

Regional Water Strategy

South Coast

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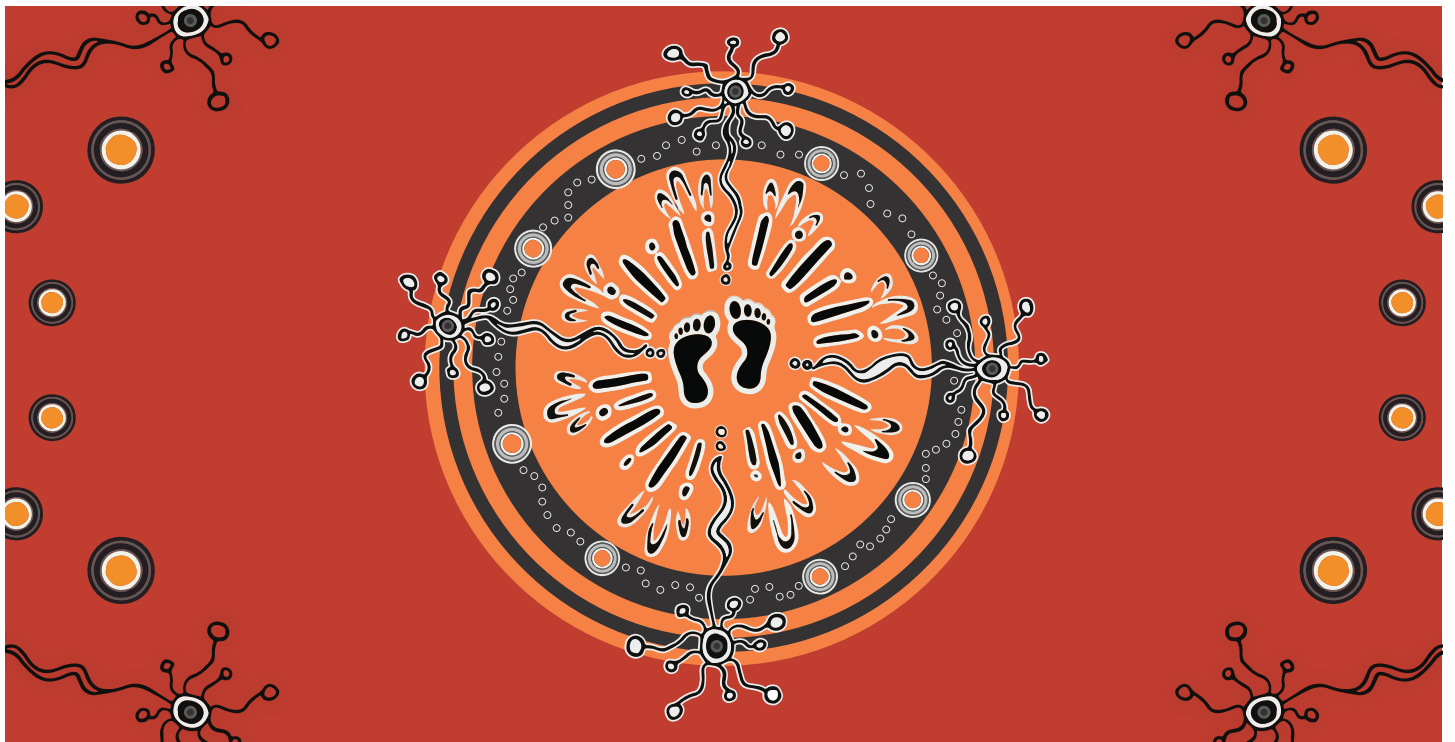
Cover image Image courtesy of Therese Hulme, Department of Planning and Environment. Bemboka River, Morans Crossing.

More information water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies

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Acknowledging First Nations people

The NSW Government acknowledges First Nations people as its first Australian people and the traditional owners and custodians of the country's lands and water. We have recognised that 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 practice the oldest living culture on earth.

The NSW Government acknowledges the First Nations people/Traditional Owners from the South Coast region as having an intrinsic connection with the lands and waters of the South 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 practice their traditional culture and lifestyle.

We recognise the Traditional Owners were the first managers of Country and by incorporating their culture and knowledge into management of water in the region is a significant step for 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, present and emerging 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 Traditional Owners/First Nations people, 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 Indigenous/Aboriginal and non-Aboriginal communities.

Artwork courtesy of Nikita Ridgeway.

