental strategies prepared by NSW Government departments and agencies. The following studies were critical for informing the Far North Coast Regional Water Strategy:

- WaterNSW's *20 Year Infrastructure Options Study for Rural Valleys*¹⁷
- Department of Land, Water and Conservation 1998, *Stressed Rivers Assessment Report: NSW State Summary*
- NSW Government's *NSW Marine Estate Management Strategy 2018–2028*¹⁸ and *NSW Marine Estate Threat and Risk Assessment*¹⁹
- Department of Environment, Climate Change and Water 2006, *NSW Water Quality and River Flow Objectives*²⁰
- Department of Planning, Industry and Environment 2017, *NSW Government water reform action plan*.²¹

Building on existing commitments and reforms

The NSW Government has made significant commitments to address the risks associated with water in regional NSW and to prepare our regions for the future. Some of the statewide water reforms include:

- improving water and sewerage services for Aboriginal communities
- improving compliance and transparency around water use and access
- implementing robust metering laws to ensure 95% of the potential water taken in NSW is accurately measured and monitored.²²

In 2020, the NSW Government commenced implementation of all the environmental water reforms derived from the Water Reform Taskforce that was set up following the publication of the Independent investigation into NSW water management and compliance report.²³

Regional water strategies build on the foundation provided by existing NSW Government commitments, actions being taken by local government, and reforms to improve water security and reliability in our regions.

16. More information is in the *Regional Water Strategies Guide*, water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies

17. WaterNSW 2018, *20-Year Infrastructure Options Study - Rural Valleys, Summary Report*, Parramatta

18. NSW Marine Estate Management Authority 2018, *NSW Marine Estate Management Strategy 2018–2028*, www.marine.nsw.gov.au/marine-estate-programs/marine-estate-management-strategy

19. NSW Government 2017, *NSW Marine Estate Threat and Risk Assessment*, marine.nsw.gov.au/marine-estate-programs/threat-and-riskassessment

20. NSW Government 2006, *NSW Water Quality and River Flow Objectives*, environment.nsw.gov.au/ieo/index.htm

21. More information is available at: www.industry.nsw.gov.au/water/environmental-water-hub/water-reform-action-plan

22. The NSW and Australian governments have committed \$23.6 million and \$12.5 million respectively to the metering program to ensure that meters are upgraded effectively. This includes rebates for water users who switch to telemetry-based systems.

23. More information is available at: water.dpie.nsw.gov.au/about-us/how-water-is-managed/independent-review-of-water-management-and-compliance



Image courtesy of iStock. Killen Falls, Tintenbar.

The Far North Coast region



Image courtesy of John Spencer, Department of Planning and Environment.
Brunswick River picnic area, Brunswick Heads Nature Reserve.

Figure 6. Snapshot of the Far North Coast region



Aboriginal people (the Bundjalung and Githabul nations) have lost access to land and water. Water is deeply entwined with Aboriginal cultural and Aboriginal people's connection to country



240,000
population



Key towns:

Tweed Heads, Lismore, Ballina, Casino and Byron Bay



Local councils:

Ballina Shire, Byron Shire, Kyogle, Lismore City, Richmond Valley, Rous County and Tweed Shire



Main rivers:

Richmond River, Tweed River and Brunswick River



Major water storages:

Rocky Creek Dam (14 GL),
Clarrie Hall Dam (16 GL),
Emigrant Creek Dam (829 ML),
and Toonumbar Dam (11 GL),
which regulates a small system
on Iron Pot Creek



The region supports a **vast range of native flora and fauna**, state and nationally significant estuarine wetlands and swamps, national parks and nature reserves



Key industries:

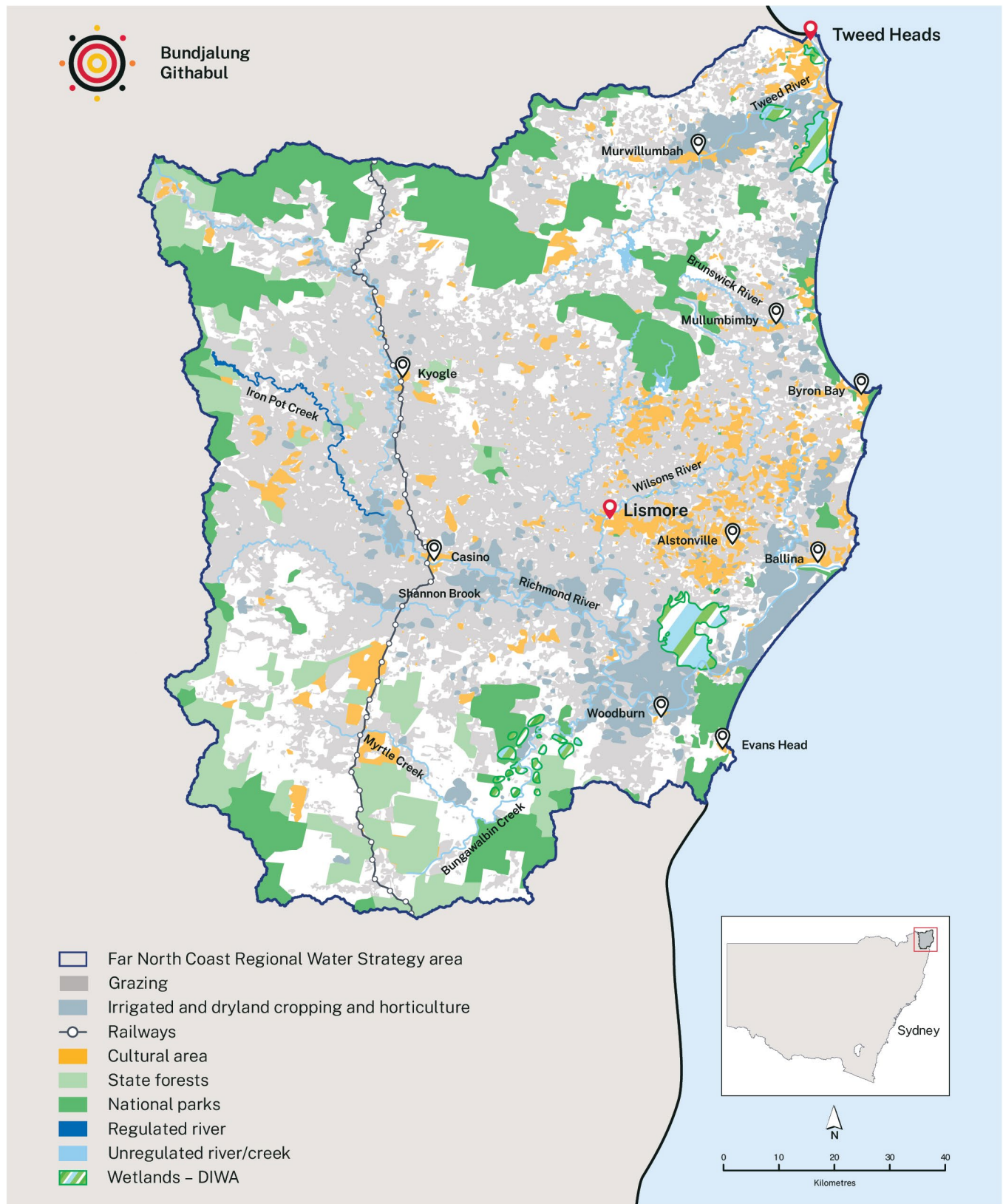
Tourism, agriculture, aquaculture, food manufacturing, health care, education and retail. Agriculture is a key part of the regional economy and represents the second-highest use of water in the region. Water entitlements for agriculture represent about 60% of available licensed water in the region



Groundwater:

Groundwater is an important source of water for towns and industries. Main groundwater sources include: Richmond Coastal Sands and Tweed-Brunswick Coastal Sands, the North Coast Volcanics, the Alstonville Basalt Plateau, Clarence Moreton Basin and New England Fold Belt Coast

Figure 7. Map of the Far North Coast region



The Far North Coast region is located in the north-eastern part of NSW. It extends from the Queensland border in the north, south along the coast to Evans Head and west to Woodenbong. The region covers an area of 8,600 km² and includes over 280 km of coastline and the catchments of the Richmond, Tweed and Brunswick rivers. It is the most biologically diverse region in NSW, with 21 national parks (several of which are World Heritage listed), more than 1,200 public reserves and many iconic scenic attractions such as Wollumbin/Mount Warning and its caldera, and Cape Byron. The region is also home to a wide variety of aquatic ecosystems.

The Far North Coast region is located within the traditional lands of the Bundjalung and Githabul Nations. These traditional owners have been the custodians and caretakers of the region for many tens of thousands of years. The region is home to more than 240,000 people and includes the main centres of Tweed Heads, Lismore and Ballina, and the towns of Murwillumbah, Casino, Mullumbimby, Byron Bay and Kyogle. Known as 'a region of villages', around half of the Far North Coast's population live in rural and coastal villages, smaller communities and hamlets. The region is highly valued as a place to live and a place for lifestyle change and retirement.

The Far North Coast region supports an extraordinarily diverse economy. Its coastal, riverine and hinterland amenity, access to South East Queensland and generally high quality infrastructure support a range of industry sectors, such as tourism, agriculture, food manufacturing, health care, education, retail and professional services. Population growth and a growing number of tourists visiting the region mean that employment opportunities are now greatest in the retail, hospitality and tourism, education and health sectors, although employment remains strong in agriculture, forestry and fishing.

The character of the region has evolved over the last 150 years. From the early timber industry and agricultural beginnings to the more recent influx of residents seeking alternative lifestyles and sea- and tree-changers, the natural environment has been a major influence on the communities and economy of the Far North Coast.



Image courtesy of Murray Vanderveer, Department of Planning and Environment. Pinnacle Lookout, NSW.

Water resources in the region

The Far North Coast region is home to 3 main catchments: the Richmond, Tweed and Brunswick.

Richmond River

The Richmond River comprises 3 main arms: the Richmond River, the Wilsons River and Bungawalbin Creek. The Richmond River tidal pool is at the downstream end of these 3 arms. The tidal pool defines the upstream extent of the Richmond River estuary, which is unique in the region because it reaches 90 km inland from where it meets the ocean in Ballina. The eastern part of the catchment is defined by a very large floodplain, which extends between Evans Head and Cape Byron. On average, about 3,000,000 ML of water runs through the Richmond River each year. Some of these flows are intercepted by one of the 3 main storages in the catchment: Toonumbar Dam, Rocky Creek Dam and Emigrant Creek Dam. Toonumbar Dam can store up to 11,000 ML and defines the only regulated system in the Richmond catchment. The system supports a small number of farmers and irrigators in the upper reaches of the catchment. Toonumbar Dam is underused. In an average year, farmers use between 1% and 10% of annual entitlement, mainly due to the reliably high rainfall. Rocky Creek Dam (14,000 ML) and Emigrant Creek Dam (829 ML) are both owned and operated by Rous County Council. The dams are used to supply towns in the Richmond and Brunswick catchments.

Several smaller weirs throughout the Richmond River catchment provide water supplies to some towns in the region.

Tweed River

Eight major tributaries feed the Tweed River, the major ones being the Oxley River and the Rous River. Tidal influence in the Tweed River estuary reaches Bray Park Weir, approximately 35 km upstream of the Tweed River entrance. The tidal influence tends to dominate river levels except during flood events. On average, approximately 175,000 ML of water flows through the Tweed River system each year. Like the Richmond River, about half of this flow happens in the wet season between February and April.

There are 2 major pieces of water infrastructure in the Tweed River catchment. Clarrie Hall Dam and Bray Park weir are both part of the Tweed Shire Council water system. Clarrie Hall Dam stores up to 16,000 ML of water for the Tweed Shire area. Water is released from the dam downstream to Bray Park weir, where it is extracted for the Tweed Shire town water supply.

Brunswick River

The Brunswick River begins in the Burringbar Ranges, traverses flatter coastal areas and is joined at Brunswick Heads by its 2 main tributaries – Marshall and Simpson's creeks – before discharging to the Pacific Ocean. The river is influenced by tides downstream of Mullumbimby. Based on the limited flow data available, the average annual flow volume in the Brunswick River is just over 31,000 ML.

The rivers and creeks of the Brunswick catchment have no major dams for water supply or instream structures. Although there are some small dams and weirs present, most water uses in the Brunswick catchment rely on natural flows for their water supply.

Water use in the region

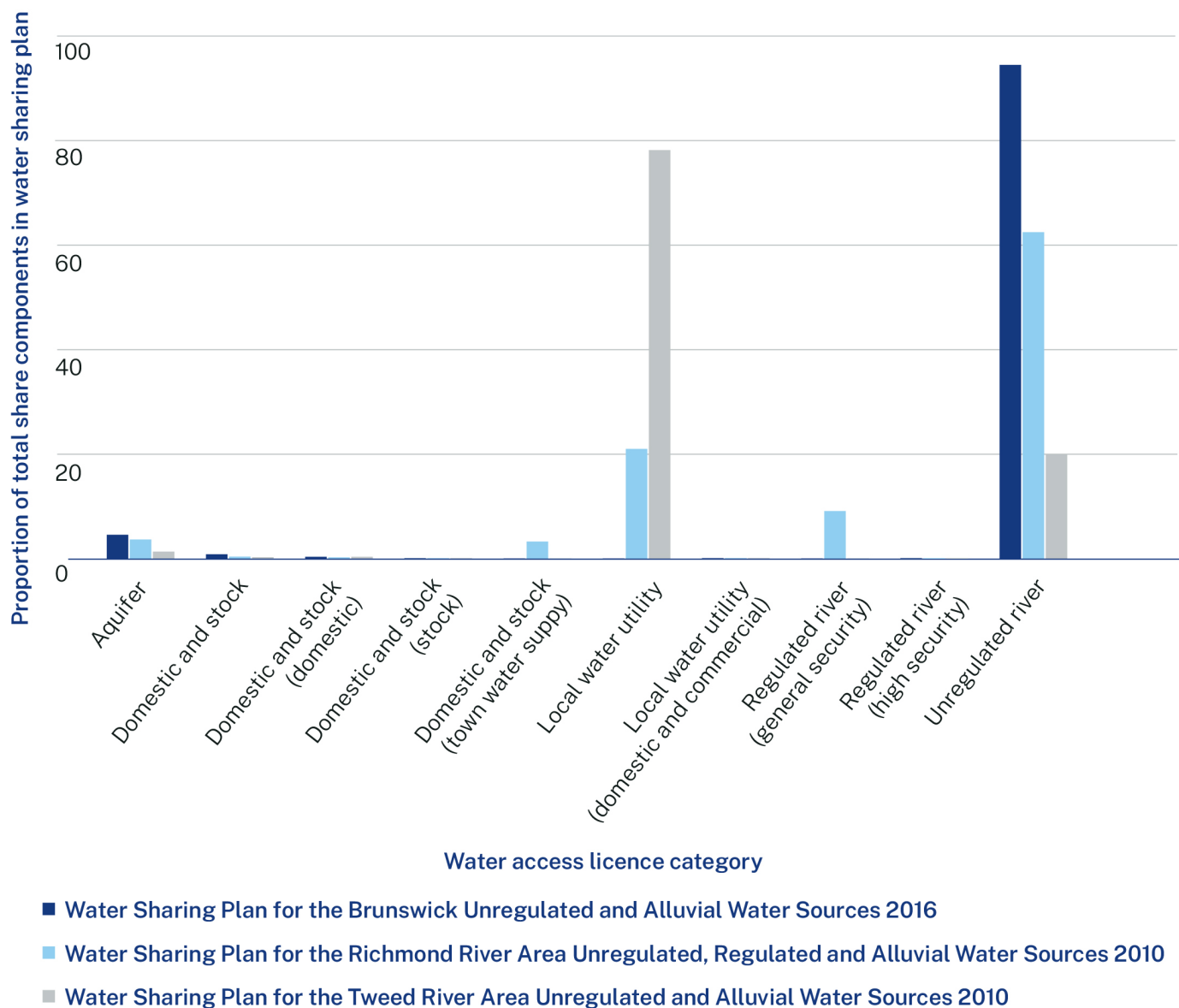
There is limited data on water use in the Far North Coast region. Water extraction from both surface water and groundwater sources is often unmetered. For this reason, water planning is largely based on the volumes of water licences and entitlements. Figure 8 shows the licensed entitlement from unregulated surface water and associated alluvial water sources by licence category and catchment.

A total of 143,453 ML surface and alluvial water is licensed for use across the region. Almost 75% of this volume is licensed for extraction within the Richmond River catchment. Around 37% of licensed extraction volumes are held by local water utilities to supply towns. Just 9,654 ML is licensed from the Richmond regulated water source.

Many landholders in the Far North Coast region have harvestable rights dams. Harvestable rights dams allow landholders to collect a proportion of runoff from their property and store it for later use.

Pasture and cereal crops (mainly for grazing) and fruit trees (including blueberries and avocados) are the crops with the greatest demand for irrigation water in the region. In the Far North Coast region, farmers generally irrigate in the spring and summer months when crops flower and the climate is hotter and drier.

Figure 8. Proportion of water licence share components by licence category and water sharing plan



Due to the variable geologies of the coast, groundwater entitlements and allocations can be very diverse across small geographical scales. Approximately 16,000 ML of coastal sands and porous/fractured rock groundwater is licensed for use across the region.

Figure 9 shows the volume of groundwater entitlements issued from Far North Coast aquifers, some of which extend beyond the Far North Coast region. The figure also shows what proportion of the total licensed aquifer volume is issued in the region. Apart from town water supply, groundwater in the Far North Coast is typically used for irrigation (particularly for large areas such as golf courses, bowling greens, school fields and public open space), sugar mills and in several quarries.

Figure 9. Licensed groundwater extraction in the Far North Coast region

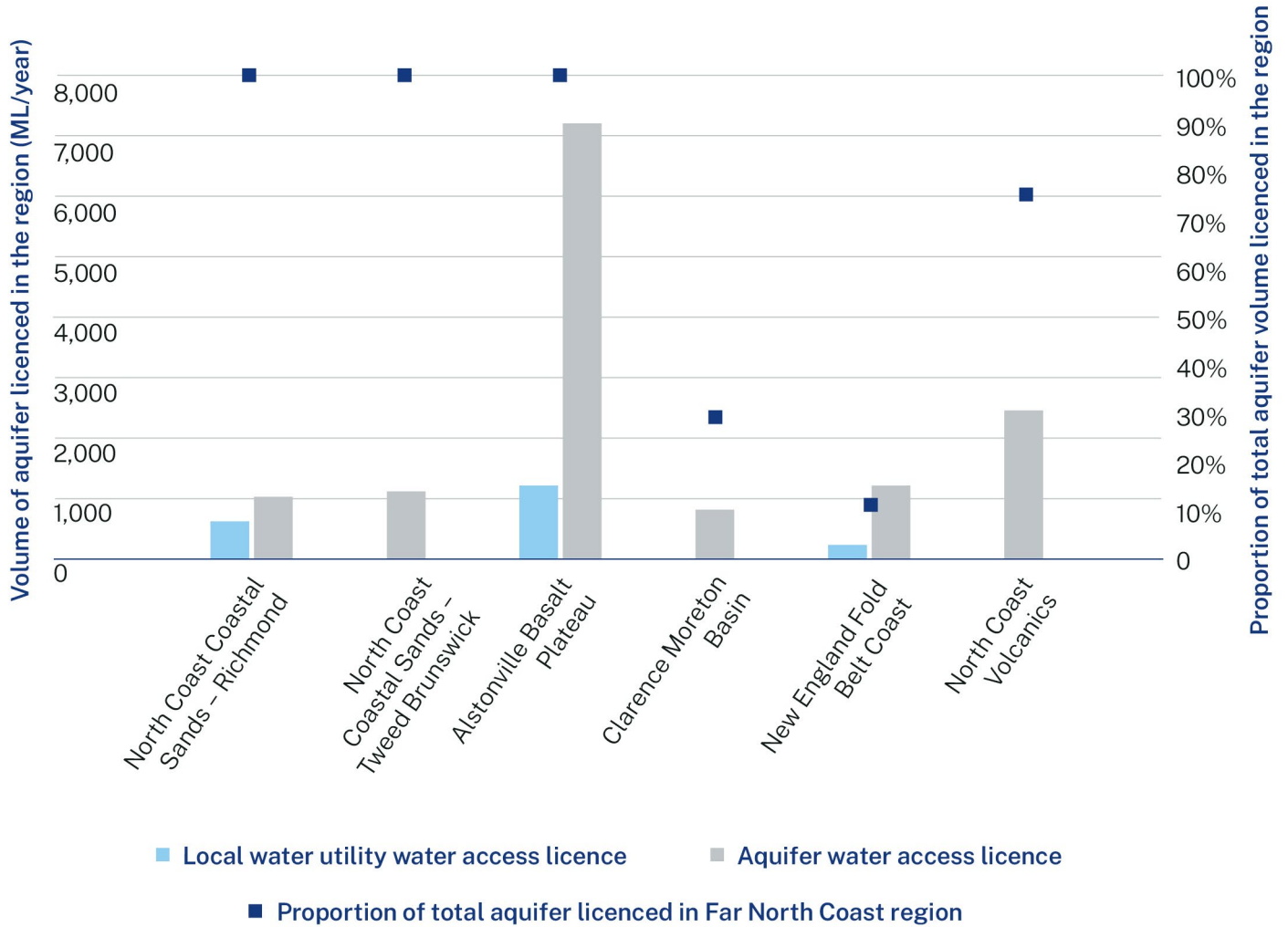




Image courtesy of Destination NSW. Mount Warning, Tweed Range.

What the future climate could look like in the Far North Coast region

3

Image courtesy of iStock. Lismore, NSW.

Climate data and modelling used to develop the strategy

We have used 3 climate datasets to understand the key regional challenges and to assess the effectiveness of actions under different climate change scenarios:

- historical data
- long-term climate variability risk data (stochastic data)
- dry climate change scenario data.

The **historical data** uses about 130 years of observed rainfall, temperature and evaporation records collected by the Australian Bureau of Meteorology. The **long-term climate variability risk data** (stochastic data) uses 10,000 years of stochastically-generated climate data. This dataset was developed by the University of Adelaide using paleoclimatic information. The **dry climate change scenario** is a modified version of the long-term climate variability data scaled using the NSW and Australian Regional Climate Modelling (NARCLiM) climate projections. These scaling factors compare the baseline period of 1990–2009 with climate projections for the periods 2020–2039 and 2060–2079. These scaling factors were applied to every climate timeseries used in the modelling.

When combined, these datasets provide us with a range of plausible climate futures that cover a range of wet and dry sequences.²⁴

Why we have used the dry ‘worst-case’ future climate scenario

The regional water strategies planned for climate change by using a dry ‘worst-case’ climate change scenario. The dry future climate change scenario²⁵ is the SRES A2, which represents a high carbon emissions scenario and thus results in higher projected climate change impacts on the region.²⁶ This is not a forecast of how climate change is expected to eventuate, but it is one possible future outcome.

This scenario assumes that governments around the world will not take any action to reduce carbon emissions. This scenario may not occur because many governments, companies and people around the world are already acting on climate change. Using this ‘worst-case’ scenario helps us plan strategically and focus on the key challenges facing a region. It also helps us understand how different options hold up in a very dry climate in the future so we can be better prepared.

24. More information about the new climate data and modelling is available at: www.dpie.nsw.gov.au/water/plans-and-programs/regional-water-strategies/climate-data-and-modelling
25. The scenario uses the regionally downscaled factors from the NARCLiM 1.0 Project to adjust the long-term past climate scenario rainfall and evapotranspiration data. Further information on the NARCLiM 1.0 Project is available on the NSW Government, AdaptNSW website: www.climatechange.environment.nsw.gov.au/climate-projections-used-adaptNSW
26. The SRES A2 assumes a 2°C warming over the regional water strategy planning horizon.