Minister's foreword



The Hon. Kevin John Anderson, MP
Minister for Lands and Water, and
Minister for Hospitality and Racing

We need healthy rivers, healthy farms and healthy communities. The way we manage water deeply affects the livelihoods of people in NSW.

Water is the most precious resource we have. Everyone and everything relies on water. It supports our towns and regional cities, the rich cultural heritage of our Aboriginal communities, our industries and our natural environment. Water underpins the South Coast region's health and prosperity.

The South Coast faces many water challenges. This has led the NSW Government to develop a long-term strategic vision for water. Our vision sets the direction and lays a path to improve water security, river health and cultural outcomes in NSW. Central to this vision is taking a holistic approach to water management. This will help us ensure that water is used sustainably and fairly, and it will help us prepare for a more variable and changing climate.

The South Coast region is located within the traditional lands of the Yuin nation. These traditional custodians have cared for the South Coast region's rivers and catchments for over 60,000 years. The region is home to 120,000 people and a number of thriving coastal towns that drive the region's strong economy.

Developing the South Coast Regional Water Strategy required us to take a detailed look at what makes this region unique. We considered its relationship with water and its needs and challenges, and we developed innovative ways to deliver safe and secure water supplies that are sustainable and resilient, both now and into the future.

We developed the regional water strategies using the best and latest scientific evidence. This helped us to understand the risks to water users, even in the most extreme climatic conditions. We engaged leading academics to develop new methods to better understand the South Coast region's climate. These new methods and data supplement our historical climate records with new evidence from the field of paleoclimatology. Over 500 years of climate data helped us to better understand historic climate variability. We have also applied the NSW Government's climate change projections to this new data to understand the impacts of a worst-case 'dry' climate scenario.

The climate modelling showed that extreme dry and wet periods worse than what has been recorded in the last 130 years have happened in the past. These events are likely to become more frequent and severe in the future. Understanding these possible climate risks lets us plan and make sure we are prepared if they do eventuate.

The contribution of the South Coast region's community has been instrumental in developing and finalising the strategy. We consulted with Aboriginal communities; local governments; industry and environmental groups; water users; and members of the public. We listened to the feedback we received to make sure we deliver a strong strategy for the whole South Coast region.

I would particularly like to thank the Aboriginal communities across the region who engaged with us and leant their voices to this strategy. Water is an essential part of their culture and is critical in Caring for Country. I hope that this strategy will start to dismantle the major barriers to Aboriginal people's water rights and access. I look forward to working collaboratively with Aboriginal communities in the South Coast region to achieve better water outcomes.

I would also like to thank local councils for their significant contributions, and their engagement and support. We will continue to partner with local councils as we implement the strategy.

I am proud to launch the South Coast Regional Water Strategy. I hope it will contribute to a healthy environment, resilient community and a vibrant regional economy.

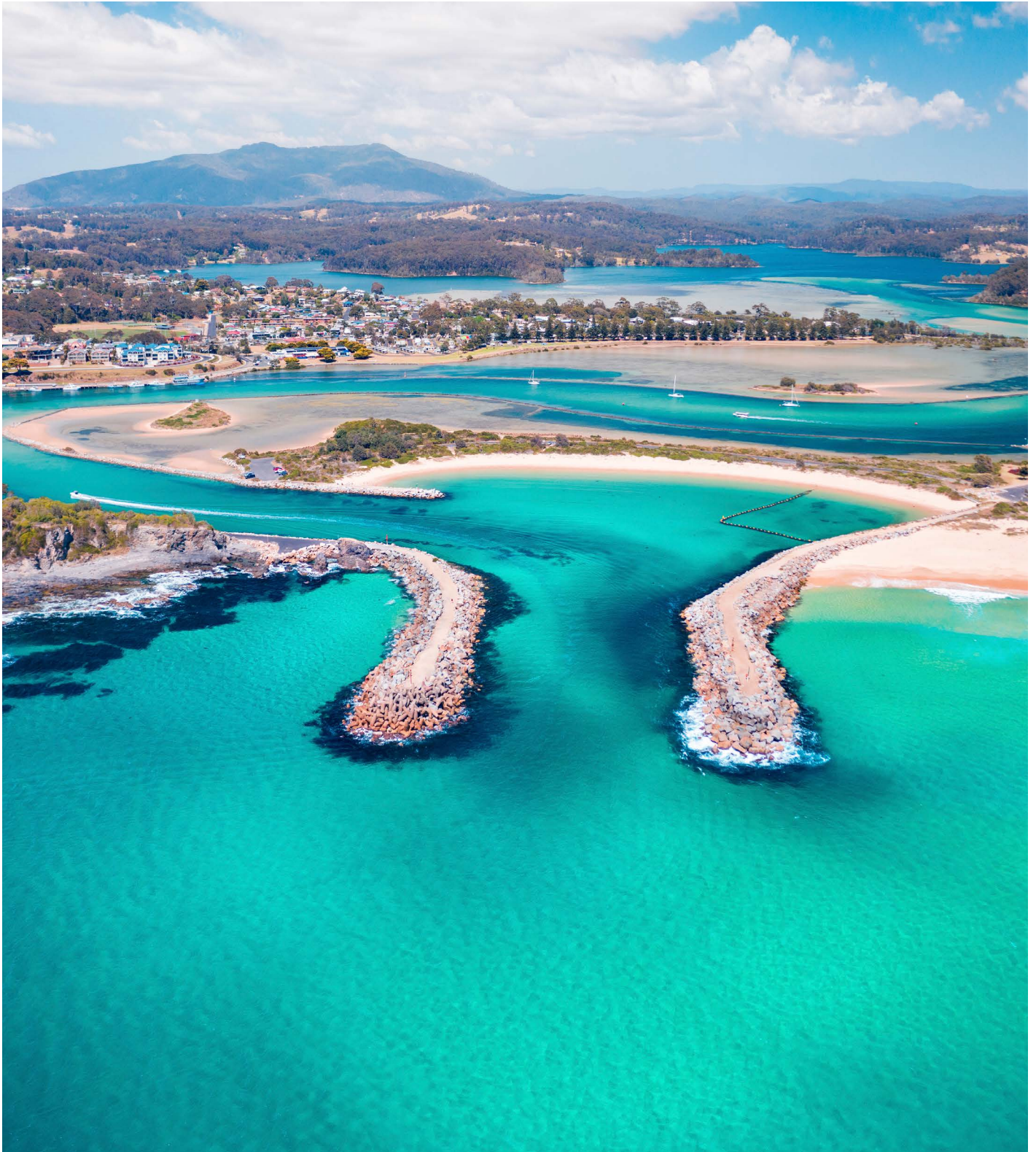


Image courtesy of Destination NSW. Wagonga Inlet, Narooma.

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Image courtesy of Destination NSW. Streetscape, Central Tilba.

About the South Coast Regional Water Strategy

Image courtesy of Lachlan Edwards, Department of Planning and Environment.
Tantawangalo Creek, Candelero.

Secure, reliable and resilient water sources are critical to regional communities in NSW. They contribute to the appeal and prosperity of rural areas, regional towns and cities. They support cultural connections to Country and strengthen community wellbeing. Water in the right places at the right times is also vital for healthy regional landscapes and sustainable ecosystems. Changing water demands, increased climate variability and shifting community expectations means we need to plan and invest in improved long-term regional water security.

The South Coast Regional Water Strategy identifies the key regional challenges that we need to tackle over the coming decades and outlines the actions that 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 Destination NSW. Kiah Wilderness Tours, Kiah.

The regional water strategies

Across NSW, valuable and essential water resources are under pressure. A more variable climate, as well as changing industries, 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 South Coast Regional Water Strategy is one of a suite of catchment-based strategies across the state (Figure 1). 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 objectives. There is a natural synergy between these objectives, which we understood more fully after engaging with primary producers, local communities, First Nations people and environmental stakeholders. The strategy actions aim to deliver benefits and complementary actions across all stakeholder groups.

Figure 1. Map of NSW regional water strategy regions



Objectives of regional water strategies

Regional water strategies will set out a long-term ‘roadmap’ of actions to deliver 5 key objectives (Figure 2). Each regional water strategy identifies the key challenges that are affecting our ability to achieve the objectives and identifies priority actions that address the challenges and works towards meeting at least one regional water strategy objective.

Figure 2. Regional water strategy objectives



Our aim is for each strategy to have a comprehensive, balanced package of options that delivers on all the regional water strategy objectives and aligns with the priority 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.