Climate snapshot

The Far North Coast region has a naturally variable climate

Over the past 130 years, the Far North Coast region has experienced extreme droughts and floods. The most well-known droughts are the:

- Federation Drought (1895–1903)
- 1911–1916 Drought
- 1990s Queensland Drought (1991–1996)
- Millennium Drought (1997–2009)
- most recent drought (2017–2020).

Flooding in the region typically happens in the summer and autumn, which tend to be wetter. Major flooding has affected the region in 1954, 1974, 1987, 1990, 2005 and 2013. In 2017, Cyclone Debbie caused widespread major flooding across Northern NSW, and was the first time a flood overtopped the Lismore levee. In February 2022, parts of the region experienced the largest flood on record. This was followed by another major flood event in March 2022.

The Far North Coast region's climate could be more variable than what we have seen

The NSW Government has invested in new climate datasets. This new data has improved hydrological modelling, and gives a better understanding of the natural variability of the Far North Coast region's climate beyond the observed historical records.

Our modelling suggests that for short droughts, the past 130 years are likely to be fairly representative of past conditions. In 2018–19, the Far North Coast experienced its driest 2-year period on record. In the Tweed catchment, rainfall totals for this period were about 2,150 mm. This is close to the most likely 2-year rainfall total in the long-term climate variability dataset. However, conditions in the past could have led to 2-year rainfall totals as low as 1,450 mm.

For longer droughts (3–10 years), the long-term climate variability data shows that more intense conditions with significantly less rainfall are likely. For example, the lowest 5-year rainfall total in the historical record for the Richmond catchment is about 5,520 mm. The long-term climate variability dataset shows that for 5-year droughts, rainfall is more likely to be between 4,700 mm and 5,400 mm. It also shows 5-year periods with as little as 3,800 mm rain. These conditions have not been seen in the past 130 years, but they are likely to occur in the future.

The long-term climate variability data shows a potential for more frequent:

- prolonged droughts with less rainfall than droughts in the historical record
- short, sharp droughts like the 2017–2020 drought.

Climate change will probably cause more extreme weather in the future

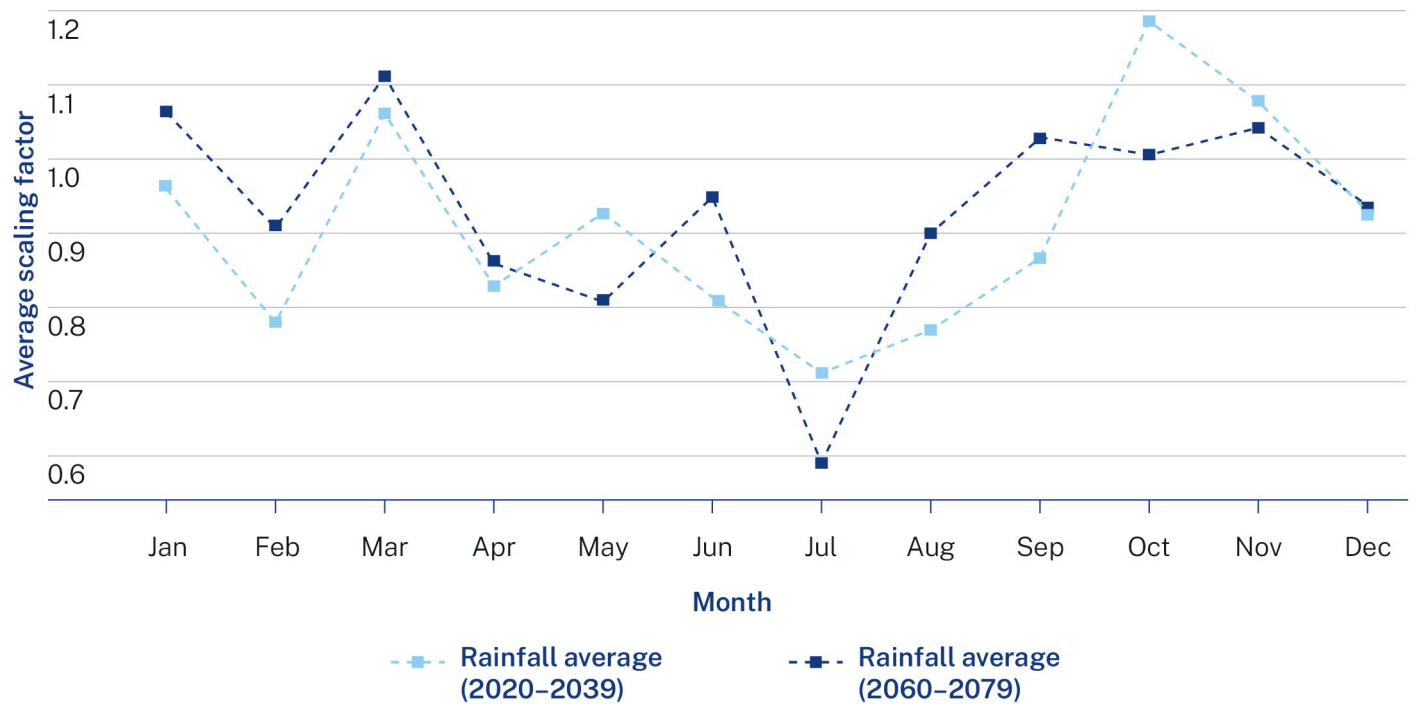
The future climate is uncertain. Our analysis of different climate projections shows there could be more extreme wet and dry periods than what has been seen in the past. There is also the potential for:

- a reduction in the total annual volume of water flowing down the major rivers

- changes to different types of river flows (low flows, high flows and overbank flows)
- an increase in evaporation by up to 6% by 2060
- a rise in sea levels of around 0.58 m by 2070.

We need to plan for this uncertainty and fully understand the future risks we face. A dry scenario, like what we have modelled, may not occur (Figure 10). However, analysing these extreme dry scenarios helps us to understand how to prepare for a more variable and changing future climate.

Figure 10. Possible future changes to rainfall in the Far North Coast region compared to the 1990–2009 average²⁷



27. Based on NARClIM climate change modelling. More information on the NARClIM project is available at: www.climatechange.environment.nsw.gov.au/climate-projections-used-adaptsw

Future climate impacts on water supplies

Future climate change

Climate change will likely cause a reduction in average rainfall in the Far North Coast region, with river flows in the future also likely to decrease. These changes could affect water users and the environment.

Table 2 shows a summary of current conditions and what conditions under climate change could look like. It shows the annual average river flows that we have modelled using the 3 datasets: historical data, long-term climate variability data (stochastic data), and dry climate change scenarios.²⁸

The effects of climate change on flows are expected to vary across the region. Flows in the Richmond River are likely to be slightly more affected by climate change than flows in the Tweed River. The rightmost column in Table 2 shows the average decrease in flows due to climate change. It compares the long-term climate variability data and the dry climate change scenarios.

Table 2. Average future water availability: annual flows in the Richmond River and Tweed River catchments

Location	Annual average flow (GL/year)			
	Historical data	Long-term climate variability data	Dry climate change scenario	Flow reduction due to climate change (% difference)
Richmond catchment headwaters	2,842	3,075	2,786	9%
Tweed catchment headwaters	175	179	169	6%
Rocky Creek Dam inflows	29	29	28	3%
Toonumbar Dam inflows	26	26	21	18%
Emigrant Creek Dam inflows	19	19	19	4%
Clarrie Hall Dam inflows	29	30	29	5%

²⁸ All the values in the 2 water availability tables are modelled flows. The 'historical data' columns are not based on measurements. Rather, they are outputs from our hydrologic models run using historical climate data.

Future climate variability

The long-term climate variability data does not reveal a lot about average conditions. But it does show that, in the past, extreme conditions were likely to have been worse than what the historical record shows. More severe droughts are likely to have occurred in all the catchments of the Far North Coast region. This is particularly true in the Richmond River catchment. Climate change will further increase the likelihood of these events occurring in the future.

Table 3 shows the worst 0.01% of river flows modelled using the 3 climate datasets. The rightmost column shows the decrease in extreme low annual flows due to climate variability. It compares the historic data with the long-term climate variability data.

Table 3. Extreme dry conditions water availability: lowest 0.01% flows in the Richmond River and Tweed River catchments

Location	Extreme dry condition (GL/year, 0.01% probability)			
	Historical data	Long-term climate variability data	Dry climate change scenario	Flow reduction due to increased climate variability (% difference)
Richmond catchment headwaters	170	124	109	27%
Tweed catchment headwaters	8	11	10	-32%
Rocky Creek Dam inflows	5	4	4	16%
Toonumbar Dam inflows	1	1	1	32%
Emigrant Creek Dam inflows	3	2	2	41%
Clarrie Hall Dam inflows	1	1	1	-34%

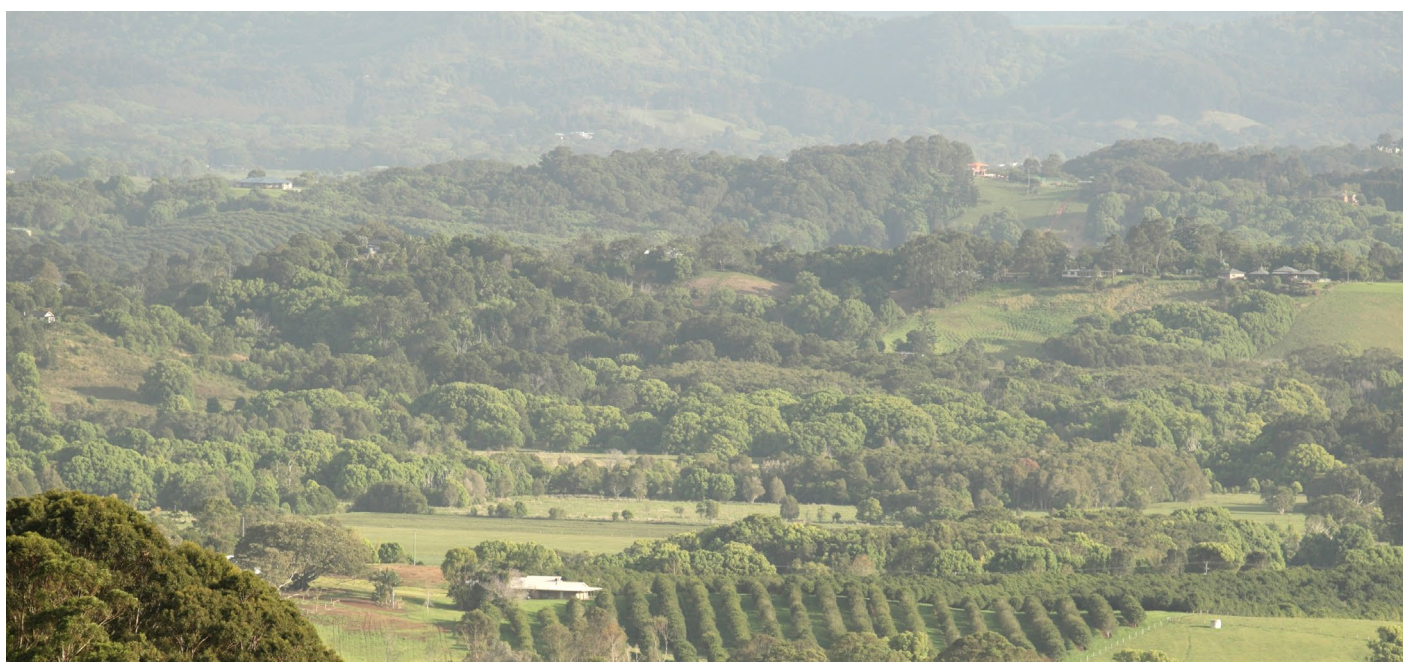


Image courtesy of iStock. Byron Hinterland, Byron.

The key challenges facing the Far North Coast region

4

Image courtesy of iStock. Tweed River, NSW.

Like all regions across Australia, the Far North Coast region faces a warmer and more variable climate. We need to prepare now to protect our most critical water needs and to do more with less water. We also need to make water management decisions based on better knowledge and information.

We have identified 7 key challenges that are immediate priorities for the region:

- Declining catchment and river health
- Competition for low flows
- Saltwater intrusion into freshwater sources
- Aboriginal people's rights and access to water
- Water security for industries in the Far North Coast
- Water security for towns and communities in the Far North Coast
- Flood risks to individuals, businesses and communities.



Image courtesy of Destination NSW. Tweed River, Murwillumbah.



Challenge: Declining catchment and river health

Opportunity: Address river health, hydrologic connectivity and water quality by improving catchment and riparian management, and restoring river hydrology.

The Far North Coast region supports a rich and diverse range of water-dependent plants, animals and ecosystems. They form an important part of our shared biodiversity resources, have cultural value for local Aboriginal communities and support the economic value, liveability and wellbeing of the region. Preserving these values is critical to supporting the communities of the Far North Coast region into the future.

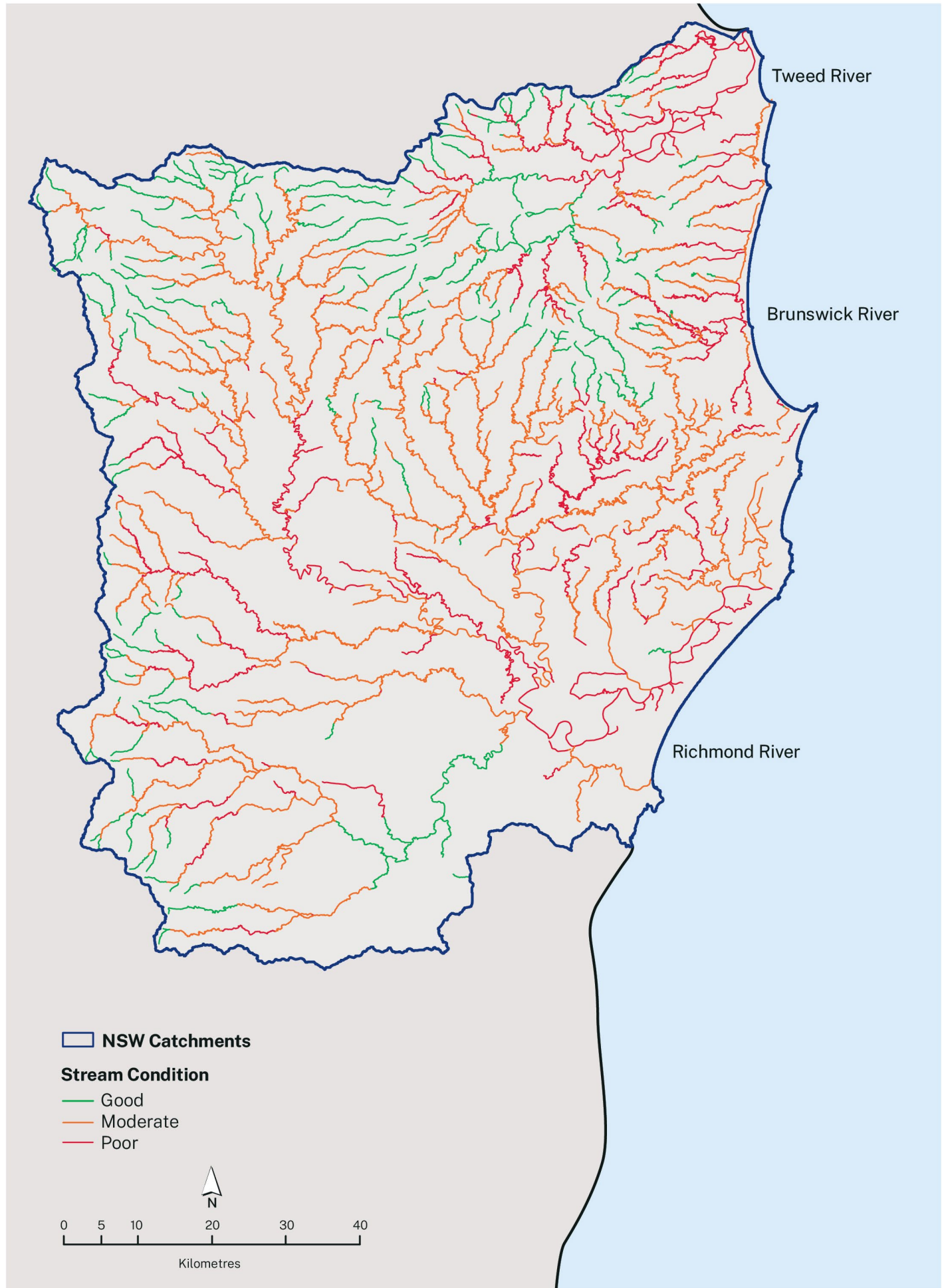
Land management practices are impacting riverine health

The decline in catchment and river health threatens aquatic and riparian ecosystems, as well as downstream estuarine health. This decline negatively affects Aboriginal peoples' connection to Country and cultural sites associated with waterways. Communities and towns have an increased need to treat poor quality water for consumption, and there are reduced opportunities for water-based recreation. Industries are also directly impacted by poor water quality, particularly those operating in estuaries, such as aquaculture. Other sectors such as tourism, are indirectly impacted through loss of amenity.

Although the Far North Coast region's agricultural industry has been important for the region's development, it has also led to land clearing and a reduction in soil carbon levels. Clearing forests and native vegetation allows water to flow through the landscape much more quickly, while reduced carbon in soil affects its capacity to take in water. Other land management practices, such as providing stock access to riverbanks and creeks, cause erosion and decrease bank stability.

Water now worsens land and waterway erosion because it moves faster and more forcefully than in its natural state. This is of particular concern in the region because erosion increases sediment inputs to waterways and reduces water quality.

Figure 11. Condition of river reaches across the Far North Coast region



Current geomorphic and riparian condition

Only 18% of waterways in the Far North Coast region are in good condition. The remainder are either in moderate (53%) or poor condition (29%) (Figure 11). These bad conditions are particularly evident in the Richmond River catchment. The 2022 floods in the Far North Coast region have significantly affected the geomorphology of the region's rivers. These changes will take time to stabilise and will worsen water quality in the meantime.

The condition of riparian vegetation is generally low across the region, except in protected or forested areas. This is often due to weed infestations and vegetation clearing, which leads to large areas devoid of native vegetation or with poor vegetation diversity. Infestations and clearing also lead to reduced leaf area and tree canopy height, and small, poorly connected patches of native vegetation. Most estuarine reaches are in poor condition, and are mostly characterised as riverbanks with little or no vegetation.

Effects of increased sediment loads

The impacts of land clearing and development are heightened during extreme rainfall events – a climatic feature of the Far North Coast region. Runoff from these events is typically high in nutrients and sediment. This causes elevated nutrient loads, smothered vegetation and subsequent deoxygenation and further release of nutrients. This can lead to increased river toxicity and fish deaths.

Some of the region's local councils find it difficult to treat water when turbidity is high. This can affect the availability of water for town water supply. During community consultation on the Far North Coast Regional Water Strategy, we heard that Aboriginal communities and the general public have significant concerns about the continued impact of catchment land uses on the quality of the region's highly valued waterways.

Poor management of fertiliser could be increasing nutrient loads in the region's waterways

Many of the region's rivers, creeks and estuaries are suffering from poor water quality, particularly due to increased sediment and nutrient loads.

Some crops that traditionally have not been fertilised are now being fertilised to increase yields. One example is macadamia plantations in the region, which are increasingly being fertigated.²⁹ Use of best practice fertiliser management helps prevent increased fertiliser use. This can prevent increased nutrient levels in downstream waterways and declines in water quality.

29. Fertigation is the practice of injecting fertilisers into an irrigation system.

Current governance arrangements are inhibiting catchment-scale decision-making, planning and project delivery

Responsibility for managing water quality impacts is shared across several state and local government agencies, with no overarching framework for managing water quality and waterway impacts. This impedes planning, collaboration, coordination and reconciliation of state and local priorities. It also:

- negatively affects the development and delivery of environmental catchment programs at different scales
- makes it difficult to ensure that environmental water quality and quantity needs are met throughout the catchment.

During consultation we heard that a reduction in the uptake of best practice is being driven primarily by:

- a lack of social willingness among users and landholders
- complicated natural resources regulation.

Instream structures are impacting natural flow regimes, aquatic health and fish movement

Although most rivers in the Far North Coast region are unregulated, there are still many instream structures that control and modify flows and drainage. These structures alter the natural flows of rivers and streams and their associated floodplains and wetlands. They also contribute to the loss of biodiversity and ecological function of waterways.

Instream structures can be significant barriers to native fish migration. Many species are directly affected by instream structures and their operation, including the endangered:

- eastern freshwater cod (*Maccullochella ikei*)
- southern purple spotted gudgeon (*Mogurnda adspersa*).

Other coastal fish species potentially impacted by barriers to fish passage include:

- freshwater catfish (*Tandanus tandanus*)
- diadromous species³⁰ such as freshwater herring (*Potamalosa richmondia*) and short-finned eel (*Anguilla australis*)
- high recreational value species such as Australian bass (*Macquaria novemaculeata*) and estuary perch (*Percaletes colonorum*).

Many other protected or unlisted species of invertebrates and mammals can also be affected negatively by instream structures. Government programs have been addressing this through fish restocking programs and actions to progress fish passages on weirs.

30. Diadromous fish migrate between fresh and salt water.

Declining quality and quantity of freshwater inflows to coastal systems is affecting estuarine health

Freshwater inflows are critical to the health and function of the region’s estuaries. These inflows help maintain low salinity levels in tidal pools and mobilise the nutrients, sediment and pathogens needed to support habitat diversity and productivity. High quality freshwater inflows are important both to estuarine health and to the communities and industries these estuaries support.

Effects of declining quantity of freshwater inflows

Projected reductions of estuary inflows may alter salinity gradients, water circulation patterns and fish movement, which could negatively affect estuarine ecology. This is particularly true in the tidal pools at the upper limits of the estuaries. These reductions can also increase salinity further upstream where water is used for agriculture and town water supplies.

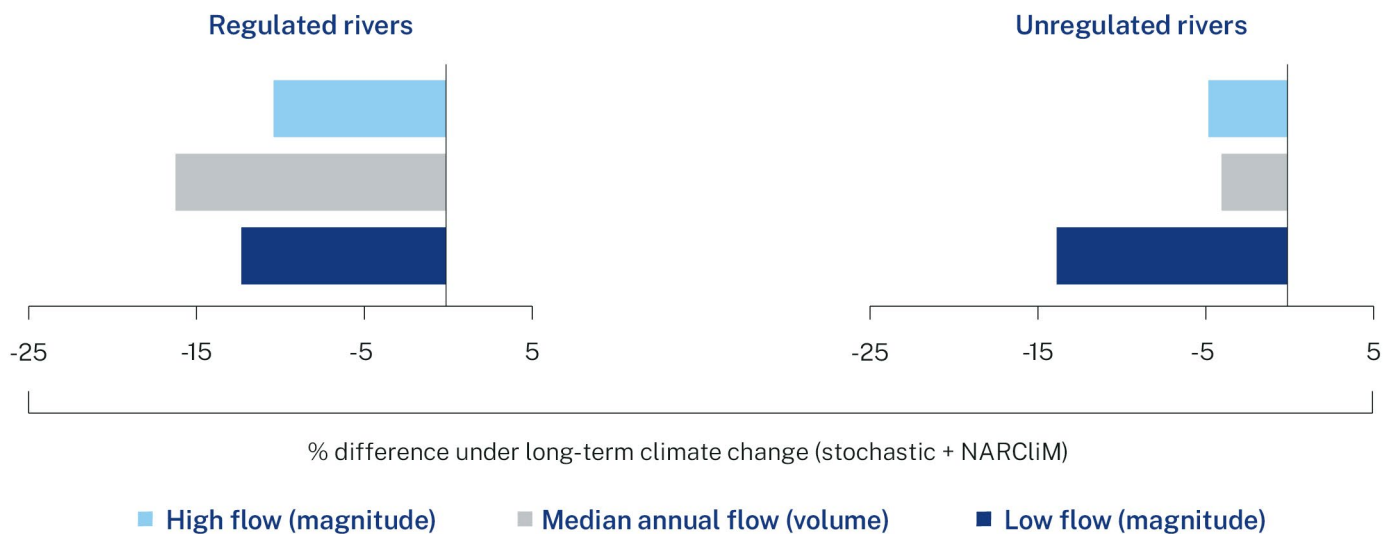
Intermittently closed and open lakes and lagoons are particularly sensitive to changes in freshwater flows. These changes can have a large effect on water quality, geomorphology and entrance opening regimes. They can also affect the health of mangroves, saltmarsh and seagrass, which are important fish habitats.

The Marine Estate Management Strategy³¹ has highlighted the regulation and extraction of freshwater flows as a statewide priority threat and identified management initiatives to help address these issues.

Our new climate data and hydrologic modelling show that the annual volume of flows in the Far North Coast region catchments may decrease by about 4–24% under a dry climate change scenario, and that all parts of the flow regime may be affected (Figure 12). Changes in medium- to high-flow events would affect:

- sediment and nutrient transport that stimulate riverine productivity
- system flushing
- the number of events that trigger fish movement and spawning.

Figure 12. Projected impacts of climate change on inflows to Far North Coast regulated and unregulated rivers³²



Effects of declining quality of freshwater inflows

There are many examples of where poor quality water is affecting river health in the Richmond River. In these locations, smothering by fine sediments has led to low numbers and diversity of fish, shellfish and crustaceans in the Richmond River system.³³

31. NSW Marine Estate Management Authority 2018, *NSW Marine Estate Management Strategy 2018–2028*, www.marine.nsw.gov.au/marine-estate-programs/marine-estate-management-strategy

32. Similar trends are also likely to be seen in estuary inflows. See Department of Planning, Industry and Environment 2020, *Draft Regional Water Strategy – Far North Coast: Strategy (PUB20/307)*, water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies/what-weheard/far-north-coast-regional-water-strategy

33. Ryder, D., et al. 2015, *Richmond Ecohealth Project 2014: Assessment of River and Estuarine Condition – Final Technical Report*, www.ipart.nsw.gov.au



Challenge: Competition for low flows

Opportunity: Reduce stress on the region's waterways and improve water access for landholders and industry by addressing competition for water in low-flow periods.

There is generally enough water across the Far North Coast region to meet urban and rural water demands each year, on average. However, competition for low flows during the drier spring months places many of the region's rivers and creeks under increased hydrologic stress. Climate change is likely to increase pressure on low flows in the future because it will reduce flows while increasing water demands for irrigation.

Low flows maintain connectivity between river pools, provide riffle flow and aeration, and deliver freshwater to sensitive estuaries and intermittently closed and open lakes and lagoons. These river functions are critical for river and ecosystem health and to support water-dependent industries.

Competition for low flows also affects groundwater systems. Many of the region's alluvial and coastal sand groundwater systems are highly connected to surface water flows. This means that reductions in surface flows can reduce recharge rates. This impacts both the health of groundwater-dependent ecosystems and consumptive users of groundwater.

Competition for water also negatively affects the reliability of water for irrigated agriculture. Unreliable water supplies can seriously threaten the long-term viability of existing industries and can discourage future investment in emerging industries.

Catchment conditions and limited data are constraining the ability to set effective rules to manage competing demands for low flows

Protecting low flows reduces the stress on the region's rivers and protects water for downstream users. Currently, we protect these low flows with cease-to-pump rules. These rules require licensed water users to stop taking water under low-flow conditions. They are based either on gauged flow rates or visible flow conditions and daily extraction limits.

A lack of stream gauging has made it difficult to effectively implement cease-to-pump rules. Sand-dominated coastal streams are not suited to conventional stream gauges and identifying reliable long-term gauging sites is difficult. Gauging stations are also expensive to install and maintain. Many new gauges would be required to get adequate coverage across all streams where extraction occurs. Consequently, expanding the coastal gauging network would come at a considerable cost to water users. This may be difficult to justify given the low level of extraction compared to inland regions.

Visible flow rules were adopted in many of the small unregulated coastal catchments in the region to manage these challenges. However, visible flows have been criticised for being subjective. They are also generally so low that they do not provide sufficient protection for environmental assets.

Daily extraction limits are another tool for addressing competition for water. They permit water users to take a proportion of the daily flow at a particular site, leaving enough water for the environment and downstream users. However, implementing daily extraction limits takes considerable resources, including stream flow gauges, water meters and coordinated rostering among users.

The low number of metered pumps makes it difficult to understand the extent of low-flow competition and to manage water sharing among users

Protecting low flows requires water users to comply with the rules. However, very few pumps for surface water or groundwater in the region are metered. This makes it difficult to ensure water is extracted legally and shared equitably during low-flow periods. In some parts of the region, water sharing arrangements and compliance with cease-to-pump rules is managed through community-operated water user associations. However, management is difficult without meters or adequate gauging.

Growth in harvestable rights dams and water extraction under basic landholder rights may place additional pressure on low flows

The protection of low flows can be compromised by water take that does not require licensing and approvals. This is particularly true where there is significant take-up of harvestable rights and basic landholder rights within a catchment.

Harvestable rights allow landholders to intercept a percentage of average regional rainfall runoff from their property and store it in one or more farm dams without a water access licence, water supply work approval or water use approval. Many landholders in coastal areas have sought the right to take and store more water during wet periods to improve their preparedness for dry periods. However, a range of stakeholders are also concerned about the effects this may have on freshes and low flows in downstream rivers and creeks.

Harvestable rights dams do not require a licence, so we have a limited understanding of their current level of water take and their effects on the environment and licensed water users. Additionally, many harvestable rights dams in the region are significantly larger than the permissible size. This could negatively affect baseflows to downstream waterways. Changes to harvestable rights in coastal-draining catchments were announced in October 2021. These changes increase the proportion of average regional rainfall runoff that may be harvested from 10% to 30%, subject to limitations and mitigation measures intended to reduce the effects on low flows. Further detailed catchment analysis in 2023 will confirm the suitability of these changes to harvestable rights.

We have heard that growth in water extraction for domestic and stock purposes under basic landholder rights is also increasing competition for water at low flows. This is particularly true for rural residential subdivisions with waterway frontage. Water extraction for basic landholder rights is not regulated. There is no limit on the volume of water that may be taken and there are no guidelines about how the right can be used, although basic landholder rights cannot be traded. Increases in these rights could compromise the effectiveness of any cease-to-pump conditions aimed at protecting the environment and downstream users.

The NSW Water Strategy³⁴ provides for a review of how domestic and stock basic landholder rights are regulated. This will improve our understanding of how these rights are being used and will factor their requirements into improved water management. The review will include estimating the quantity of water extracted under these rights.

34. Department of Planning, Industry and Environment 2021, *NSW Water Strategy*, water.dpie.nsw.gov.au/plans-and-programs/nsw-water-strategy



Challenge: Saltwater intrusion into freshwater sources

Opportunity: Improve our understanding of, and ability to respond to, the threat on freshwater coastal waterways and aquifers from sea level rise, groundwater extraction and changes in catchment hydrology.

Global sea levels are rising, mostly from increasing greenhouse gas concentrations in the atmosphere and associated glacial and ice sheet melt.³⁵ Between 1966 and 2009, sea levels around the coastline of Australia rose at an average rate of 1.6 mm/year,³⁶ which equates to approximately 7 cm over the past 50 years. Rising sea levels will result in saline water migrating upstream and saltwater intrusion in many of the region’s groundwater and low-lying water sources.

Increased water salinity may negatively affect:

- coastal wetlands and freshwater and estuarine habitats, such as mangroves, that are critical for fauna breeding and recruitment
- town water security and water users who currently access and rely on freshwater close to, or within, current tidal limits

- Aboriginal communities’ abilities to practice culture and protect important cultural sites and assets.

The magnitude of sea level rise and its impacts will vary by location due to geological factors, ocean currents and localised thermal expansion or contraction of oceans. The extent to which sea levels rise will also depend on how much greenhouse gas emissions are reduced in the coming years.

The average projection for sea level rise along coastal NSW is between 0.30 m and 0.45 m by 2070.³⁷ For the Far North Coast region, the average projection is between 0.24 m and 0.58 m by 2070 (Table 4).

Table 4. Sea level rise projections for the Far North Coast region

Year	Low emissions scenario (RCP4.5) [m]	Very high emissions scenario (RCP8.5) [m]
2030	0.14 (0.09–0.18)	0.14 (0.09–0.18)
2050	0.24 (0.17–0.32)	0.27 (0.19–0.35)
2070	0.36 (0.24–0.48)	0.4 (0.31–0.58)

Table notes:

- Values are averaged, with the likely range provided in brackets.
- Projections are relative to an average calculated between 1986 and 2005.
- RCP = representative concentration pathway.

35. Oppenheimer et al. 2019, *Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities*. In Pörtner et al. (Eds.), IPCC Special Report on the Ocean and Cryosphere in a Changing Climate, Intergovernmental Panel on Climate Change

36. Siebentritt, M. 2016, *Understanding sea-level rise and climate change, and associated impacts on the coastal zone: CoastAdapt Information Manual 2*, National Climate Change Adaptation Research Facility, coastadapt.com.au/information-manuals

37. CoastAdapt 2017, *Sea-level rise and future climate information for coastal councils*, www.coastadapt.com.au/sea-level-rise-information-all-australian-coastal-councils

Larger sea level rises are possible beyond these scenarios. The Intergovernmental Panel on Climate Change states that sea level rise will continue for centuries to millennia due to continuing deep ocean warming and ice sheet melt. It projects that the global mean sea level rise by 2100 could be up to nearly 2 m (for a very high greenhouse gas emissions scenario). Storm surges may also contribute to higher sea levels during the more frequent and intense low-pressure systems caused by climate change.

The severity of impacts from sea level rise, saltwater intrusion and altered catchment hydrology is likely to worsen as growing populations and industries increase the demand for freshwater in coastal areas.

Saltwater intrusion negatively affects water sources

Saltwater intrusion in freshwater and estuarine systems poses significant risks to water users in low-lying areas across the region because it increases salinity levels. A large portion of water entitlement in the region is extracted below the tidal limit.

Many towns also extract water from rivers and alluvial groundwater immediately upstream of the existing high-tide limit. This means that even a small rise in sea level may reduce the suitability of water sources for a number of important uses, including:

- local town water supplies
- irrigation
- dairy washdown
- stock and domestic supplies.

Saltwater intrusion may also compromise water and wastewater treatment plant infrastructure.

Sea level rise is likely to negatively affect coastal environments such as low-lying coastal wetlands that could become inundated for longer. At the most extreme, some low-lying coastal wetlands could be permanently inundated. The Marine Estate Management Strategy recognises sea level rise as a key threat to the NSW coastal, estuarine and marine environments, and has identified several actions to prepare the region to manage this risk. These actions include on-ground activities that provide habitat protection and rehabilitation to help mitigate the impacts of climate change. They also include tools that will help industry and the community better understand future impacts.

Plans and strategies for water resources in the region will need to incorporate more up-to-date information on climate change to better manage the future impacts of sea level rise.

Possible reductions in river flows are likely to worsen the effects of sea level rise

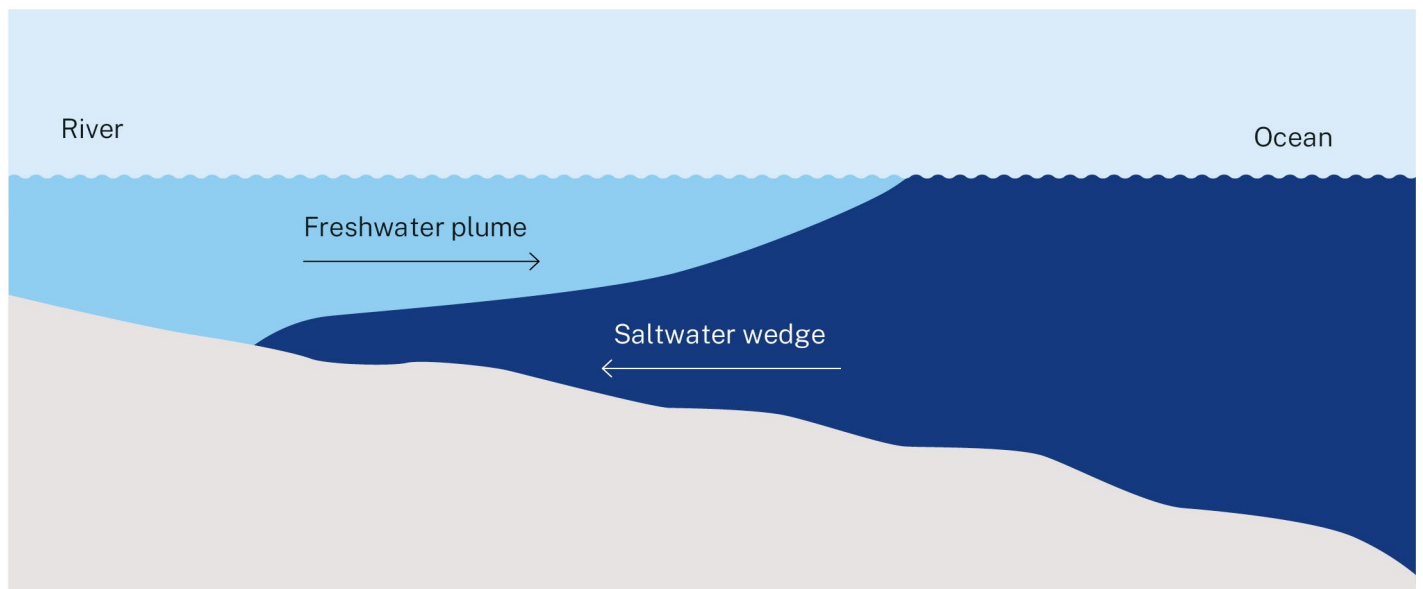
Many of the Far North Coast region's rivers have a maximum high-tide footprint that extends far upstream, including a 90 km tidal influence for the Richmond River. Sea level rise is likely to cause estuarine zones to migrate further upstream. Other climate change impacts on coastal estuaries are expected, mainly due to the reduction in the magnitude of freshwater inflows and increased frequency of cease-to-flow events. This is likely to have other negative effects.

During low-flow and cease-to-flow events, salinity gradients in tidal pools change as freshwater entering estuaries is either reduced or stops (Figure 13). This change allows the salt wedge that usually sits below the freshwater in tidal pools to move further upstream.

Our modelling shows that median annual flows in the region's rivers could decrease by up to 16% under a worst-case climate change scenario. There is potential for flows into the region's estuaries to decrease by 33%. The most significant reductions in flow are likely to occur in the Richmond River catchment.

Cease-to-flow events are likely to occur more often. The most significant increase in the frequency of cease-to-flow events is likely to occur in the Tweed River estuary. The frequency of cease-to-flow events there could increase by 13%.

Figure 13. Concept of a tidal saltwater wedge for a permanently opened estuary³⁸



Water sharing plans for major tidal pools in the river catchments have cease-to-pump rules that try to prevent the unnatural progression of saltwater into the tidal pools. However, it is currently unclear if these rules are enough to protect downstream users and environments in the future.

We need to form a clearer regional picture of the combined effects of changes to catchment hydrology and sea level rise. This will help us develop appropriate local management responses.

Sea level rise is likely to increase the risk of saltwater intrusion into groundwater

Saltwater intrusion into groundwater is caused by sea level rise and over-extraction of groundwater and freshwater. Areas where groundwater and surface water systems are highly connected are particularly vulnerable. The intrusion of saltwater into groundwater affects ecosystems and town water security by significantly degrading water quality and reducing freshwater availability.

Groundwater sources that are vulnerable to saltwater intrusion across the Far North Coast include coastal sands and floodplain alluvials. These groundwater sources are important to industries and for stock and domestic use across the region. Around 4,300 ML of water entitlement is issued in alluvial water sources across the region and about 2,750 ML is issued in coastal sands aquifers.

Climate-related salinity problems have already been experienced in the Richmond River catchment. During the Millennium Drought, flows into the tidal pool were very low and the saltwater/freshwater interface migrated a significant distance upstream. This caused large increases in salinity in the tidal pool and prevented water extractors from pumping at certain times.

We currently manage the impacts of saltwater intrusion by ensuring coastal aquifers are not over-extracted. This is done mainly by controlling licensed extraction and managing water levels in areas of high extraction.

38. Adapted from Hurdle, J 2020, *As Sea Levels Rise, Will Drinking Water Supplies Be at Risk?*, Yale School of the Environment e360.yale.edu/features/as-sea-levels-rise-will-drinking-water-supplies-be-at-risk



Challenge: Aboriginal people's rights and access to water

Opportunity: Improve Aboriginal people's access to water and their ability to care for Country by addressing government water management processes and the ongoing effects of colonisation.

The people of the Bundjalung and Githabul nations have been the custodians of the lands and waterways in the Far North Coast region for tens of thousands of years. Water is deeply entwined with Aboriginal culture. Healthy waterways are essential to the culture and wellbeing of Aboriginal communities across the Far North Coast region, providing food, kinship, connection, recreation, stories, songlines and healing.

*'Water is not a resource – it's a source of life...
Clean water is caring for Country.'*

(Arakwal people, Draft Far North Coast Regional Water Strategy consultation, 2020).

Aboriginal people have lost access to waterways

The historical dispossession of land and the effect of colonial-era settler laws continue to affect the ability of Aboriginal people in the Far North Coast to access water and to care for Country. Fences and locked gates on public land such as Crown land and state conservation areas prevent Aboriginal people from accessing Country, carrying out cultural practices and using traditional cultural knowledge to care for and manage waterways.

Water infrastructure, modifications made to waterways, and poor land management and land use practices negatively affect important cultural sites and traditional water and food sources.

Access to Country, waterways and the important sites they hold, is critical to providing a purpose and pathway for young people to connect to culture. These sites provide spaces for healing, as well as for food, medicine and teaching.

Steps are being taken by governments to address this. For example, the National Parks and Wildlife Services is developing a new model for Aboriginal joint management of the NSW national parks estate. The new model is expected to provide for the potential handback of title of all NSW national parks – covering nearly 10% of the state – over a 15- to 20-year period, subject to the land being leased back (over the long term and for nominal rent) to the NSW Government for its continued use and management as national park.

Aboriginal people in the Far North Coast want a ‘seat at the table’ when it comes to decision-making

Current water legislation and water management processes do not adequately bring the Far North Coast region’s Aboriginal people into decision-making; nor do they fully reflect Aboriginal people’s perspectives, approaches and values. These processes also do not draw on the knowledge held by the Far North Coast region’s Aboriginal people about their traditional lands, water bodies and the flora and fauna that inhabit them. This is made worse by the limited involvement of the region’s Aboriginal people in water consultation processes. Most often this lack of involvement has been because:

- There is a lack of trust in governments. Historically, governments have not engaged thoroughly in water and natural resource management in the region; nor have they followed through on previous commitments.
- Consultation timeframes and processes around water policy changes do not allow the time needed for Aboriginal cultural governance processes.
- The state and federal laws and systems around water and natural resource management are complex. They do not match well with Aboriginal perspectives and are often not clearly explained.
- Aboriginal groups lack resources and support to drive their engagement in water management.

Aboriginal people in the Far North Coast want a ‘seat at the table’ when it comes to decision-making, at both the state and local levels. Government needs to develop a collaborative, culturally sensitive approach that is appropriate for Aboriginal communities. This means working with Aboriginal communities to develop governance structures that are familiar to them, and setting aside adequate time to engage, consult and genuinely listen to Aboriginal people.

These investments in time and resources will help build respect and trust between all parties. They will also help identify the different needs, challenges and interests of each Aboriginal community.

This model can benefit both Aboriginal communities and government by:

- offering Aboriginal people in the Far North Coast region the opportunity to improve outcomes for Country and for their communities
- improving natural resources management by incorporating the rich and holistic approach to water and land management that Aboriginal people have been practising for thousands of years.



Image courtesy of Destination NSW. Tweed Eco Cruises, Tweed Heads.



Challenge: Water security for industries in the Far North Coast

Opportunity: Grow the viability of regional industries by improving the certainty of access to secure water supplies.

Water-dependent industries are facing an uncertain future in the region due to climate variability and climate change. New modelling shows that the reliability of existing water access licences is likely to be less than originally thought and may reduce in the future. Saltwater intrusion also threatens existing supplies of high-quality water in low-lying areas close to the coast and in coastal groundwater systems.

Existing and prospective Far North Coast region businesses find it hard to gain access to additional water to mitigate these risks or to support new or expanding industries.

There is limited stored water or alternative sources of water to meet irrigation demands, particularly during drought

Historically, large volumes of water have not needed to be stored for irrigation across the Far North Coast region. Traditional crops were rain-fed and only required irrigation during the drier spring months. For most landholders, the costs of constructing, maintaining and operating farm dams and the additional pumping infrastructure was not economically viable.

The 2017–2020 drought highlighted the need to shift from a reactive to a proactive management approach to weather extremes. The drought showed that the crops currently grown in the Far North Coast region are vulnerable to extended dry periods, particularly the more recently grown horticultural crops.

Our modelling shows that dry periods are likely to increase in frequency and intensity, and traditional surface water sources may be less reliable than previously thought. Currently, there are few alternative water sources available in the region that are readily accessible and able to mitigate the water security risks of drought.

Groundwater is often considered an emergency supply of water during drought. For the Far North Coast region, the interconnectivity between surface water and many of the region's groundwater sources means that reductions in surface water flows – from changes to rainfall during periods of drought, as well as from over-extraction – can reduce groundwater yields.

Water extraction limits are restricting development opportunities in unregulated catchments

Water sharing plans set limits on how much water can be extracted annually from the region's water sources through long-term average annual extraction limits (LTAAELs). LTAAELs aim to balance long-term reliable access to water with protecting the environment.

Surface water and alluvial groundwater LTAAELs in the Far North Coast region reflect the sum of licensed volumes and estimated basic landholder rights at the time the water sharing plan was made. As such, no new water access licences can be issued to surface water sources, even if they would not cause water extractions to exceed long-term sustainable limits.

The region's groundwater LTAAELs vary by aquifer and are based on the calculation of several key components, including groundwater recharge, risk assessments, planned environmental water, and current and future water requirements. Unassigned water exists in some of these sources because the LTAAELs still exceed the total volume of water access licences and basic landholder rights. Acknowledging this, the NSW Government has made shares available in these groundwater sources through a controlled allocation process each year since 2017. Future controlled allocations will be made in accordance with the *Strategy for the controlled allocation of groundwater*.³⁹

We have heard that agricultural production in the Far North Coast region is constrained by existing harvestable rights limits. Harvestable rights apply to coastal-draining catchments and allow landholders to collect a proportion of the average regional rainfall runoff from their property in one or more dams on non-permanent, mapped minor streams, or unmapped streams.

This collection is allowed without a water access licence, water supply work approval or water use approval. Some water users have advocated for increases in harvestable rights to support commercial enterprises and believe that this could be achieved while still maintaining a sustainable level of access for downstream users. The 2021 increase in the harvestable rights limit in coastal-draining catchments recognises the strong interest expressed by some water users for the need to improve water security for stock and domestic and basic farming use during extended dry periods and to ensure water for firefighting. The increase in the harvestable rights limit excludes the use of this water for intensive agricultural uses such as horticulture and aquaculture.

39. Department of Primary Industries 2017, *Strategy for the controlled allocation of groundwater*, www.industry.nsw.gov.au/water/allocations-availability/controlled

Water users are not taking up opportunities available in water sharing plans to access more water

For water sources where no additional licences can be allocated, additional water can be accessed through permanent or temporary trade of existing water access licences, in line with water sharing rules. The rules aim to maximise flexibility for water users without negatively affecting the environment or the reliability of other water access licences.

Although trade is allowed and annual water use in most areas is generally well below LTAAELs, very little trade occurs in the region's catchments. There are no examples of temporary trades and only one example of a permanent trade in the region. Water users have noted many barriers to trade, including lack of meters, restrictive trade rules and limited market information.

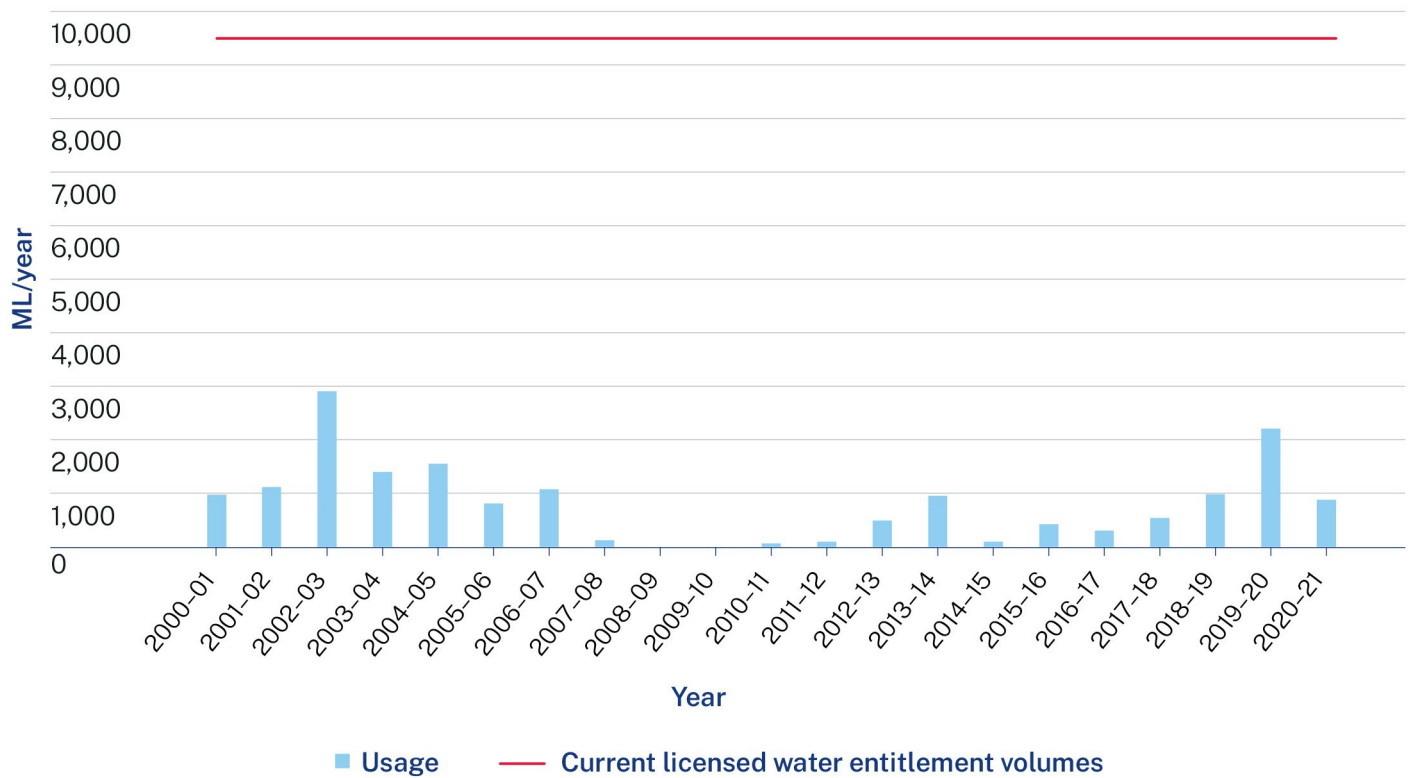
Water sharing plan rules allow for low-flow to high-flow conversions in many Far North Coast region water sources. Although the main intent of these conversions is to protect low flows, it also allows landholders to access a greater volume of water during high-flow periods to store for later use. In theory, this approach could also provide landholders with more water to support expanded operations. However, licence holders in the region have not taken up conversions to high-flow access.

Water entitlements in the Richmond River regulated system are underused

Toonumbar Dam stores around 11 GL water and supplies a small number of agricultural producers. It has historically filled to capacity in most years. The dam is very underused, mostly because the region has high rainfall and supports cropping with relatively low irrigation demand (see Figure 14). This means Toonumbar Dam is used primarily to manage droughts.

Water prices across the region for both regulated and unregulated sources are some of the highest in NSW. This can make it difficult for producers to afford water when they need it. The cost of water increases with decreasing water use because it becomes more difficult for WaterNSW to recover the costs of operating Toonumbar Dam. Consequently, WaterNSW operates the dam at a loss, despite water charges being high compared to other large regulated systems in NSW.

Figure 14. Water use from Toonumbar Dam between 2000 and 2021





Challenge: Water security for towns and communities in the Far North Coast

Opportunity: Improve the resilience of town water supplies by planning for the uncertainties of population growth and projected climate change.

Population growth is putting pressure on town water supply systems in the Far North Coast region. The risks to these systems could increase with the increasing frequency and severity of dry periods likely to occur in the future.

There are risks to town water supplies during extended dry periods

The new long-term climate data shows risks of extended droughts are greater than previously thought. Climate change is also likely to lead to future reductions in winter rainfall and higher temperatures. This may result in a reduction in overall water availability and an increase in evaporation from storages.

Over the next 40 years, population growth in the Far North Coast is likely to have a greater impact on water supply security than climate change. The population of towns across the Far North Coast coastal fringe is projected to increase significantly. This will put more pressure on reticulated town water supplies during dry periods. Rural users (unconnected residents) can put extra pressure on town water supplies during intense dry periods as they often need to cart in water to replenish their own domestic supplies. This can increase overall demand on town water supplies even though water restrictions may be reducing use in urban areas.

Our modelling suggests that the risks to town water supplies in the Far North Coast region occur mostly during extreme dry periods. This is of particular concern for the Rous County Council and Tweed Shire Council water supply systems because they service large populations and the consequences of shortages could be severe.

Both Rous County Council and Tweed Shire Council have limited water storage available. Currently, there is roughly 12–18 months of water storage available for the major urban supplies in the Far North Coast. During a drought longer than this, local councils would have to rely on emergency supplies such as temporary desalination plants. The lead times for these supplies can be long (12–24 months), which means that they need to be implemented very early on in a drought. There can be significant costs to maintaining reliable water supplies during drought. Councils in the Far North Coast region need to consider the levels of risk that Far North Coast communities are willing to endure and to balance these with the associated costs of their emergency supplies.

Councils in the region are already focusing on reducing the risks to supplies. For example, a core component of Rous County Council's Future Water Project 2060 is to reduce water loss.⁴⁰ The strategy commits council to developing and implementing water loss management plans for each of its service areas. Tweed Shire Council is actively trying to reduce general water use, while also augmenting Clarrie Hall Dam to increase supply. These kinds of actions can reduce system risk by delaying the need for emergency supplies.

40. Hydrosphere Consulting 2022, *Rous Regional Supply: Future Water Project 2060 – Integrated Water Cycle Management Strategy*, rous.nsw.gov.au/future-water-for-our-region

Uncertainty makes it difficult to plan future water supplies

In the Far North Coast region, climate and population are the variables that most profoundly affect town water supply systems. Future changes to these variables are very uncertain. The future state of the climate will depend on global emissions and the policies of governments and other actors around the globe. Uncertainty in the future population of the Far North Coast region has led the NSW Government and local government authorities to estimate different rates of population growth. There is currently no way to calculate the likelihood of any of these different states occurring. They are all plausible futures, the trajectories of which will only become clearer with time.

The modelling completed for the Far North Coast Regional Water Strategy has tested many different climatic conditions, as well as state and local government population projections. This modelling has given us a much better understanding of multiple plausible futures. For most communities, the NSW Government's modelling suggests that the current water supply systems across the Far North Coast region perform well across a broad range of climatic conditions and population estimates. This methodology allows us to evaluate and prioritise options across the state in a consistent way.

The models that we use for this analysis consider unrestricted supply. That is, they do not account for water restrictions during drought. However, water restrictions are known to play a vital role in reducing the risk of shortfalls. This means that the current framework of water restrictions, water efficiency and conservation measures can go a long way to reducing these risks. While risks to future water supply still remain, local councils are managing these risks as part of their core business.

The results of the NSW Government's hydrologic modelling for the Far North Coast did not show shortfalls that lasted for 2 years or more.⁴¹ However, the region does not have the same levels of water storage that many other regions do. Rocky Creek Dam can store just over 12 months' supply with no restrictions. If water restrictions are put in place, the dam has about 18 months' supply.

The towns and communities in the Far North Coast are relatively large. This means that it can take a long time to make an adequate emergency source of water available. For example, to allow for a 12-month planning horizon, Tweed Shire Council currently needs to plan for emergency supplies once Clarrie Hall Dam drops to about 97% capacity. Projections suggest that in the future demand will increase and climate change will reduce inflows. This will lead to dam levels dropping faster. As a result, planning for emergency

augmentations will need to happen much earlier. Some models suggest that by 2030 Tweed Shire Council will need to start planning emergency augmentations when Clarrie Hall Dam is completely full.

Local councils need more support to diversify town water sources

Town water supplies in the Far North Coast currently come mostly from surface water sources. However, ensuring resilient water supplies requires a diverse set of water sources.

Coastal aquifers can provide a source of reliable water during droughts and can produce good quality, high-yielding groundwater for the Far North Coast region. However, these coastal aquifers are vulnerable to contamination and are coming under increasing pressure from growing coastal populations, such as the growing regions of Alstonville, Ballina and the Tweed coast. Concurrent growth in local industries has also placed pressure on groundwater sources such as the Alstonville Basalt Plateau, Richmond Coastal Sands and North Coast Volcanics groundwater sources. As a result, these coastal aquifers require careful management to ensure reliable groundwater sources are available for the Far North Coast region when they are needed most.

We have a limited understanding of coastal groundwater systems. In particular, we have knowledge gaps on aquifer capacities and on how reliable these groundwater resources are during dry periods. As part of its Future Water Project 2060, Rous County Council is looking to diversify its water sources by using more groundwater supplies.⁴² However, our limited understanding of groundwater systems in the region could affect the ability of Rous County Council – and other towns and communities – to do this well.

Diversifying to other water sources, such as purified recycled water for drinking, can also be difficult. Studies from across the globe have shown that one of the major hurdles to implementing potable reuse schemes is community acceptance. In some parts of the Far North Coast region, public perception of purified recycled water makes acceptance of potable reuse schemes challenging. Additionally, the frameworks that currently govern the treatment and use of purified recycled water for potable use can make it difficult for local councils to pursue reuse as a feasible augmentation option.

Any future decision to include purified recycled water in potable water supplies would be subject to community consultation and require stringent government approvals.

41. The frequency of 2-year shortfalls was a key metric used in the assessment process across the state.

42. Hydrosphere Consulting 2022, *Rous Regional Supply: Future Water Project 2060 – Integrated Water Cycle Management Strategy*, rous.nsw.gov.au/future-water-for-our-region, accessed 3 April 2023

Regional solutions for improving access to water for towns are difficult to plan and implement

There are several regional solutions that are beyond the capacities of individual councils to implement, but that could be considered in their planning processes. The inability to consider these options can lead to inefficient investment decisions, higher capital and operational costs, and less resilient systems. Examples of regional-scale augmentations that can benefit multiple local councils include regional desalination, network interconnections and infrastructure sharing.

Most local councils have already taken steps to protect town water supplies against dry periods

The 2017–2020 drought highlighted that some of the region's town water supply systems can be put under pressure during drought. Local councils in the Far North Coast region are already taking steps to protect town water supplies from dry periods (Figure 15). Many of the Far North Coast local councils have developed integrated water cycle management strategies for their supplies.⁴³

Key initiatives for the region include:

- Tweed Shire Council is planning augmentation of Clarrie Hall Dam (from 16 GL to 42.3 GL capacity).
- Rous County Council is planning an upgrade to the Alstonville groundwater scheme, increasing access to groundwater, and further investigating long-term augmentations, including recycled water and desalination. By 2030, Rous County Council aims to have the new groundwater sources operational and to pilot a purified recycled water plant.

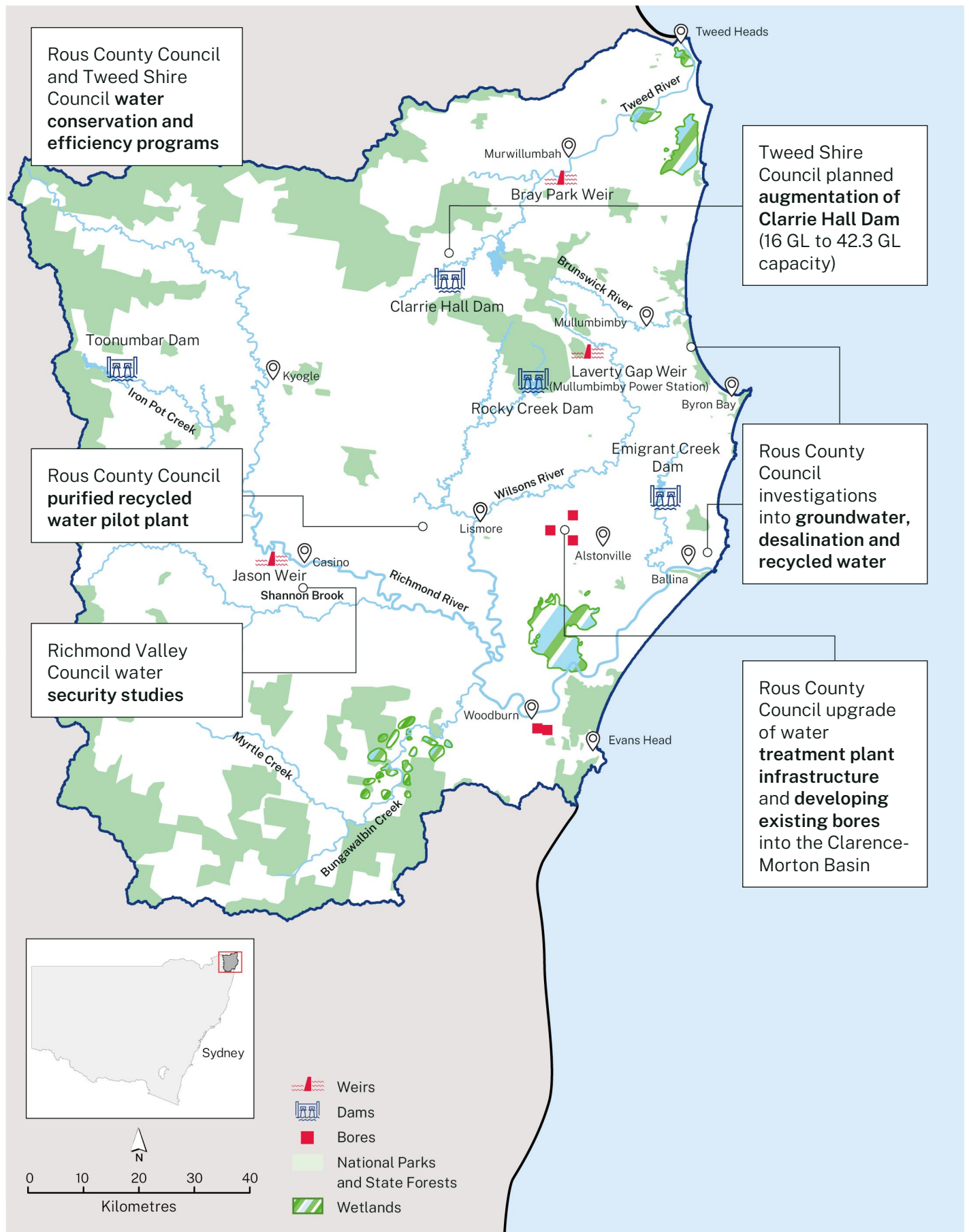
- Water security studies are being carried out by Richmond Valley Council.
- Water conservation and efficiency programs are being rolled out by Tweed Shire and Rous County councils.

The assessment undertaken for the Far North Coast Regional Water Strategy uses new climate data that differs from the data councils have used to develop their plans. The NSW Government is working with councils to determine how this new data should be used.

In further developing and implementing the Far North Coast Regional Water Strategy, the NSW Government and councils will need to better understand population pressures, including from rural landholders. The NSW Government will continue to support local councils to plan their supplies through the regulatory and assurance framework for local water utilities (see Action 4.2).

43. The integrated water cycle management (IWCM) process has been replaced by a new regulatory and assurance framework for local water utilities. The NSW Government is working with local councils to ensure their IWCM strategies meet the requirements of this new framework. More information is available at: www.industry.nsw.gov.au/water/water-utilities/best-practice-mgmt

Figure 15. Current water security initiatives in the Far North Coast





Challenge: Flood risks to individuals, businesses and communities

Opportunity: Support local councils to improve their understanding and management of flood behaviour and flood risks.

Floods are an important part of the ecosystem, but they can negatively affect communities

Flooding is a vital, natural process that supports the region's diverse ecosystems. Floods provide significant groundwater recharge events and connections between rivers and their wetlands and floodplains, such as the Tuckean Swamp, Ballina Nature Reserve and Big Scrub in the lower Richmond River. Floodplains and their ecosystems are integral to Aboriginal culture and traditions. Floods are responsible for the productive soils valued by landholders on the Far North Coast region's floodplains. Flooding is also a key driver of estuarine productivity: it transports carbon and

nutrients into the estuary, and provides breeding cues for species such as prawns. This can bring significant economic benefit to local communities.

However, development on the floodplain has meant that floods can have significant impacts on people and businesses, damaging infrastructure, creating safety risks and causing financial and economic loss.

Flooding is a major concern in the Far North Coast region. Early in 2022, parts of the region experienced the largest and most devastating flooding on record. During community consultation, we heard that the community in the region considers flooding a critical and persistent risk. Climate change is expected to worsen this risk.

2022 NSW Flood Inquiry

In response to the widespread floods in 2021 and 2022, the NSW Government commissioned an independent expert inquiry into the preparation for, causes of, response to and recovery from the 2022 flood events in NSW.⁴⁴ The final inquiry report was published in August 2022 and included 28 recommendations. The NSW Government supported all 28 recommendations, either in full or in principle.

Several of the report's recommendations and the NSW Government's response⁴⁵ support the aims of the Far North Coast Regional Water Strategy. These include, but are not limited to, the NSW Government's in-principle support for:

- building more accurate and complete data for flood threat identification, warning and modelling systems (recommendation 1)
- building on existing initiatives around climate and weather research to identify opportunities to build and align disaster research and technology development (recommendation 2)
- strengthening the delivery of evidence-based, targeted education campaigns aimed at building disaster resilience (recommendation 14)
- developing further essential service infrastructure above the flood planning level, where appropriate (recommendation 28).

44. NSW Government 2022, *NSW Flood Inquiry*, www.nsw.gov.au/nsw-government/projects-and-initiatives/floodinquiry

45. Available at: www.nsw.gov.au/nsw-government/projects-and-initiatives/floodinquiry

Achieving integrated flood risk management in multi-jurisdictional catchments can be challenging

Local councils are generally responsible for managing floods within their boundaries. However, the Richmond River catchment contains 5 local government areas. This means that development or geomorphic changes in one local government area can influence flood behaviour in downstream local government areas. This can make it more challenging to implement an integrated and consistent approach with clear roles and responsibilities.

As a flood mitigation authority in the Richmond River catchment, Rous County Council helps its constituent councils to manage flood impacts. It mainly does this by constructing, replacing and maintaining flood mitigation infrastructure. However, it has also supported councils to improve their flood modelling. In general, local councils develop and maintain their own flood models. In 2010, Rous County Council collaborated with the NSW Government to resolve inconsistencies in the modelled flood levels of different local council models. Since then, local councils in the Richmond River catchment have been working collaboratively with the NSW Government through the Floodplain Management Program to improve and refine their flood models and flood risk management processes. A new catchment-scale flood model is currently being developed by the CSIRO and is funded by the Australian Government through the Northern Rivers Resilience Initiative.



Image courtesy of Lori Cameron, Department of Planning and Environment. Brunswick River picnic area, Brunswick Heads Nature Reserve.

Managing flood risks

Local councils are primarily responsible for managing flood risks in their local government areas. The Department of Planning and Environment is the lead NSW flood risk management agency. It provides technical advice and financial support to assist councils' flood risk management activities. Local councils develop floodplain risk management plans that can:

- identify the need for flood risk management works
- identify improvements to emergency management
- inform land use planning.

Planning considerations try to ensure that development is appropriately sited and that controls such as minimum habitable floor levels are complied with. These measures can go a long way towards minimising localised flood threats. The NSW Government provides support through:

- **Floodplain Development Manual and guidance:** The manual and associated guidance support councils to develop and implement local floodplain management risk plans in accordance with the NSW Government's Flood Prone Land Policy.
- **Floodplain Management Program:** This program provides financial assistance and technical advice to councils to assist them manage flood risks. Since 2012, the NSW Government has granted about \$9.36 million under this program to councils in the Far North Coast region to help them better understand and manage flood risk in their communities.
- **Flood Prone Land Package 2021:** This package provides updated advice to councils on considering flooding in strategic and statutory land use planning instruments, supporting better management of severe to extreme flood events.
- **Interagency collaboration:** councils work closely with the Department of Planning and Environment and the State Emergency Service to ensure that land use planning and emergency management processes are in place to protect the community from the impacts of flooding. This includes considering the potential impacts of climate change on flood risk.
- **Climate Change Fund:** This fund supported projects to improve NSW's resilience to natural hazards and climate risks. As part of the current program, \$3 million was granted in 2018 to Tweed Shire Council for its Industrial Land Flood Mitigation Strategy.

Councils are taking steps to address flood risks in the region: Lismore case study

Rous County Council completed a flood risk management study for Lismore in January 2021. The hydrologic model covered the catchments upstream of Lismore and the hydraulic model extended downstream to Wyrallah in the Wilsons River. Lismore City Council has commenced preparing its flood risk management plan, which it expects to complete in 2023. Lismore City Council is considering nature-based solutions for the upper catchments as one of many flood mitigation measures. Nature-based solutions may reduce the negative effects of small-to-medium floods in some locations. They can also offer other benefits including improved water quality, and improvements to riparian and geomorphic condition.

We can improve our understanding of the risks from sea level rise and climate change on flood behaviour

To understand and manage coastal flooding, we need to consider the additional impacts of climate change and sea level rise on flooding.

Flood modelling already considers the implications of sea level rise in lower coastal waterways. However, recent advances in our understanding of the hydrology of the Far North Coast can complement these considerations.

Hydraulic modelling for the Richmond and Tweed estuaries is being conducted through the Marine Estate Management Strategy. This modelling considers future sea level rise and saline intrusion and their effects on floodplain drainage. This work can complement our understanding of flood behaviour in the region.

A plan to improve water outcomes for the Far North Coast

5

Image courtesy of iStock. Killen Falls, Tintenbar.

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

To address the 7 challenges in the Far North Coast region, we have prioritised actions that aim to:

- Take a holistic approach to land and water management
- Improve our understanding of the region's water resources
- Ensure water resource development and use is sustainable and equitable
- Prepare for future climatic extremes.

Together, the actions in this strategy can improve the region's readiness to adapt to a more variable climate. They will support the decisions we may need to make to ensure healthy, reliable and resilient water resources for the region's future.

The priorities set out in this strategy do not override the priorities around water sharing in the *Water Management Act 2000*. The priorities act as key responses to the challenges. They help identify the range of actions that need to be progressed in the region over the coming decades. The order in which the actions are listed is not indicative of government preferences or priorities.



Image courtesy of iStock. Sugar cane fields, Murwillumbah.

Figure 16. Regional Water Strategy: overview of strategy vision, objectives, water security challenges and priorities

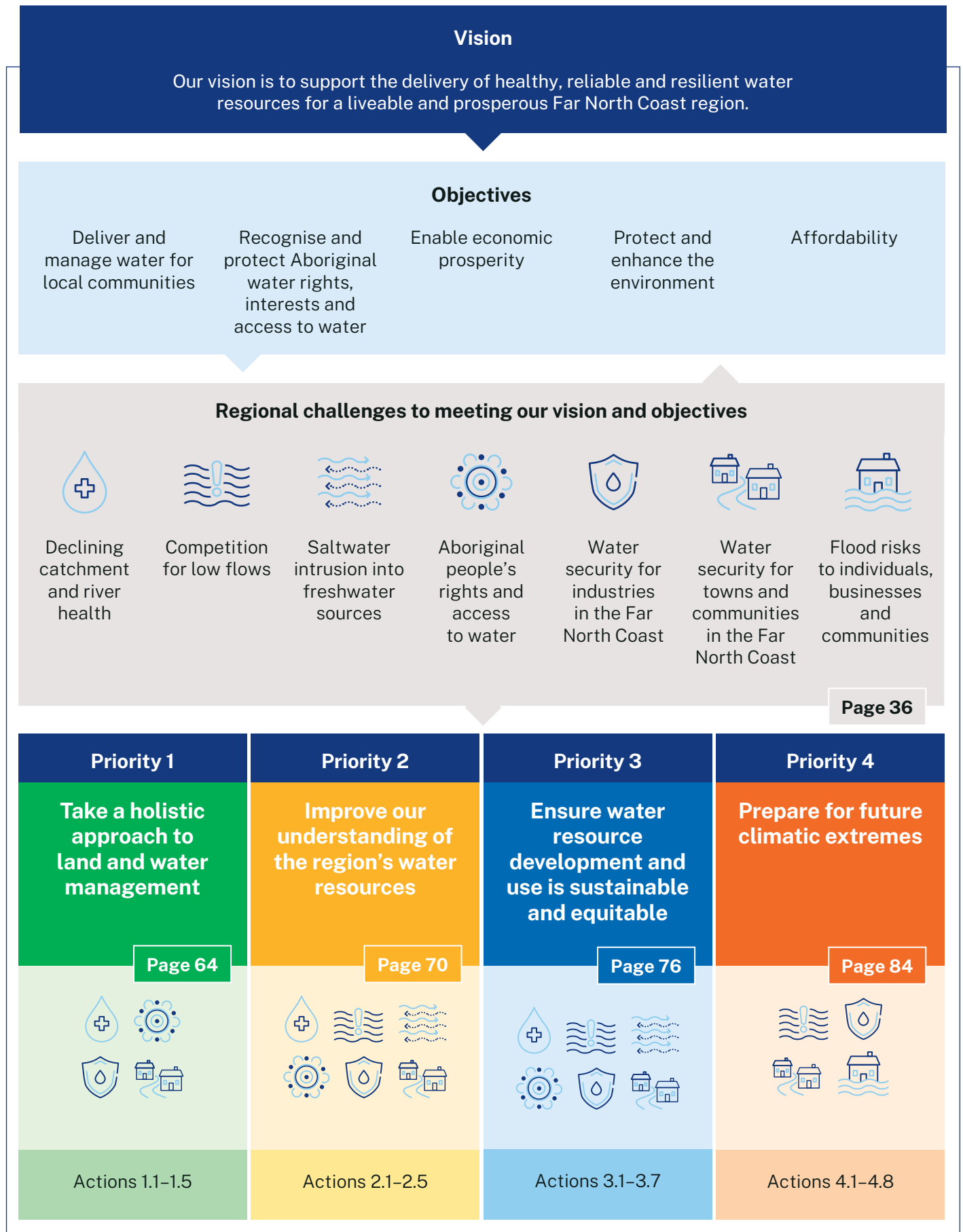
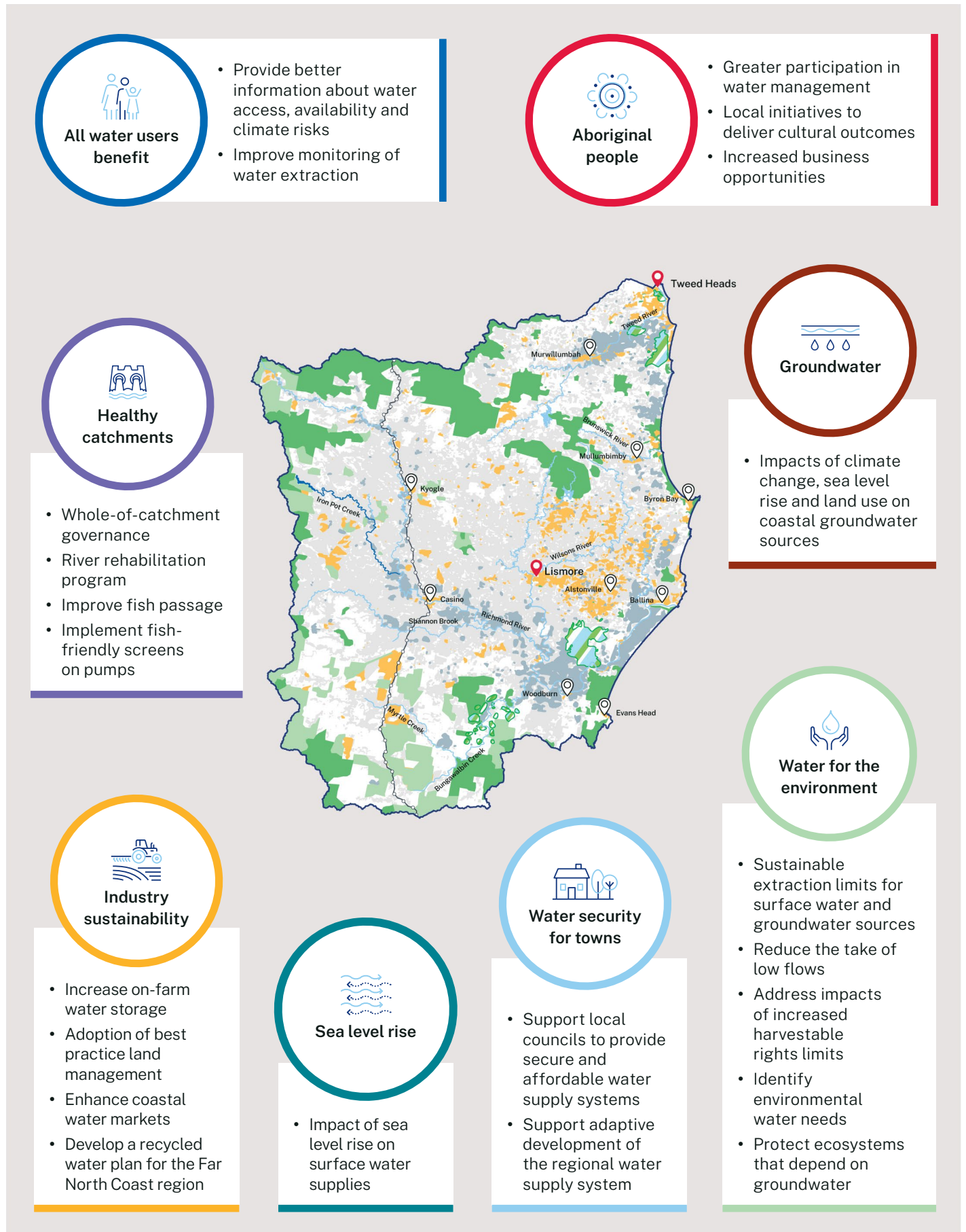


Figure 17. Summary of Far North Coast Regional Water Strategy actions



All water users benefit

- Provide better information about water access, availability and climate risks
- Improve monitoring of water extraction

Aboriginal people

- Greater participation in water management
- Local initiatives to deliver cultural outcomes
- Increased business opportunities

Healthy catchments

- Whole-of-catchment governance
- River rehabilitation program
- Improve fish passage
- Implement fish-friendly screens on pumps

Groundwater

- Impacts of climate change, sea level rise and land use on coastal groundwater sources

Water for the environment

- Sustainable extraction limits for surface water and groundwater sources
- Reduce the take of low flows
- Address impacts of increased harvestable rights limits
- Identify environmental water needs
- Protect ecosystems that depend on groundwater

Industry sustainability

- Increase on-farm water storage
- Adoption of best practice land management
- Enhance coastal water markets
- Develop a recycled water plan for the Far North Coast region

Sea level rise

- Impact of sea level rise on surface water supplies

Water security for towns

- Support local councils to provide secure and affordable water supply systems
- Support adaptive development of the regional water supply system

Priority 1

Take a holistic approach to land and water management

It is important that we continue to protect and enhance the region's waterways, groundwater systems and the ecosystems they support. To do this, we need to ensure our management systems and decision-making processes use a holistic, whole-of-catchment approach. This approach includes coordinating efforts across stakeholder groups and supporting landholders to build awareness and capacity for best practice natural

resource management and sustainable agriculture. Adopting best practice land and water management that considers Aboriginal knowledge and culture, together with science, will be critical to ensuring efforts that protect waterway health are targeted and benefit users at a local, whole-of-catchment and regional scale.

Our starting point

The NSW Water Strategy (Priority 3) commits to actions that improve river, floodplain and aquifer ecosystem health and system connectivity. One example of this is by taking landscape scale action to improve river and catchment health and adopting a more intense, statewide focus on improving water quality.

The NSW Government will partner with First Nations/Aboriginal people to co-design a statewide Aboriginal Water Strategy that will identify a program of measures to deliver on First Nations' water rights and interests in water management. The strategy will include a focus on addressing statewide systemic issues to better enable the exercise of First Nations/Aboriginal peoples' rights and access to water.

The Marine Estate Management Strategy is progressing actions that address the cumulative impact of agricultural runoff, urban stormwater, sediment contamination and other threats to the water quality of NSW estuaries (Initiative 1). On-ground activities that provide habitat protection and rehabilitation are being designed to help mitigate the impacts of climate change on estuarine and coastal habitats, particularly from sea level rise.

The NSW Government is investigating options for better managing the issues caused by coastal drains through a review of coastal drainage management in NSW. This is being delivered through the Marine Estate Management Strategy.








The North Coast Local Land Services delivers a large number of natural resource management and sustainable agriculture projects across the region, supporting private landholders to adopt best practice land and water management practices. These projects contribute to improvements in soil, vegetation and riparian condition, and ultimately water quality and landscape health. Funding for these projects has been provided through a variety of sources including the Marine Estate Management Strategy and Catchment Action NSW.



Coastal management programs, developed by local councils with the support of the Department of Planning and Environment, provide strategic direction and funding support for local councils to address key coastal management issues.

The NSW Government has developed the NSW Groundwater Strategy that identifies the key risks to our groundwater resources and the associated management challenges for NSW. The strategy sets out the actions required to address these challenges and provides a logical framework for funding of groundwater management reform work over the next 20 years.

The Protecting Our Places Program is a contestable grants program for Aboriginal community organisations and groups, seeking to achieve long-term beneficial outcomes for the environment.

Table 5. Actions to address Priority 1: Take a holistic approach to land and water management

Legend						
						
Declining catchment and river health	Competition for low flows	Saltwater intrusion into freshwater sources	Aboriginal people's rights and access to water	Water security for industries in the Far North Coast	Water security for towns and communities in the Far North Coast	Flood risks to individuals, businesses and communities

Action number	Action name	Challenges addressed
Incorporate Aboriginal knowledge and culture into land and water management		
Action 1.1:	Foster ongoing collaboration with local Aboriginal people in water management	
Action 1.2:	Support place-based initiatives to deliver cultural outcomes for Aboriginal people	
Undertake whole-of-catchment planning, decision-making and project delivery		
Action 1.3:	Support whole-of-catchment governance	
Action 1.4:	Deliver a river rehabilitation program	
Support local landholders to adopt best practice land use and water management		
Action 1.5:	Support landholder adoption of best practice land management	

Incorporate Aboriginal knowledge and culture into land and water management

As custodians of Australia's land and water for tens of thousands of years, Aboriginal people have developed a rich spiritual connection to Country and have a large body of knowledge and culture. Healthy waterways are critical for Aboriginal people's health, wellbeing and culture. Aboriginal people do not consider land and water as separate. A more holistic approach to land and water management involves working collaboratively with Aboriginal people, drawing on their knowledge and experience, and integrating their perspectives, approaches and values into water legislation and management frameworks. We will develop whole-of system governance structures that are understood and supported by Aboriginal people and give them direct input to water management decision-making. We will also provide Aboriginal people with opportunities to manage water using their culture and knowledge and create improved economic opportunities and environmental outcomes. Restoring degraded spiritual and cultural sites are important acts of reconciliation.

Action 1.1: Foster ongoing collaboration with local Aboriginal people in water management

Aboriginal people have told us that consultation with their communities on water issues has been infrequent and poorly executed. Community sentiment is that government agencies often come out to 'tick a box' and are never seen again after this. During consultation in the Far North Coast region, Aboriginal groups told us that government has to earn the trust of the community as the first step in building strong, lasting relationships with them.

To address this issue now and over the next 20 years, we need an approach that allows Aboriginal people in each local area and region to get the right people involved or appointed to seats where decisions about water are being made. Aboriginal people need to have a direct line of contact with regional water managers, compliance officers and decision-makers. Aboriginal knowledge and science should be actively sought, respected and incorporated into decision-making.

An effective governance, engagement and knowledge sharing arrangement is the first step in improving Aboriginal people's involvement in water management. The makeup and function of groups need to be led by local communities to be successful. Experience has shown that governance models for Aboriginal communities do not work when they are set by government. This action will include supporting new or existing Aboriginal groups to develop a model for involvement in water management processes. The success of this action will be driven by the extent to which it enables self-determination and provides an adequate level of support for the groups.

This action supports Priority Reform 1 in the *National Agreement on Closing the Gap*,⁴⁶ which focuses on formal partnerships and shared decision-making arrangements and commits Australian governments to developing place-based partnerships that respond to local priorities.

Local Aboriginal groups in the Far North Coast region could be involved in:

- developing culturally appropriate water knowledge programs
- identifying culturally appropriate methods for how and when communities should be consulted and how their feedback should be considered in decision-making processes
- outlining a process that the NSW Government can follow to ensure water-related decisions have been appropriately considered by the community.

46. Various parties 2020, *National Agreement on Closing the Gap*, closingthegap.gov.au/national-agreement

Action 1.2: Support place-based initiatives to deliver cultural outcomes for Aboriginal people

The Australian Government's *Closing the Gap*⁴⁷ report and Local and Indigenous Voice program have highlighted that Aboriginal people want strong and inclusive partnerships in which local communities set their own priorities and tailor services and projects to their unique situations. Successful programs are often those that are tailored to local circumstances, place-based, well-resourced and locally driven.

This action will fund and support Aboriginal organisations and communities to develop tailored projects for their communities. It will move away from centralised decision-making and develop a flexible program that is driven by the principle of self-determination – local communities 'speaking with their voices' to make decisions about which programs are needed for their community and their region.

There are already examples of local Aboriginal groups leading the way in delivering on-ground river restoration and education programs. The Githabul Rangers have been operating since 2009. They are a group of Githabul people that combine their traditional knowledge with western practices to restore and look after the land, as well as to inform and empower local Aboriginal people (especially young people) to take a more active interest in the environment and language of their Country.

In the Far North Coast region, this action will build on the work already started by local Aboriginal groups by:

- **Identifying cultural water needs for specific sites or locations where water may support cultural practices:** This could involve working with the Department of Planning and Environment–Water, Department of Planning and Environment–Environment, Energy and Science and WaterNSW to understand if cultural water access licences or water for the environment could help deliver water to these locations.
- **Improving access to Country:** This could be done by opening up gated or locked parcels of land that have access to waterways. These could be locations of significance and could include travelling stock reserves or Crown roads.
- **Piloting a restoration reach:** This would use cultural knowledge and science to rehabilitate riparian land, plant native species and care for Country.
- **Supporting other local Aboriginal communities to develop 'Caring for Country' programs:** These engage young Aboriginal people in water and landscape management. Their objectives include building cultural awareness and giving a sense of ownership and cultural connectivity.

To receive government funding or support, these initiatives will need to have local champions, effective local governance arrangements and a strong capacity-building component, such as activities that focus on water legislation, licensing structures, landscape management or knowledge activities for schools and youth programs.

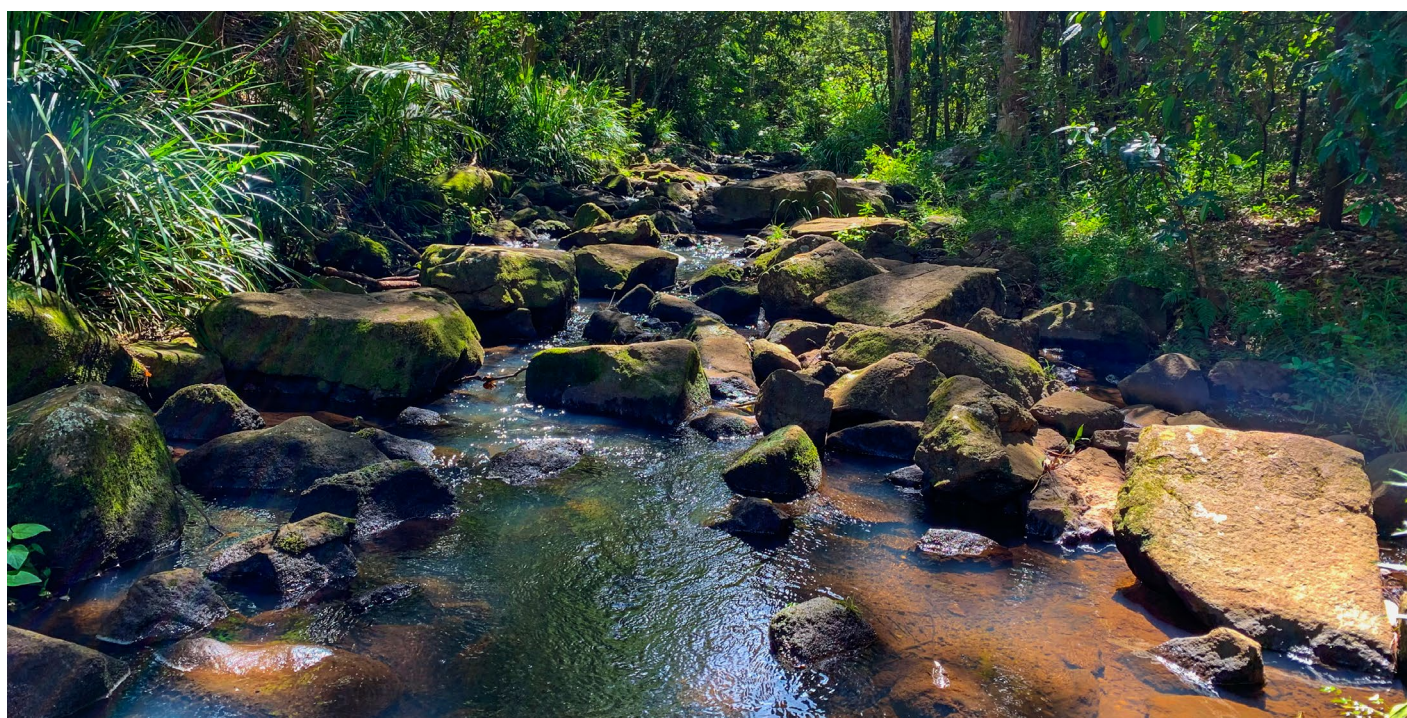


Image courtesy of iStock. Lismore, NSW.

47. Australian Government 2020, *Closing the Gap report*, ctgreport.niaa.gov.au/

Undertake whole-of-catchment planning, decision-making and project delivery

Many strategies, programs and on-the-ground projects have tried to improve the health of the region's aquatic environment. These have focused mainly on managing the impact of diffuse pollutants from urban and rural land on the coastal, estuarine and marine environments.

These initiatives include:

- the NSW Government's Marine Estate Management Strategy⁴⁸
- NSW coastal management framework⁴⁹ and supporting coastal management programs
- different on-ground works administered by the Department of Planning and Environment, Local Land Services, Department of Regional NSW, Department of Primary Industries, local councils, community groups, private landholders and local Aboriginal organisations.

The following actions build on these existing programs. They will support a whole-of-catchment approach to planning, decision-making and project delivery. Catchment planning will help target and coordinate these programs. It will also help highlight and address gaps in the current range of programs being delivered, particularly those related to river and geomorphic health.

Action 1.3: Support whole-of-catchment governance

Current catchment-scale governance arrangements in the Far North Coast region are fragmented. This affects decision-making, investment prioritisation, monitoring and reporting. Delivering effective governance is a key initiative of the Marine Estate Management Strategy to help address threats and improve health outcomes to the NSW coastal, estuarine, and marine environments.

The Marine Estate Management Strategy recognises the need to improve collaboration and integration across government agencies and is supporting a pilot program for improved governance of diffuse source water pollution in the Richmond River catchment in the Far North Coast region.

This action supports the ongoing delivery of the Richmond River pilot governance framework. The framework will help to:

- clarify roles and responsibilities
- synchronise projects
- build collaborative networks
- avoid duplication
- coordinate funding
- highlight gaps in knowledge.

This action will be important to successfully plan and deliver the river rehabilitation program (Action 1.4). It will also facilitate collaboration between many of the region's commercial, environmental, social and cultural organisations.

Learnings from the Richmond River pilot program may be used to develop and deliver long-term catchment governance arrangements. These could support governance arrangements in the other catchments of the Far North Coast region.

Action 1.4: Deliver a river rehabilitation program

The health and resilience of rivers and the ecosystems they support depends on their geomorphic condition and the condition of surrounding floodplains.

This action will develop a whole-of-catchment program for improving the health and water quality of the region's rivers and the ecosystems they support, including native and threatened aquatic species. It will ensure that future river rehabilitation efforts:

- are coordinated and effective at a catchment scale
- support broader ecological, social, cultural and economic outcomes.

Developing a framework to prioritise the type and location of rehabilitation works will be important for the success of this action. The framework will support evidence-based prioritisation by using important river health metrics such as:

- the River Styles classification system, which provides information on condition and recovery potential, and allows us to focus on reaches classified as conservation, strategic or rapid recovery
- severity of land degradation
- mapped high ecological value aquatic ecosystems
- local Aboriginal knowledge and cultural water needs.

48. NSW Marine Estate Management Authority 2018, *NSW Marine Estate Management Strategy 2018-2028*, www.marine.nsw.gov.au/marine-estate-programs/marine-estate-management-strategy

49. More information on the coastal management framework is available at: www.environment.nsw.gov.au/topics/water/coasts/coastal-management/framework

Support local landholders to adopt best practice land use and water management

The Department of Planning and Environment, Local Land Services and the Department of Regional NSW deliver programs that support local landholders to adopt best practice land management by improving productivity and reducing land and water degradation. These programs include:

- irrigation audits
- guidelines for fertiliser application
- improved management of farm runoff and water quality
- improved capacity to prepare and recover from droughts and bushfires.

Many landholders have adopted best practice land and water management. However, some landholders need support to recognise and adopt potential improvements to their land and water management. Feedback received through engagement with local landholders showed that some are frustrated with the lack of extension services available to help them understand the rules and their obligations, and the opportunities for accessing and managing farm water needs.

Action 1.5: Support landholder adoption of best practice land management

Best practice land management helps to improve the infiltration capacity of land and the quality of water leaving properties. As stewards of the land and active natural resource managers, landholders play a vital role in generating natural capital value and improving ecosystems and habitats by adopting best practice land management.

This action will build on existing programs to support private landholders to adopt best practice land management in priority waterways across the region. Support will be provided largely through natural resource management, sustainable agriculture advisory services and on-ground projects, with a focus on:

- stock grazing management
- raising soil carbon levels
- soil disturbance and erosion management
- soil condition and ground cover management
- native vegetation and biodiversity management
- streambank and riparian vegetation protection and restoration
- structural instream habitat restoration works
- drainage and fertiliser use management.

A suite of fit-for-purpose tools will be used to build landholder capacity in knowledge and skills, and to access networks and resources. The tools could include:

- one-on-one consultation
- advice and referrals
- webinars and podcasts
- targeted social media campaigns
- field days and demonstrations
- incentives to deliver on-the-ground projects.

Program delivery will align with the prioritisation framework developed in Action 1.4 and the environmental water requirements established under Action 2.2. This approach will ensure that improvements in private landholder land and water management practice are directed to catchments where river reaches have a high recovery potential or where improvements are critical to achieving key environmental objectives.

This action will be implemented collaboratively with other government agencies, established research groups, local Aboriginal and community groups, and universities.

Priority 2

Improve our understanding of the region's water resources

The NSW Government has a key role to play in helping coastal regions prepare and adapt to future climate-related challenges.

Filling critical gaps in our understanding of the impacts of climate change is essential to fulfilling this role. Investment in new climate datasets, the development of new hydrological models and the roll-out of the NSW Government's non-urban metering framework are all important first steps. However, more targeted investigations are needed to properly understand the cumulative effects of population growth, climate

change, water extraction and sea level rise on the Far North Coast region's water resources. We also need more flexibility in how we share and manage these water resources.

The actions taken under this priority will improve our understanding and future management of the region's water resources. These actions will build on the initiatives of other strategies, particularly the NSW Water Strategy,⁵⁰ the Marine Estate Management Strategy⁵¹ and the NSW Groundwater Strategy.⁵²

Our starting point

The Department of Planning and Environment is applying a new risk-based assessment process to help understand the relative impact of water sharing plan rules on key environmental functions. These include the effects that reduced inflows can have on low flows, freshes and water quality. This new approach is being considered as part of the review or remake of coastal water sharing plans.

In December 2022, the NSW Government published the NSW Groundwater Strategy. Developing the strategy was a key priority of the NSW Water Strategy. The strategy will ensure an enhanced, statewide focus on sustainable groundwater management for the next 20 years. It includes a suite of actions that will ensure investment decisions are made based on improved information and knowledge.

The Department of Planning and Environment–Water is committed to making the water sector more transparent by making its data, models, information products and publications open. In 2022, the department developed and began implementing the open data framework.⁵³








50. Department of Planning, Industry and Environment 2021, *NSW Water Strategy*, water.dpie.nsw.gov.au/plans-and-programs/nsw-water-strategy






51. NSW Marine Estate Management Authority 2018, *NSW Marine Estate Management Strategy 2018–2028*, www.marine.nsw.gov.au/marine-estate-programs/marine-estate-management-strategy

52. Department of Planning and Environment 2022, *NSW Groundwater Strategy*, www.dpie.nsw.gov.au/water/plans-and-programs/nsw-groundwater-strategy

53. The framework sets the department's position that all water data in NSW — collected from both public and private sources — should be 'open data' by default. The open data model will help the department meet important strategic outcomes and responsibilities, including aligning with the NSW Water Strategy outcomes to make more data and models publicly available (Action 1.2 and Action 1.3). More information on the open data framework is available at: water.dpie.nsw.gov.au/science-data-and-modelling/data/open-data-framework

Table 6. Actions to address Priority 2: Improve our understanding of the region’s water resources

Legend						
						
Declining catchment and river health	Competition for low flows	Saltwater intrusion into freshwater sources	Aboriginal people’s rights and access to water	Water security for industries in the Far North Coast	Water security for towns and communities in the Far North Coast	Flood risks to individuals, businesses and communities

Action number	Action name	Challenges addressed
Improve our understanding and management of the region’s water resources		
Action 2.1:	Assess the vulnerability of surface water supplies to sea level rise and saltwater intrusion	
Action 2.2:	Identify environmental water needs to support healthy coastal waterways	
Action 2.3:	Characterise and plan for climate change and land use impacts on coastal groundwater sources	
Action 2.4:	Protect ecosystems that depend on coastal groundwater	
Action 2.5:	Improve monitoring of water extraction	

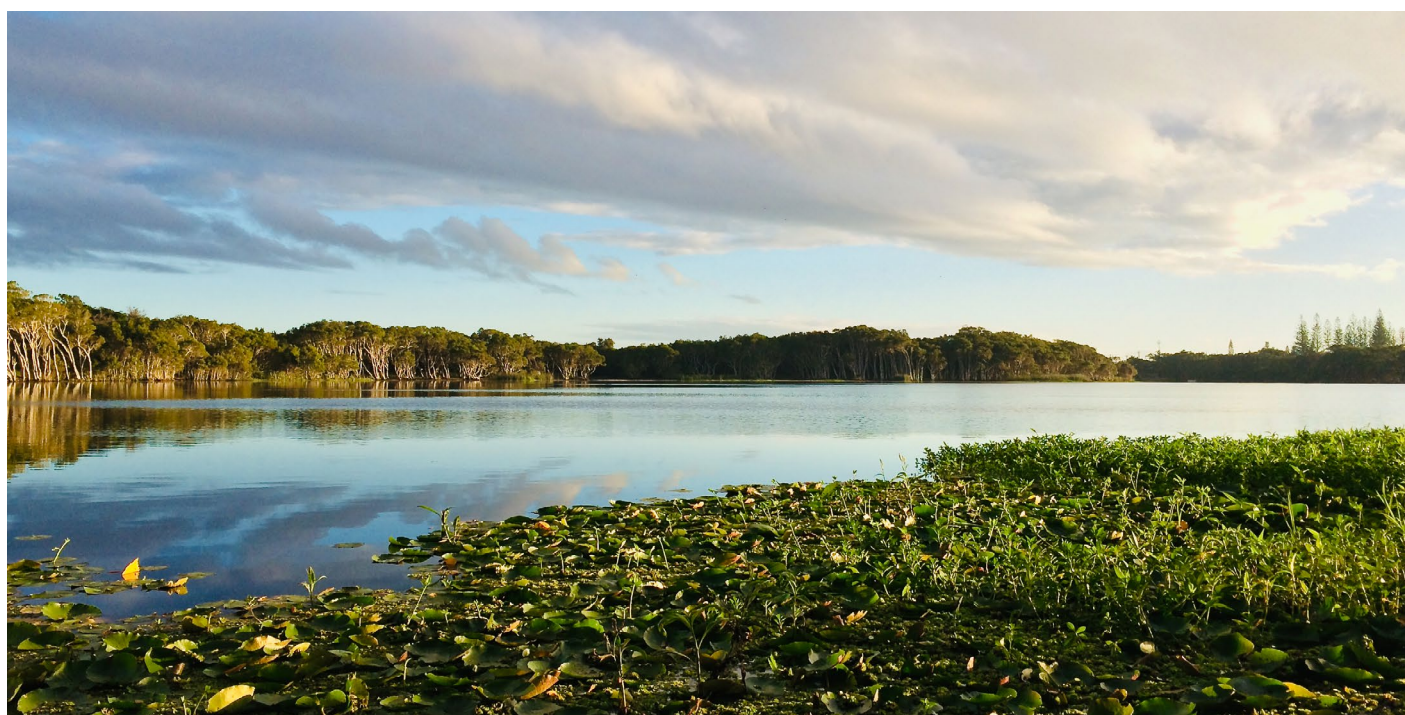


Image courtesy of iStock. Lake Ainsworth, Lennox Head.

Improve our understanding and management of the region's water resources

Action 2.1: Assess the vulnerability of surface water supplies to sea level rise and saltwater intrusion

This action will investigate how future changes to hydrology and water extraction could affect salinity in estuaries in the Far North Coast region. This action will also consider how intermittently closed and open lakes and lagoons will be affected.

We need to better understand how changes to salinity will affect water users and the environment. The Department of Planning and Environment has recently studied the effect that sea level rise will have on floodplain drainage and low-lying land along the NSW coast. However, these studies did not consider the effects that sea level rise will have on water resources. This action will build on existing studies to:

- improve existing models and build new models where needed
- develop a method to assess the impacts of sea level rise on water supplies.

This action will improve understanding of the risks that sea level rise and saltwater intrusion pose to water supplies. It will allow the department to:

- provide information to water users so they are fully informed about the risks to their water supplies
- develop the planning and policy settings required to address the risks that saltwater intrusion presents to water supplies.

This action provides 3 important benefits:

- **Reduces cost to government and water users in the long term:** Formulating policy to meet the challenges associated with sea level rise is complex due to the uncertainty involved. While this uncertainty cannot be removed entirely, taking early action can significantly reduce the future costs of damages. It can also mitigate the economic impacts from sea level rise and saltwater intrusion.
- **Supports tidal pool water users to manage their business risks into the future:** Previous studies have considered the impacts of projected sea level increases on coastal properties, infrastructure and future development. However, more needs to be done in NSW to assess the risks to water users and water resources from increasing salinity.
- **Supports Aboriginal communities to manage cultural assets that may be affected by sea level rise:** This support includes identifying cultural

assets that could be impacted by future sea level rise and saltwater intrusion. For example, changes to ecology in important fishing sites.

This action will also inform our assessment of sea level rise and saltwater intrusion on groundwater resources. We will assess how sea level rise will affect groundwater sources through Action 2.3 of this strategy. The knowledge and understanding we gain from this action will be important inputs to the groundwater models developed for Action 2.3.

Action 2.2: Identify environmental water needs to support healthy coastal waterways

Environmental water requirements define a suite of flow strategies to maintain and improve aquatic health. They are a key tool for linking ecological objectives to management actions and water sharing plan rules. These requirements often include information about the volume, frequency, timing and duration of different types of flows, and water quality. They may also define the ecological risks and constraints, and complementary non-water measures. However, many species and aquatic ecosystems in the Far North Coast region have not been studied enough to describe these requirements and to target them through management actions.

Coastal water sharing plans currently define ecological objectives. It is difficult to evaluate their effectiveness for 2 reasons:

- the links between objectives and water management activities in water sharing plans are unclear
- the data needed to undertake effective evaluation are insufficient or missing.

This action will:

- establish the objectives and water requirements to protect important species, ecological communities and aquatic ecosystems in the region
- provide a framework to identify and prioritise data and monitoring gaps
- develop methods to address data and monitoring gaps, which could include using data from information-rich areas to represent the water needs of a broader river reach or valley.

Current initiatives such as WaterNSW's review of the existing hydrometric gauging network⁵⁴ may support this framework. We will also consider alternative management approaches that can protect important flows without relying on flow gauges. The results from Action 3.6 to address catchment-based impacts of increased harvestable rights limits will be an important input to this action.

54. More information is available at: water.dpie.nsw.gov.au/science-data-and-modelling/data/hydrometric-network-review

Action 2.3: Characterise and plan for climate change and land use impacts on coastal groundwater sources

Access to data is essential to inform future management decisions for groundwater that mitigate the effects of climate change and land use change. However, there is not enough data and information about groundwater sources across coastal regions of NSW. Current data is limited to monitoring bores managed by WaterNSW.

Increased data about groundwater extraction and characteristics can support understanding of:

- groundwater over-extraction
- changes to groundwater recharge and movement
- contamination from diffuse sources (such as pesticides and fertilisers)
- saltwater intrusion from sea level rise.

This action will:

- continue to characterise key aquifers across the region
- continue to make groundwater information available to water users
- support local government and decision-makers to better understand the risks to groundwater resources from climate change and land use.

We will start with the 3 highest priority groundwater sources: the North Coast Volcanics (which includes the Alstonville Basalt Plateau), the Clarence-Morton Basin and Coastal Sands. We have selected these groundwater sources because of their high level of licensed entitlements (mainly for industry), their vulnerability to contamination and evidence of saltwater intrusion.

Data sources for this action will include satellite imagery and field investigations⁵⁵ to help characterise the groundwater resources. The investigations will focus on factors known to be affected by climate change and land use pressures. These investigations will be supported by a review and potential expansion of the bore monitoring and metering network.

The results of this work will support:

- development of a conceptual model of key groundwater resources across the Far North Coast region
- descriptions of the key challenges facing coastal groundwater resources in the region
- an assessment of the risk to coastal groundwater sources from diffuse pollution (pesticides and fertilisers).

This action will improve our understanding of coastal groundwater resources and the threats they face. It will provide decision-makers with a better idea of:

- how much groundwater is available
- how groundwater recharges
- where groundwater discharges
- how extraction impacts on the resource
- the climate and land use risks to important groundwater sources in the region.

This action will also make information available to water users, enabling them to make better informed decisions about their groundwater use. Access to information can also support the co-design of projects by stakeholders and researchers that aim to reduce the negative effects of climate change on coastal groundwater sources.

55. Such as geological, geophysical, geochemical, ecological and hydrogeological studies

Action 2.4: Protect ecosystems that depend on coastal groundwater

This action will improve our knowledge and management of groundwater-dependent ecosystems in the Far North Coast region. This can inform and guide sustainable water sharing arrangements that protect the environmental values of these ecosystems.

Our knowledge of groundwater-dependent vegetation communities is still developing. Supported by the NSW Groundwater Strategy,⁵⁶ this action will improve knowledge-based management and protection of these communities by:

- developing a method for identifying groundwater-dependent ecosystems across the Far North Coast region that are reliant on surface water flows
- monitoring the condition and extent of the associated vegetation communities.

The success of this action depends on the adequacy of the monitoring bore network and metering coverage across the Far North Coast region. These are being assessed through other actions (Action 2.5 and Action 3.4).

This action will inform the environmental water requirements for the region's waterways (Action 2.2). It will also inform future reviews of water sharing plan rules.

Action 2.5: Improve monitoring of water extraction

Water extraction, water storage and increases in access to basic landholder rights can negatively affect water sources. Monitoring and data collection are important to understanding these effects. Current monitoring and data collection in the Far North Coast region's water sources is not sufficient to provide this understanding.

Several recent studies have identified the lack of water data in the Far North Coast region as a problem. These studies include the recent audits of the Richmond River and Tweed River surface water and alluvial water sharing plans by the Natural Resources Commission.⁵⁷ This problem is not new. An irrigation profile completed in 2003 for the NSW North Coast noted data scarcity as a key issue affecting natural resource planning, as well as irrigation management and planning.⁵⁸

This action aims to improve the way we monitor water extraction in the Far North Coast region. It will provide several important benefits, including:

- improving our understanding of how well water sharing plan objectives are being met
- improving future water sharing decisions and natural resource planning
- supporting landholders to identify where they can reduce water use.

56. Department of Planning and Environment 2022, *NSW Groundwater Strategy*, www.dpie.nsw.gov.au/water/plans-and-programs/nsw-groundwater-strategy

57. Natural Resources Commission 2021, *Final Report: Review of the water sharing plans for the Richmond and Tweed unregulated and alluvial water sources (D20/3832)*, NSW Government

58. Hope, M. 2003, *NSW North Coast Region Irrigation Profile*, NSW Agriculture

Improved monitoring of water extraction: considerations and links to other programs

Non-urban metering framework

The non-urban metering framework aims to ensure 95% of licensed water take in NSW is accurately metered by 2024. In the Far North Coast, around 13% of surface water supply works and 22% of groundwater supply works will meet the requirements for mandatory metering. This metering will provide a good starting point to better understand the effects of water extraction in the region. However, increasing metering in coastal catchments is challenging because the flashy nature of coastal floods can damage or wash meters downstream.⁵⁹ Metering reforms also target large water users, but the combined impacts of smaller water users in smaller waterways can be substantial.

Action 2.5 will build on the NSW Government's non-urban metering reforms by investigating other opportunities for improving water extraction monitoring across the region. This includes improving:

- awareness of current exemptions
- financial support
- the availability of compliant metering solutions, such as specifications for metering moveable pumps.

Implementation of the harvestable rights review

Increases in water extraction under basic landholder rights may increase unmetered water take across the Far North Coast region. This is due to growth in rural subdivisions and smaller properties, as well as the 2022 increase to the harvestable rights limit in coastal-draining catchments.

As part of the changes to the harvestable rights limit, there are 2 important initiatives that can support and inform Action 2.5:

- The NSW Government has purchased high resolution satellite imagery to better understand the current levels of uptake of harvestable rights dams.
- Landholders who build new dams or enlarge dams above their existing harvestable right dam capacity will need to notify the Natural Resources Access Regulator.

Other initiatives

A number of other initiatives will inform and support implementation of Action 2.5. These initiatives include work funded through the Commonwealth's Hydrometric Networks and Remote Sensing Funding Program.

Action 2.5 will also complement and link to the NSW Groundwater Strategy⁶⁰ Action 3.1: Develop the groundwater components of a water knowledge plan.

59. Coastal floods can peak dramatically within hours of heavy rain and usually return to medium flows within a few days.

60. Department of Planning and Environment 2022, *NSW Groundwater Strategy*, www.dpie.nsw.gov.au/water/plans-and-programs/nsw-groundwater-strategy

Priority 3

Ensure water resource development and use is sustainable and equitable

Sustainable water management means that we meet the water needs of the present without compromising the ability of future generations to do the same.

Ensuring this for the Far North Coast region will require us to improve management of water between users and to reduce the impact of infrastructure on waterway health.

Our starting point

The NSW Water Strategy has committed to the sustainable management of surface water and groundwater systems. These initiatives include better integrating land use planning and water management, reviewing water allocation and water sharing in response to new climate information, and publishing the NSW Groundwater Strategy.⁶¹

The NSW Government has recently updated the North Coast Regional Plan.⁶² The objectives of regional plans recognise the need to think holistically about water management and to encourage innovation in water efficiency and whole-of-water-cycle management.

The Department of Planning and Environment is applying a new risk-based assessment process to help understand the relative impact of water sharing plan rules on key environmental functions, such as the effects that reduced inflows can have on low flows, freshes and water quality. This new approach is being considered as part of the review or remake of coastal water sharing plans.

The NSW Fish Passage Strategy provides a coordinated 20-year plan to proactively restore unimpeded fish passage and improve native fish access to mainstem rivers and key off-channel habitats across NSW. Under the Marine Estate Management Strategy,⁶³ the action Reconnecting Fish Habitats aims to address high priority fish passage barriers along the NSW coast. Both strategies are led by the Department of Regional NSW, and provide a framework for prioritising restoration work across the state and the Far North Coast region.

The NSW Government has assisted local councils to develop regional economic development strategies (REDS)⁶⁴ based on the concept of a functional economic region. REDS provide a clear economic development strategy for the region and were updated at the beginning of 2023.

The NSW Government has also committed \$3.9 million under Future Ready Regions to promote resilience and develop drought resilience plans that will assess drought impacts and responses. Individual plans can focus on intra- or inter-industry diversification, leadership and building social capital, and planning council works counter-cyclically.

The 20-Year Economic Vision for Regional NSW⁶⁵ is the NSW Government's plan to drive sustainable, long-term economic growth in regional NSW. It is the roadmap to unlock significant economic potential in regional NSW. It guides transformative, once-in-a-generation investment in our regions through the \$4.2 billion Snowy Hydro Legacy Fund, to create jobs now and into the future.

61. Department of Planning and Environment 2022, *NSW Groundwater Strategy*, www.dpie.nsw.gov.au/water/plans-and-programs/nsw-groundwater-strategy

62. More information on the North Coast Regional Plan is available at: www.planning.nsw.gov.au/Plans-for-your-area/Regional-Plans/North-Coast/North-Coast-Regional-Plan-2041

63. NSW Marine Estate Management Authority 2018, *NSW Marine Estate Management Strategy 2018–2028*, www.marine.nsw.gov.au/marine-estate-programs/marine-estate-management-strategy

64. More information on the Regional Economic Development Strategies is available at: nsw.gov.au/regional-nsw/regional-economic-development-strategies

65. More information on the 20-Year Economic Vision for Regional NSW is available at: nsw.gov.au/a-20-year-economic-vision-for-regional-nsw-refresh

The NSW Government's \$48 million expanded Farms of the Future program supports on-farm connectivity and encourages farmers to adopt AgTech to boost productivity, including water efficiency and drought preparedness. In 2022, the AgTech Grant Program was established to help farmers purchase AgTech devices and applications.

The NSW Government's Climate Change Research Strategy⁶⁶ is supporting projects that help primary industry sectors adapt to climate change. Under this strategy, the Department of Primary Industries is undertaking a detailed analysis of the risks and opportunities of a changing climate to support resilience and adaptation in the broadacre cropping sector.

Implementation of the harvestable rights review

From May 2022, landholders in the Far North Coast region are able to capture a maximum of 30% of the average regional rainfall runoff from their property in harvestable right dams. This applies to dams that are built on non-permanent flowing minor streams, hillsides and gullies. The remaining runoff will continue to flow downstream into licensed dams and the local river systems, where it is shared between the environment and other water users.

This increase from 10% up to a maximum 30% limit follows a review and community consultation of harvestable right limits in coastal-draining areas of NSW. It provides landholders in these regions better access to water storage for domestic and stock purposes, and extensive agriculture such as stock grazing and pasture irrigation. However, the increase excludes use for intensive livestock and plant agriculture, such as horticulture and feedlots. Water taken under the existing 10% harvestable right can continue to be used for any purpose.

A number of critical steps have been completed to support these new arrangements. These include:

- consultation with Native Title holders
- determining a method for setting a landholder's revised maximum harvestable right dam capacity
- working with other agencies, including the Natural Resources Access Regulator, on monitoring and enforcement issues
- replacing the Harvestable Rights Order applying to the Central and Eastern Division with 2 separate new Orders.








The Far North Coast Regional Water Strategy will provide critical support for the implementation of these changes. Actions taken through the strategy will help to manage future impacts on downstream water needs, including those of the environment, from uptake of the higher limit. Commencing in 2022, the Department of Planning and Environment–Water will assess whether the increase to a 30% harvestable right limit is appropriate at the water source scale, while considering the limitations and mitigation measures announced as part of these changes.























The department will include an amendment provision in upcoming water sharing plans to review the uptake of harvestable rights by either year 3 or year 5 of the plan. The provision will require a review of access, trade and water supply work approval rules if the uptake of harvestable rights has increased above the 10% limit in the original Harvestable Rights Order. Updated plans will include an estimate of the current uptake in harvestable rights within the long-term average annual extraction limit (LTAAEL).

The Far North Coast Regional Water Strategy will help to ensure these changes not only improve water security for rural landholders but also consider the impacts on the downstream environment and licensed users.

66. More information on the Climate Change Research Strategy is available at: www.dpi.nsw.gov.au/dpi/climate/about-dpi-climate/climate-change-research-strategy

Table 7. Actions to address Priority 3: Ensure water resource development and use is sustainable and equitable

Legend						
						
Declining catchment and river health	Competition for low flows	Saltwater intrusion into freshwater sources	Aboriginal people's rights and access to water	Water security for industries in the Far North Coast	Water security for towns and communities in the Far North Coast	Flood risks to individuals, businesses and communities

Action number	Action name	Challenges addressed
Reduce the impact of water infrastructure on ecosystem health		
Action 3.1:	Improve fish passage	 
Action 3.2:	Implement fish-friendly water extraction	 
Action 3.3:	Address cold water pollution	
Better manage competing demands for water		
Action 3.4:	Establish sustainable extraction limits for surface water and groundwater sources	     
Action 3.5:	Reduce the take of low flows	     
Action 3.6:	Address catchment-based impacts of increased harvestable rights limits	  
Action 3.7:	Support Aboriginal business opportunities	 

Reduce the impact of water infrastructure on ecosystem health

Many native fish species in the Far North Coast region require free passage up and down the region's rivers to access food, avoid predators and find shelter. They also need seasonal passage to spawn, migrate and reproduce. Removing high-priority barriers to fish movement will help the resilience of fish species, particularly those that are threatened or endangered.

Action 3.1: Improve fish passage

Physical barriers to fish passage such as weirs, floodgates, causeways and culverts can limit fish movement. This leads to a decline in the health and viability of native fish populations. Removing barriers to fish movement and allowing fish to move, breed, find food and locate ideal habitat is critical to supporting native fish populations in the Far North Coast region.

The 6 high-priority barriers identified by the NSW Fish Passage Strategy and the Marine Estate Management Strategy in the Far North Coast region are:

- Bray Park Weir
- Jabour Weir
- Pioneer Crossing
- Eureka Road
- Eden Creek Weir
- Goolmangar Creek Weir.

Improving fish passage can lead to changes in current flow patterns near instream structures. The effects that improving fish passage could have on flows near town water supply extraction points will be considered to ensure they do not compromise local councils' access to drinking water.

Action 3.2: Implement fish-friendly water extraction

Modern fish-protection screens offer significant benefits for biodiversity and businesses. Self-cleaning, retractable designs are available to suit all types and sizes of water pumps and channels. The technology represents a new best practice for water users, protecting up to 90% of native fish and excluding virtually all debris. Installation of screens presents an opportunity to reduce fish losses at water diversions and improve the recovery of threatened species, while also reducing energy costs and downtime for water users.

This action will promote the installation of modern fish-protection screens on pumps across the Far North

Coast region. This action includes building awareness among water users of the benefits of modern screening technology. The NSW Government's non-urban metering framework will collect valuable information on the locations and sizes of pumps in the region. This will support implementation of this action by helping to prioritise locations for screen installation.

Action 3.3: Address cold water pollution

Between spring and autumn, the water stored in large dams can form 2 layers, with a warm surface layer overlaying a cold bottom layer. Cold water pollution is an artificial decrease in the temperature of water in a natural river. It is caused when the lower cold water is released into rivers from large dams during warmer months. This can have serious negative effects on ecological health.

The major storages in the Far North Coast region vary in their likelihood of releasing cold water to the environment.⁶⁷ While Toonumbar Dam has a destratification system, the dam was identified in the NSW Cold Water Pollution Strategy as having the potential to cause moderate cold water pollution effects. Clarrie Hall Dam does not have a destratification system and is likely to intermittently cause cold water pollution effects. Cold water pollution effects of Emigrant Creek Dam are likely to be minimal, while Rocky Creek Dam does not release water to the environment.

There is a lack of monitoring sites both upstream and downstream of storages in the region. This can make it difficult to determine the extent of cold water pollution in the region.

This action will:

- evaluate the extent of cold water pollution effects from existing storages in the Far North Coast
- work with asset owners to implement appropriate capital and operational responses to mitigate these negative effects.

This action is structured as a 5-year partnership, commencing with a scoping-study in the first phase to assess the issue and identify suitable works and project partners.

This action will align with the NSW Cold Water Pollution Strategy and include:

- assessing existing temperature metrics against best-practice frameworks for managing impacts on aquatic fauna
- exploring the potential for, and feasibility of, technologies to mitigate cold water pollution effects. Examples of these technologies are augmentation of dam outlets, improvements to mixing regimes and modifications to water delivery mechanisms.

67. Department of Planning, Industry and Environment 2020, *Draft Regional Water Strategy – Far North Coast: Strategy (PUB20/307)*, water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies/what-we-heard/far-north-coast-regional-water-strategy

Better manage competing demands for water

Governments have a legal responsibility to ensure that water is allocated and used to achieve beneficial environmental, social and economic outcomes. We need to review how extraction is regulated across the Far North Coast region to ensure that we meet this responsibility, particularly in managing competing demands for water during dry and low-flow periods. We also need to provide greater opportunities for the Far North Coast region's Aboriginal people to access water.

The following actions will help to provide confidence that the rules that determine water sharing arrangements are equitable and sustainable, while also providing opportunities to shift water demand and extraction out of critical low-flow periods.

Action 3.4: Establish sustainable extraction limits for surface water and groundwater sources

The *Water Management Act 2000*⁶⁸ outlines the principles that guide water sharing. These principles oblige the government to ensure the ecological sustainability of the state's water sources and to maximise the economic and community benefits from water.

The water sharing plans prepared under the Act regulate the diversion, extraction and development of water resources in NSW. Putting limits on extracting water from rivers and aquifers is a key tool that can help meet the obligations of the Act.

Water sharing plans can define different types of extraction limits, including the total volume of water that can be extracted from a river or aquifer in a year. These annual limits are called the long-term average annual extraction limits (LTAAELs). Other types of limits aim to protect specific parts of river flows by governing when water users can take water from a river. An example of this type of limit is daily extraction limits.

Water sharing plans in the Far North Coast region do include LTAAELs. However, the current LTAAELs were set as the sum of existing water entitlements at the time the water sharing plans were first developed. It is not known if the current LTAAELs can meet the requirements of the environment and the community.

The Natural Resources Commission has recommended that the Department of Planning and Environment review coastal LTAAELs. It has also recommended that the department develops extraction limits that better meet water sharing principles.

This action will transition water sharing to a regime that is based on science and evidence. It will establish the extraction capacity of the region's surface water and groundwater systems and use this new knowledge as the starting point for water sharing. This approach will allow water extraction to be best managed to improve outcomes for the environment and the community.

This action will:

- improve understanding of the different methods for setting extraction limits
- test one or more methods on a pilot water source in the Far North Coast region
- establish the appropriate extraction limits for water sources across the region
- investigate the feasibility of implementing and setting daily extraction limits.

Defining sustainable LTAAELs in water sharing plans across the region will:

- allow water users to maximise water resource development within ecological limits
- ensure that water is shared equitably among users
- provide water users with greater certainty in their share of the resource
- identify if and where additional water entitlements could be made available.

68. Available at: legislation.nsw.gov.au/view/html/inforce/current/act-2000-092

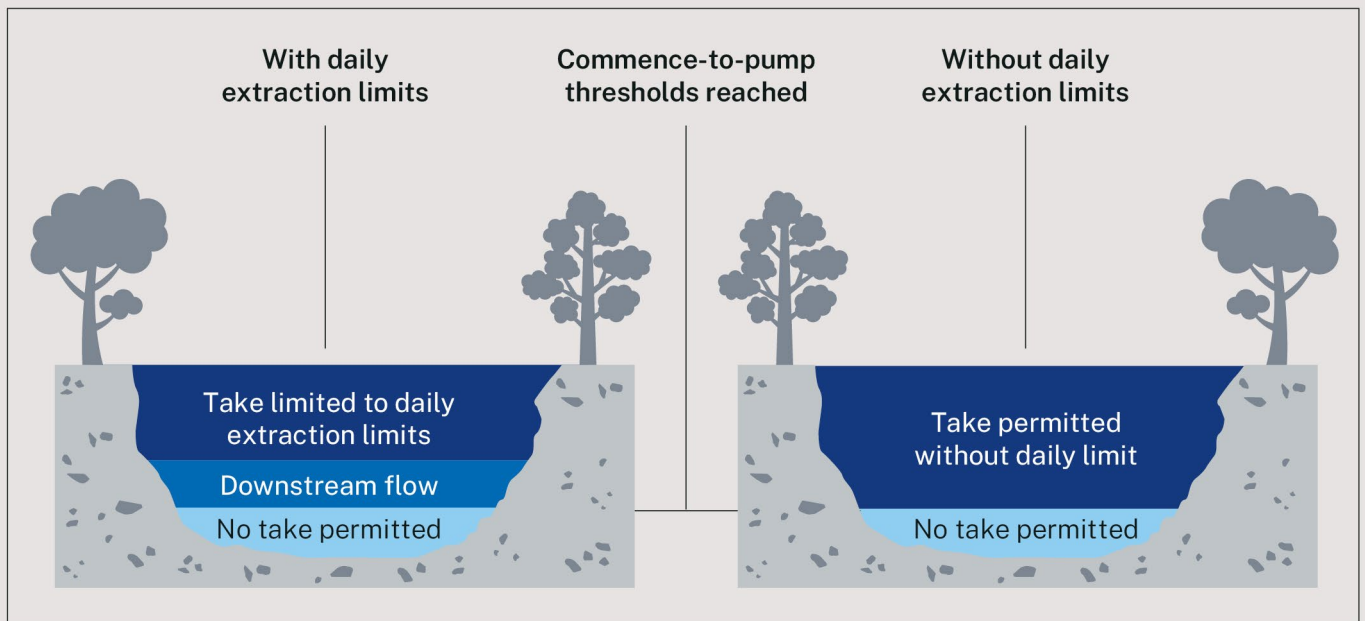
Daily extraction limits

Daily extraction limits restrict the rapid removal of water during peak irrigation periods (Figure 18). They are included in water sharing plans to protect low and medium flows, reducing the impact of water extraction at certain times of the year. This ensures there is enough water in a river system for the environment, non-extractive users (aquaculture, cultural and recreation) and downstream extractive water users.

There are a number of requirements for implementing daily extraction limits:

- stream gauging and monitoring
- daily measurements of water extraction, or estimates of water extraction
- a mechanism to co-ordinate water extraction between water users.

Figure 18. Daily extraction limit concept



Action 3.5: Reduce the take of low flows

Reducing water extraction from rivers during periods of low flow will improve both river connectivity and natural flow variability. It will also complement other actions aimed at improving river health.

This action will investigate and assess options for reducing water extraction during low flows. We will focus on the effectiveness of high-flow conversions, low-flow bypasses for farm dams and options for landholders to store water extracted from streams under basic landholder rights. Selecting and implementing options will depend on the assessment's findings and will require extensive community engagement.

High-flow conversions

In some water sources in the Far North Coast region, water users can apply to convert their existing water access licence to a high-flow access licence. This allows water users to extract more water but only under high-flow conditions. The high-flow conversion rule only applies in catchments that are gauged and are experiencing hydrologic stress in periods of low flow. Widespread adoption across a catchment would increase the protection of low flows and improve river connectivity during dry times, while increasing the water available for extraction during wetter times.

No licence holders in the Far North Coast region have yet converted their entitlement to a high-flow access licence. This is because:

- the current conversion rates do not provide enough water security benefits to counter the extra costs of irrigating from on-farm storages
- the frequency and intensity of droughts historically in the Far North Coast region have not been severe enough for water users to consider licence conversion
- there is limited space for off-stream storages
- pump equipment is susceptible to being washed downstream during high-flow events.

Any modification to the current conversion rate would need to consider the effect on all parts of the flow regime, including:

- the ecological effects of changing high-flow patterns and the associated effects on river health
- reliability of downstream licences
- social and cultural values.

Overcoming constraints to on-farm storages (Action 4.6) and an improved understanding of climate risks to surface water availability may make high-flow licence conversions more feasible in the future.

Low-flow bypasses

Farm dams increase water security for landholders but can reduce the volume of runoff that flows into downstream waterways. During extended dry periods, the effect that farm dams have on waterways can worsen. Because they are usually partially empty during dry periods, they capture most of the that falls on the land. Low-flow bypass devices can allow some of this runoff to bypass dams and to flow into waterways.

Low-flow bypass devices change the timing of when a dam captures water. At the beginning of a rainfall event, the device allows flows to pass through to downstream waterways. As the rainfall event continues or becomes more intense, it allows the higher flows to enter the dam. This can reduce the negative effects of dams on low flows while still providing water security benefits to landholders.

The Department of Planning and Environment will commission a desktop review of the use of low-flow bypasses in other jurisdictions. This will inform other potential measures for mitigating downstream impacts from an increase in extraction from coastal harvestable rights dams. Subject to the findings of this review, field trials will be conducted to test the design efficacy of low-flow bypasses under a range of NSW coastal conditions, and to assess their cost effectiveness. The outputs of these investigations will be a key input to understanding the benefits and constraints of low-flow bypasses more broadly.

Storage of water extracted under basic landholder rights

Landholders with river frontage are permitted to extract water under basic landholder rights, including during very low-flow conditions, regardless of the cease-to-pump rules in water sharing plans. Extracting water under these rights during higher-flow periods and storing it in tanks or turkey nest dams⁶⁹ can reduce the volume of water extracted from stressed rivers and delay the need to draw water from town water supply networks.

State and local government rebates on rainwater tanks have assisted in addressing this problem. However, there is a need to better understand the extent of current and future growth of water extraction under basic landholder rights.

69. A dam with a completely enclosed earth embankment that is filled by pumping water from alternative water sources.

Action 3.6: Address catchment-based impacts of increased harvestable rights limits

The NSW Government's decision in October 2021 to increase the harvestable rights limit in coastal-draining catchments from 10% to 30% of average annual regional rainfall runoff included a range of mitigation measures to manage the potential impact of the change on downstream users, communities and the environment.⁷⁰

This action will ensure potential impacts on downstream licence holders, communities and the environment resulting from the increase in harvestable rights limits are understood at a more localised scale and are considered and managed in future water sharing plan arrangements. It will support the current mitigation measures by:

- undertaking further assessment to confirm the appropriateness of the 30% limit in each water source, taking into account the specific characteristics of the water source
- introducing a mechanism to manage potential future impacts from an increase in the uptake of harvestable rights on existing water sharing plan arrangements
- including an estimate of annual extractions under the 10% of rainfall runoff harvestable rights limit in the updated coastal water sharing plans to assist in establishing the long-term average annual extraction limits.

Action 3.7: Support Aboriginal business opportunities

During our consultation on the Draft Far North Coast Regional Water Strategy, we heard of a need for, and support of, business opportunities in the region that are led by Aboriginal communities. We also heard of business plans already being pursued by local Aboriginal people.

Investing in local Aboriginal businesses can help diversify incomes, create employment for local Aboriginal youth and help deliver positive social and economic outcomes for Aboriginal people. Realising some of these opportunities may require access to surface water or groundwater resources.

This action will support Aboriginal water-related business development opportunities in the Far North Coast region. The action will be led by the Department of Planning and Environment with support from the Department of Regional NSW. Through the Aboriginal Partnership Program, a dedicated partnership manager will work with Aboriginal organisations, businesses, and individuals to:

- identify and develop new water-related business opportunities
- better manage existing businesses
- access support or grant funding.

Other support is also available through the NSW Department of Aboriginal Affairs, the NSW Aboriginal Lands Council, and the National Indigenous Australians Agency.

70. More information on harvestable rights in coastal-draining catchments is available at: dpie.nsw.gov.au/water/licensing-and-trade/basic-landholder-rights/harvestable-rights/coastal-draining-catchments

Priority 4

Prepare for future climatic extremes

We need to prepare for future climate variability, particularly extended dry periods, to help build a stronger and more resilient Far North Coast region. Providing more and better information on the impacts of climate change on water resources will allow the community to plan better for the future, particularly

local councils and businesses that are highly dependent on water. The resilience of local industries will be strengthened by having the tools and infrastructure at hand to make the most of existing water supplies and manage the risks of increased climate variability and change.

Our starting point

The NSW Water Strategy⁷¹ commits to increasing the resilience of the region's water users to changes in water availability. This includes supporting more efficient water use by industry and improving drought planning, preparation and resilience.

The \$1 billion Safe and Secure Water Program⁷² supports councils to implement infrastructure and non-infrastructure solutions to address key risks to regional water safety and security.

The Town Water Risk Reduction Program is currently underway. It is working with local councils to develop a new framework that will better support them to manage safe, secure and sustainable water supply and sewerage services to regional communities across NSW.

The Government will support water utilities to diversify sources of water including groundwater, stormwater harvesting and recycling. This will include progressing relevant regulatory reform and community acceptance campaigns to help increase the uptake of diverse water sources with the potential to increase water security and resilience for towns and communities.

The Future Ready Regions Strategy⁷³ includes a commitment to upgrade the Enhanced Drought Information System to provide farms with world-leading weather and climate data so they can make better business decisions.

The NSW Government's Climate Change Research Strategy⁷⁴ is supporting projects that help primary industry sectors adapt to climate change. Under this strategy, the Department of Primary Industries is undertaking a detailed analysis of the risks and opportunities of a changing climate to support resilience and adaptation in the broadacre cropping sector.

The NSW Government has recently published the long-term climate variability risk data that supports the regional water strategies. This is the first step in providing water users with better access to information on the future risks to water availability. The stochastic datasets for rainfall and potential evapotranspiration for the Far North Coast region and a number of other NSW regions are available on the SEED portal.⁷⁵

The NSW Government is working towards a policy of more open and easily accessible data. The open data framework⁷⁶ recently published by the Department of Planning and Environment–Water outlines how we will manage and drive open data to improve transparency and data sharing.

71. Department of Planning, Industry and Environment 2021, *NSW Water Strategy*, water.dpie.nsw.gov.au/plans-and-programs/nsw-water-strategy

72. More information on the Safe and Secure Water Program is available at: industry.nsw.gov.au/water/plans-programs/infrastructure-programs/safe-and-secure-water-program








73. More information on Future Ready Regions is available at: nsw.gov.au/regional-nsw/future-ready-regions









74. More information on the Climate Change Research Strategy is available at: www.dpi.nsw.gov.au/dpi/climate/about-dpi-climate/climate-change-research-strategy

75. The long-term climate variability risk data is available at: datasets.seed.nsw.gov.au/dataset/water-modelling-stochastic-climate-data

76. More information on the open data framework is available at: water.dpie.nsw.gov.au/science-data-and-modelling/data/open-data-framework

Table 8. Actions to address Priority 4: Prepare for future climatic extremes

Legend						
						
Declining catchment and river health	Competition for low flows	Saltwater intrusion into freshwater sources	Aboriginal people's rights and access to water	Water security for industries in the Far North Coast	Water security for towns and communities in the Far North Coast	Flood risks to individuals, businesses and communities

Action number	Action name	Challenges addressed
Support local councils and water users to manage risks		
Action 4.1:	Provide better information about water availability and climate risks	
Action 4.2:	Support local councils to provide a secure and affordable water supply for towns	
Action 4.3:	Support regional-scale, adaptive decision-making for town water supplies in the Far North Coast	
Action 4.4:	Support councils to improve flood risk management in the Far North Coast	
Optimise use of existing water supplies		
Action 4.5:	Enhance coastal water markets	
Action 4.6:	Investigate increased on-farm water storage	
Action 4.7:	Investigate managed aquifer recharge in the Far North Coast region	
Investigate alternative water supplies		
Action 4.8:	Develop a recycled water plan for the Far North Coast	

Support local councils and water users to manage risks

The NSW Government supports local councils to manage town water supply and security risks through the Safe and Secure Water Program.⁷⁷ The Safe and Secure Water Program has funded around \$38 million of projects in the Far North Coast region over the past 3 years, including funding support for the preparation of local water utility strategic plans. The Safe and Secure Water Program has generally prioritised funding for sewage discharges and sewer overflows that pose risks to water quality, water security and the environment. The NSW Government is committed to ensuring that drinking water is available, affordable and safe.

The NSW Auditor-General's report *Support for regional town water infrastructure*⁷⁸ recognises that more needs to be done to properly support local councils with issues such as affordability and project delivery.

Local industries also need support. Sustainable and drought-resilient industries are underpinned by good business planning, which includes understanding future water availability.

Action 4.1: Provide better information about water availability and climate risks

Reliable and timely information helps both the community and government make informed decisions, particularly when preparing for droughts and floods. However, this information can often be difficult to access or use. This affects the ability of landholders to make business decisions and the capacity of all residents to plan for natural disasters, including drought. These issues were an important theme during recent consultation on several NSW Government water initiatives.

Recently, the NSW Government has improved how it provides information about water availability and climate risks by moving to an open data model. Under this model, all NSW water data – collected from both public and private sources – will be 'open data' by default. Moving to an open data model⁷⁹ will contribute to the Department of Planning and Environment meeting important strategic outcomes and responsibilities, including those set out in the NSW Water Strategy:

- Action 1.2: Increase the amount of and quality of publicly available information about water in NSW
- Action 1.3: Enhance modelling capabilities and make more data and models openly available.

These initiatives will enhance access to climate and water data. However, there is still room to improve how information is provided to ensure it meets the needs of the Far North Coast region's communities and industry.

This action will build on existing state and national information platforms, including:

- WaterNSW's WaterInsights portal⁸⁰
- NSW Government's Water Usage dashboard⁸¹
- Bureau of Meteorology's Water Information Dashboard⁸²
- NSW Government's SEED portal.⁸³

Stakeholders in the Far North Coast region will be consulted to ensure the Department of Planning and Environment provides the training and information products that the region needs.

As part of this action, the department will:

- review the ways water information is made available to improve usability and accessibility
- educate industry and local government on water access options, including the recent changes to the coastal harvestable rights limit
- educate water users on how water markets can help them diversify their water supply options
- encourage new industries to develop drought management plans as they set up in the region.

The department will also support water users to understand what the long-term climate variability data tells us about:

- surface water availability and water quality
- the likelihood of consecutive years of low or no water availability
- groundwater availability.

Improving forecasts and data about short-term and long-term water availability offers several benefits, including:

- helping water-dependent businesses in the region to make informed decisions on how to manage their water entitlements
- supporting farms to make informed climate adaptation decisions
- ensuring new industries can remain in the region over the long term.

77. More information on the Safe and Secure Water Program is available at: industry.nsw.gov.au/water/plans-programs/infrastructure-programs/safe-and-secure-water-program

78. New South Wales Auditor-General 2020, *Support for regional town water infrastructure*, Audit Office of New South Wales, www.audit.nsw.gov.au/our-work/reports/support-for-regional-town-water-infrastructure

79. More information on the open data framework is available at: water.dpie.nsw.gov.au/science-data-and-modelling/data/open-data-framework

80. Available at: waternsw.com.au/waterinsights/water-insights

81. Available at: industry.nsw.gov.au/water/allocations-availability/water-accounting/utilisation-dashboard

82. Available at: bom.gov.au/water/dashboards/

83. Available at: www.seed.nsw.gov.au/

Action 4.2: Support local councils to provide a secure and affordable water supply for towns

The current approach to managing water security for towns relies on defining an ‘acceptable risk’ of running out of water. Existing NSW Government guidelines suggest town water supplies should meet a minimum service level. This roughly correlates to town water supplies being able to withstand a drought that has the probability of occurring 1 in 1,000 years.⁸⁴ This level of risk may be too high for large towns in extreme droughts where there are no last resort options such as water carting.

This action will ensure that the NSW Government continues to support local councils with water system planning, and to build skills and capacity for implementation. This support will focus on the department’s new regulatory and assurance framework for local water utilities, which highlights key outcomes for understanding and addressing water security and water quality risks.

The new regulatory and assurance framework⁸⁵ sets the expectations the department has for local water utilities, including:

- establishing the outcomes required to meet customer needs and to manage key risks
- undertaking evidence-based strategic planning to meet these outcomes
- assessing the standard to which the outcomes are met.

The new framework encourages local water utilities to develop and apply sound water security criteria and service levels either through a traditional approach, an enduring supply approach, or another credible and robust approach.

The use of an enduring supply approach can help utilities evaluate options for meeting customer and communities’ minimum water needs during long and extreme drought. It requires utilities to understand:

- how much water is needed by the community
- the water that will be available from existing sources in an extreme drought
- additional supply options, how much they can supply and how long they will take to deliver.

The NSW Government aims to provide the right mix of tools to support local councils in the Far North Coast region to address their town water security challenges. This includes assisting councils to explore options to reduce demands on surface and groundwater sources – for example, water use efficiency programs and accessing other water sources such as desalinated water and purified recycled water. The department will provide guidance and support to local water utilities to help them undertake their strategic planning under the new framework. The department will also monitor this work to ensure it sufficiently manages the key risks.

Other actions in the Far North Coast Regional Water Strategy aim to improve river health and land management. These actions will also benefit councils by improving access to high quality water for town water supplies.

84. This does not mean that a drought will only occur once in 1,000 years. Rather, it means there is a 0.1% probability that this severity of drought could occur in any given year.

85. More information on the regulatory and assurance framework is available at: www.industry.nsw.gov.au/water/water-utilities/best-practice-mgmt

Action 4.3: Support regional-scale, adaptive decision-making for town water supplies in the Far North Coast

Local councils in the Far North Coast are responsible for providing safe and secure drinking water to residents in the region. Councils plan their supplies based on the knowledge of their water systems and the service requirements set by the NSW Government. The Department of Planning and Environment also supports councils to plan and implement improvements to their water supplies through initiatives like the Safe and Secure Water Program and the Town Water Risk Reduction Program.

The Far North Coast presents opportunities for regional-scale water initiatives that cut across local council and state boundaries. Regional-scale initiatives can help build the resilience of town water supplies in the region. They do this by increasing the water sources available to different councils, and by sharing the benefits and costs of infrastructure across the region.

However, planning and implementing cross-border initiatives is complex and can be very challenging. The uncertainties about future water supply requirements in the region add to this complexity. Our analysis shows that there is still a lot of uncertainty in the Far North Coast around the region's future population and future water demands, as well as the effects of climate change, such as changes to rainfall and rates of sea-level rise.

Councils in the Far North Coast region have tried to coordinate regional water supply planning in the past. The *Northern Rivers Regional Bulk Water Supply Strategy*⁸⁶ was an important start for this work. The Far North Coast Regional Water Strategy provides an opportunity to support local councils and state-owned corporations to continue this regional-scale planning. This can help councils to properly consider and implement regional projects that are difficult to achieve without state-level support. It also provides the opportunity to take an agile, flexible approach to ongoing water system investment. This enables councils across the region to benefit from their own short- and medium-term investments while providing the time to better understand and plan adaptive pathways.

What are adaptive pathways?

An adaptive pathway approach to planning can be useful when dealing with uncertainty because it avoids making premature decisions. It acknowledges that while not all decisions can be made now, they can be prioritised, planned and prepared for.

Adaptive strategies typically do not rely on a single static solution. They set out a suite of potential options together with social and environmental triggers for decisions. The available options are 'tested' against plausible futures and acceptable risks when a trigger is reached. This allows us to choose the most appropriate option for the moment while remaining resilient and able to adapt to new conditions, information and technologies.

When designing adaptive pathways, it is important to prioritise no-regrets or low-regrets options until critical knowledge gaps are filled. This helps keep options open for the future as more information becomes available. These types of decisions – such as water efficiency improvements and upgrades to existing local council assets – increase reliability without constraining future options. Local councils are already progressing no-regrets decisions through their local water utility strategic planning. The NSW Government will continue to support councils with these decisions through Action 4.2 and Action 4.3.

This action will support local councils in the Far North Coast to make and implement regional water supply decisions. The key steps for implementing this action are:

- support councils to identify and progress additional studies, research or designs required to adequately assess regional-scale supply options and bring them to an equal level of understanding
- continue the existing government initiatives that support councils to identify and progress the studies they need to understand their own supply risks and future options
- support councils to coordinate negotiations needed to progress regional-scale supply options
- collaboratively develop the modelling methods and decision-making processes that will inform the adaptive pathways and future decisions, including defining triggers and thresholds for decision-making.

86. Hydrosphere Consulting 2013, *Northern Rivers Regional Bulk Water Supply Strategy*

Action 4.4: Support councils to improve flood risk management in the Far North Coast

Understanding the nature of flooding and the complexities of flood risk management is challenging. Local councils are primarily responsible for managing flood risks in their local government areas. However, the Richmond River catchment contains 5 local government areas. This adds further complexity to the roles and responsibilities for flood mitigation in the catchment as there is sometimes no clear lead agent. It also makes it challenging to implement an integrated and consistent approach. Land use development or geomorphic changes in one council area can influence flood behaviour in downstream local government areas.

This action supports the NSW Government's continued provision of technical and financial support to local councils to improve their flood risk management.

The Department of Planning and Environment currently provides funding and technical support to local councils through the Floodplain Management Program. The program supports councils to develop and implement floodplain risk management studies and plans. The department also provides technical support to the Northern Rivers Reconstruction Corporation and its Resilient Homes Program.

The Australian Government has engaged the CSIRO to undertake the Northern Rivers Resilience Initiative (NRRI). The NRRI is being delivered in 2 phases:

- Phase 1 (complete) developed an understanding of the catchment and climate characteristics that led to the February/March 2022 flooding and then rapidly prioritised flood resilience projects suitable for available funding.
- Phase 2 (commenced) will collect suitable data and construct a whole-of-catchment model for the Richmond River by December 2024.

This action will provide several benefits to the Far North Coast region, including:

- improving the management and understanding of flood risk
- informing decision-making
- contributing to building more resilient communities.



Image courtesy of iStock. Clarrie Hall Dam, NSW.

Optimise use of existing water supplies

Water resources are finite. By using water wisely today, we can support thriving and resilient communities in a drier future. Current rules and regulations aim for flexibility in how and when water is extracted, while protecting the environment and other water users. The following actions will review these rules to ensure they provide the flexibility needed for local businesses to prepare for and manage drought.

Action 4.5: Enhance coastal water markets

Our climate modelling shows the Far North Coast region is likely to experience drier conditions and more frequent and severe droughts in the future. Active and effective water markets are important for maintaining a thriving regional economy. They enable industries, especially those reliant on unregulated water, to adapt to change, increase their water security and prepare for drier conditions. Trade is also a key tool in shifting water demands from low flows to high flows in the region's unregulated rivers, consistent with the regional priority to better manage competing demands for water. The Australian Competition and Competition Commission (ACCC) identified common elements of effective water markets in its Murray–Darling Basin water markets inquiry.⁸⁷

This action will:

- assess how well the Far North Coast region's water markets are set up to deliver the key elements identified by the ACCC water markets inquiry
- investigate the barriers to trade and seek to understand why so little trade has occurred in the region's unregulated and groundwater sources
- identify the improvements that can be made to the Far North Coast region's water markets.

This investigation will be informed by:

- forecast behaviour change and more detailed hydrologic and economic analysis of benefits and costs
- recommendations from the Department of Planning and Environment's review of trade rules in unregulated catchments, and the ACCC's water market inquiry
- the establishment of sustainable extraction limits for surface water sources (Action 3.4).

Action 4.6: Investigate increased on-farm water storage

Climate change will increasingly put pressure on farmers and rural landholders. Higher temperatures will dry out the landscape, and changing rainfall patterns will increase the frequency and severity of low river flows.

Increasing the volume of water stored on farms will help landholders in unregulated catchments manage these impacts of climate change on water security:

- Capturing runoff high in the catchment and using it for irrigation in drier times will help retain water in the catchment for longer periods.
- Converting low-flow water access to high-flow water access requires an increase in off-stream storage.
- Storing water on-farm has the potential to provide vital water supplies to help fight bushfires.

This action considers water harvested and stored on-farm under a water access licence. It will investigate:

- current levels of on-farm storage and use, and barriers to constructing farm dams
- options to mitigate downstream environmental and water security impacts of increased storage capacity
- impacts on catchment hydrology, particularly the potential to reduce take of low flows
- the value of on-farm storages to various Far North Coast region industries and as a local water supply to fight bushfires
- options to provide incentives for the uptake of on-farm storage.

As on-farm storage can increase how much licensed water is taken, this action may risk placing further pressure on rivers and streams already under hydrologic stress. This action will have the greatest benefits to extractive users and have the least impact on river ecology if considered in conjunction with actions that shift water extraction away from low flows, which is where the greatest pressure from extraction occurs (Action 3.5), or that aim to increase trade (Action 4.5).

Any proposal to increase on-farm storage will need to be considered and implemented alongside investigations to address catchment-based impacts of increased harvestable rights limits (Action 3.6) and establish sustainable extraction limits for surface water and groundwater sources (Action 3.4).

87. Australian Competition and Consumer Commission 2021, *Murray–Darling Basin water markets inquiry*, Australian Competition and Consumer Commission, www.accc.gov.au/publications/murray-darling-basin-water-markets-inquiry-final-report

Action 4.7: Investigate managed aquifer recharge in the Far North Coast region

Managed aquifer recharge⁸⁸ is the purposeful recharge of water into aquifers for environmental benefit or future use, particularly during drought. A range of water sources can be used to recharge aquifers, including stormwater, treated wastewater, river or dam water, or industrial water. Water can be artificially injected into the aquifer with pumps or infiltrated naturally through ponds or purpose-designed wetlands.

Progressing managed aquifer recharge is a NSW Government priority. Potential benefits from managed aquifer recharge include:

- minimising evaporation, compared to surface storage of water
- providing additional recharge to groundwater sources to increase water reliability for groundwater dependent users, including ecosystems
- reducing pressure on surface water supplies during drought, which could improve environmental outcomes for riverine environments.

Our initial assessment suggests there is potential for managed aquifer recharge to be undertaken in several locations in the region, including in the Alstonville Basalt Plateau and North Coast Volcanics groundwater sources. While a site may be viable from a hydrogeological perspective, other issues such as the availability of water for storage and operational costs are potential constraints that require further investigation.

This action will investigate the feasibility of local, place-based managed aquifer recharge projects in the Far North Coast region.

The NSW Government is currently developing the regulatory framework for managed aquifer recharge. As it is a new way of managing and storing water in NSW, stakeholder and community consultation will be essential to developing the regulatory framework and delivering this action.



Image courtesy of iStock. Clarrie Hall Dam, NSW.

88. Also known as groundwater replenishment, water banking or artificial recharge.

Investigate alternative water supplies

The projected effects of climate change on the Far North Coast region will put water supplies under pressure. We need to ensure that water supply is resilient and that users have feasible access to alternative water supplies.

As part of their local water utility strategic planning, local councils are already considering options and alternative water sources that meet future water security challenges. The NSW Government is progressing statewide initiatives to overcome regulatory constraints to recycled water use. The Government will also work with communities to increase understanding and acceptance of recycled water use.

Action 4.8: Develop a recycled water plan for the Far North Coast

Getting the most from our recycled water resources requires us to consider a wide range of recycled water technologies, processes and end uses. These all have different costs, benefits and risks. For example, indirect potable reuse can involve large pumping costs to bring treated wastewater to a dam. On the other hand, direct potable reuse has lower pumping costs but requires more investment in risk management and operation.

The cost effectiveness of using different types of recycled water also differs across scales and locations. For example, while purified recycled water for drinking may not be cost effective in small towns, recycling wastewater to a lower quality for irrigation could be. However, purified recycled water for drinking may be feasible in larger centres. This is particularly true if the distance to agricultural land makes supplying recycled water for agriculture too expensive.

The Far North Coast is in a relatively strong position to improve reuse of its wastewater streams. There are 24 municipal sewage treatment plants across the region with a combined capacity of approximately 87 ML/day.⁸⁹ Industry and unsewered rural properties are also potential sources of additional wastewater.

The recycled water options assessed for the Far North Coast Regional Water Strategy were shown to be expensive for the benefit they provide. However, the assessments were not able to fully explore the wide range of reuse options available. There could be other cost-effective ways of improving our use of recycled water. We need to develop an informed regional view of all the possible sources of, and uses for, recycled water. This will provide an opportunity to optimise our use of this valuable resource.

This action will identify the best uses of existing and potential recycled water streams around the region. The NSW Government will work collaboratively with local councils to build on the important work they have already been progressing. One example of this is the Byron Shire Recycled Water Management Strategy.⁹⁰ The recycled water plan will also be developed in close consultation with the community.

This action will also be informed by work delivered through the NSW Water Strategy⁹¹ and the Town Water Risk Reduction Program. This is supporting local councils to overcome regulatory barriers to cost effective water recycling and increase community understanding and acceptance of water recycling.

This action will also be informed by research into agricultural water recycling that the Department of Primary Industries is conducting.

This work will result in development of a recycled water plan for the Far North Coast that will:

- create clarity around which recycled water options are most feasible for the region and where they are most suited
- provide a framework to guide future investment in recycled water infrastructure
- support councils to build recycled water into their water cycle planning
- support industry in its planning for future water access.

Any future decision to include purified recycled water in the water supply would be subject to community consultation and require stringent government approvals.

89. This is current design capacity. Actual inflows to sewage treatment plants in the region are currently significantly less than this.

90. Byron Shire Council 2018, *Byron Shire Recycled Water Management Strategy 2017–2027*, Byron Shire Council

91. Department of Planning, Industry and Environment 2021, *NSW Water Strategy*

Recycled water: barriers and benefits

Recycled water can have a higher nutrient profile than freshwater sources, which can negatively affect downstream water quality. Recycled water users for agriculture may need to change how they fertilise crops and to reduce excess runoff.

Key barriers to widespread uptake of recycled water for irrigation include:

- public perception
- water quality impacts
- community acceptance of recycled water
- regulatory and administrative barriers.

Increased use of recycled water has significant benefits. Using recycled water can:

- reduce demand for river extractions including demand for low flows
- provide an alternative to increasing on-farm dam storage
- increase reliability by providing a climate independent water source for industry
- potentially reduce runoff pollution through a circular economy on farms.



Image courtesy of Destination NSW. Tweed Valley, NSW.

Implementing the strategy



Image courtesy of Destination NSW. Tweed River, NSW.

Getting our timing right

A critical feature of developing the Far North Coast Regional Water Strategy was deciding which actions and investments are needed now, and which ones will be needed further into the future. The strategy has a 20-year timeframe. The timing of actions aims to meet existing challenges, identify and prepare for future challenges, and lay the groundwork for adapting to future uncertainties and changing circumstances.

The water security actions in this strategy have a strong focus on drought security following the experience of the 2017–2020 drought. However, this drought was closely followed by major flood events between 2020 and 2022.

Some of the actions in the strategy may be able to reduce the effects of small-to-moderate flood events. Analysing the flood benefits of many of the actions in this strategy will require more investment by governments in flood modelling and mitigation works. A better understanding of the effects on flood risk mitigation of water security options presented in this strategy will inform implementation of the strategy.

The *Floodplain Development Manual*⁹² and the Flood Prone Land Policy guide local government in managing flood risk in their communities. The Office of Local Government and the Department of Planning and Environment–Environment and Heritage Group also lead flood-risk reduction for towns and regional centres across the state.

Implementation plan

The Far North Coast Regional Water Strategy is accompanied by a separate implementation plan⁹³ that prioritises the delivery of actions over the life of the strategy. The implementation plan also outlines responsibilities and timeframes for delivery. This plan will allow us to monitor progress of the actions to assess the effectiveness of the strategy, and to identify areas where we need to adapt. The current implementation plan sets our priorities over the next 3 years.

We cannot start implementing all the actions at once. Funding will be a key consideration in planning when and how actions will be implemented. Because regional water strategies set the NSW Government's priorities for water management, they will be a key tool for seeking future funding.

The implementation plan identifies the key partners who will be involved in implementing the strategy:

- NSW Government agencies will lead the implementation of actions that develop and review policies and regulatory arrangements, involve research, or deliver regional programs. They will also take action where there is a market failure or other need for government intervention.
- Local councils will be involved in actions that influence town water supply at the local level and actions directly related to local-level strategic planning.
- State-owned corporations such as WaterNSW will be involved in actions that require changes to the design, operation and management of major infrastructure, or the way water is delivered in regulated rivers.
- Community and industry groups and research organisations will be engaged in implementation. They may also partner with different levels of government to progress or deliver certain actions.

Each year, we will report on our progress in implementing the strategy actions. This will provide transparency to the community, and allow us to show what we have achieved and what we will deliver in the future.

92. Available at: www.environment.nsw.gov.au/topics/water/floodplains/floodplain-manual

93. Available at: www.dpie.nsw.gov.au/water/plans-and-programs/regional-water-strategies/final/far-north-coast-regional-water-strategy

Figure 19. Far North Coast Regional Water Strategy Implementation Plan

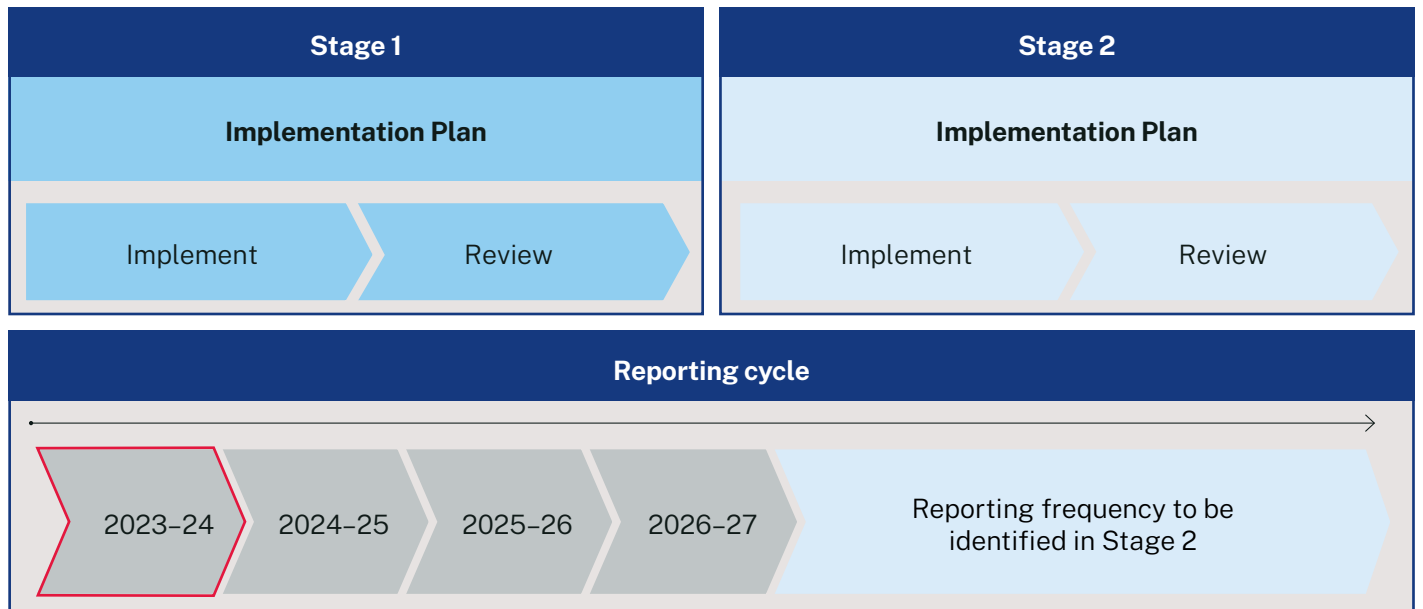


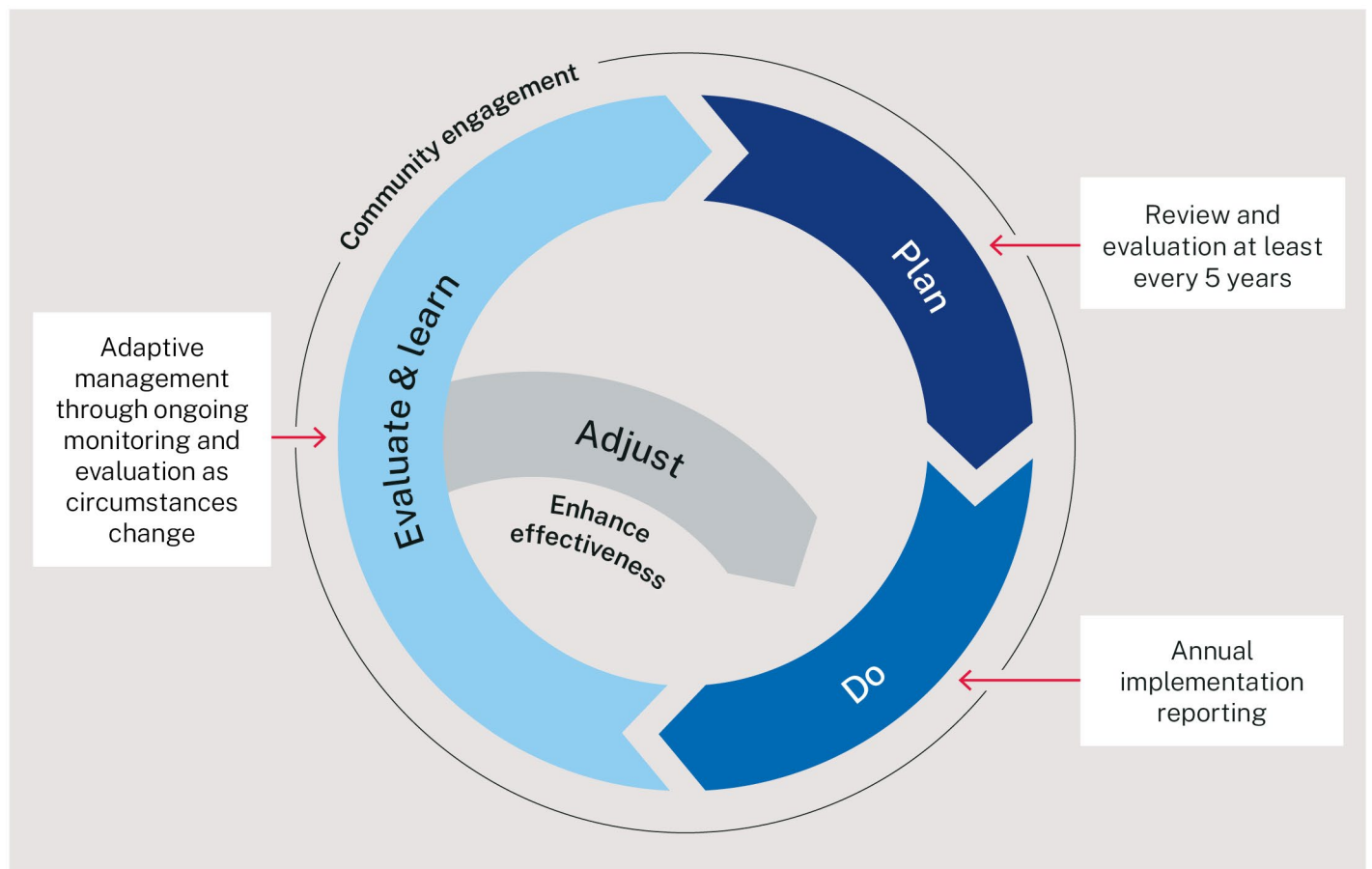
Image courtesy of iStock. Lismore, NSW.

Ongoing monitoring, adaptation and reporting

The Far North Coast Regional Water Strategy is designed to respond to changing circumstances. We will undertake a formal review of the strategy at least every 5 years, or in response to significant changing circumstances. The formal review will ensure that the key assumptions, such as population and demographics, have not significantly changed.

We may make amendments in response to key changes in water demand, social preferences, science and technology, economic conditions or other events, including how climate change assumptions and responses evolve. These amendments may result in a shift in priorities, and the implementation plan will be updated to reflect this.

Figure 20. Regional water strategies process



Glossary

The documents that were developed for the Far North Coast Regional Water Strategy use a number of technical terms. Some of these terms have been used in specific ways across the different documents. The glossary below lists and clarifies the main technical terms used across the Far North Coast Regional Water Strategy document set.

Name	Description
Action	A description of the on-the-ground next step required to achieve the priorities of the regional water strategy. These are expanded on in the implementation plan.
Breakeven analysis	Determines at what price a megalitre of water would result in the costs being equivalent to the benefits. This analysis assumes the proposed option is viable on the balance of outcomes within the economic analysis framework presented and determines what price for a megalitre of water would make the benefits equal the cost of the option.
Consultation paper	A document developed in response to feedback on the first round of public exhibition of the draft regional water strategies. It includes shortlisted options and additional analysis.
Distributional impact	Analysis that considers how an option impacts different water users and classes of licences.
Draft regional water strategy	A document released including a long list of options as part of the first round of public exhibition.
Economic base case	An assumption of existing infrastructure and policy settings but including central planning assumptions on projections of future population in each region.
Instrumental data	The available historic record in the region, referred to as the instrumental record of approximately 130 years (1890 to 2020).
Longlist options	Potential options released in the draft regional water strategy.
Option	One of the water management options listed in the draft regional water strategies long list of options. Options were taken through an assessment process. Options that progressed to the regional water strategies have been called actions.
Projection	A plausible estimate of future population or climatic conditions.
Rapid CBA	A cost benefit analysis undertaken with the instrumental hydrologic dataset.
Recurrence interval	The probability that a climatic event will occur in a given time period. This generally refers to river flows or droughts. For example, an annual recurrence interval, or 5-year recurrence interval.

Name	Description
Scenario	A model run with a particular set of model conditions. These conditions are usually made from a particular climate projection and may also include a particular population projection. A scenario represents a plausible future condition for the region.
Sensitivity analysis	Used to identify the extent to which changes to the key assumptions influence the outcomes of the detailed analysis.
Shortlist of options	A refined list of potential options in the Consultation Paper.



Image courtesy of Destination NSW. Richmond River, Casino.