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

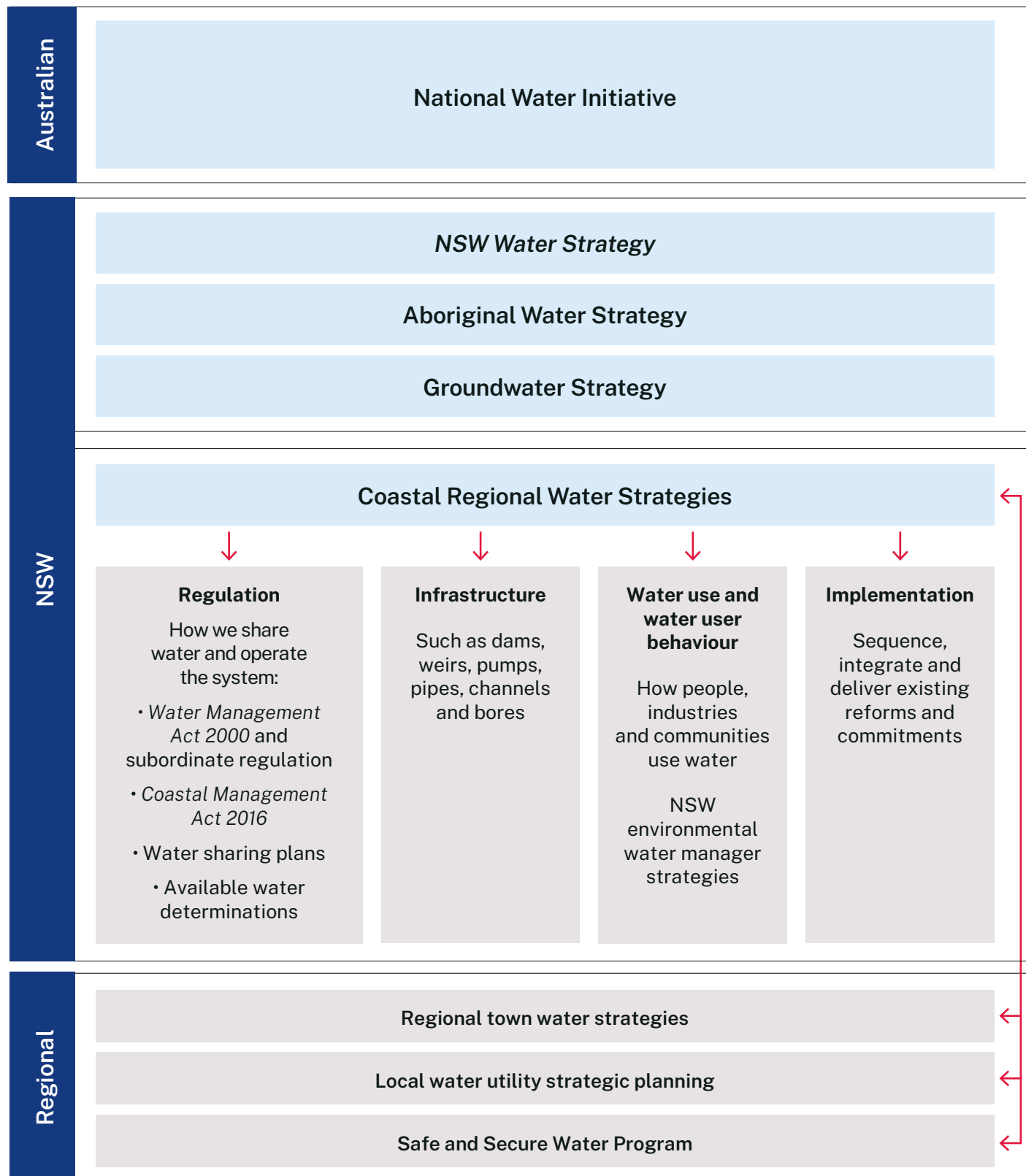
Fitting regional water strategies with other plans and policies

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 Jaime Plaza Van Roon, Department of Planning and Environment. Oyster farms at Merimbula Lake. Merimbula, NSW.

Figure 3. NSW water policy and planning context



The strategic planning framework for water management in NSW includes the *NSW Water Strategy*,² which is underpinned by the 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 including:

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

- the NSW Groundwater Strategy – to ensure sustainable groundwater management across NSW³
- 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 councils⁴
- a new statewide Water Efficiency Framework and Program – to reinvigorate water use efficiency programs in our cities, towns and regional centres.⁵

The *NSW Water Strategy* and the South Coast Regional Water Strategy also complement other whole-of-government strategies, including the *20-Year Economic Vision for Regional NSW*,⁶ the *State Infrastructure Strategy*,⁷ the *NSW Marine Estate Management Strategy 2018–2028*,⁸ *Illawarra Shoalhaven Regional Plan 2041*⁹ and the *South East and Tablelands Regional Plan 2041*.¹⁰



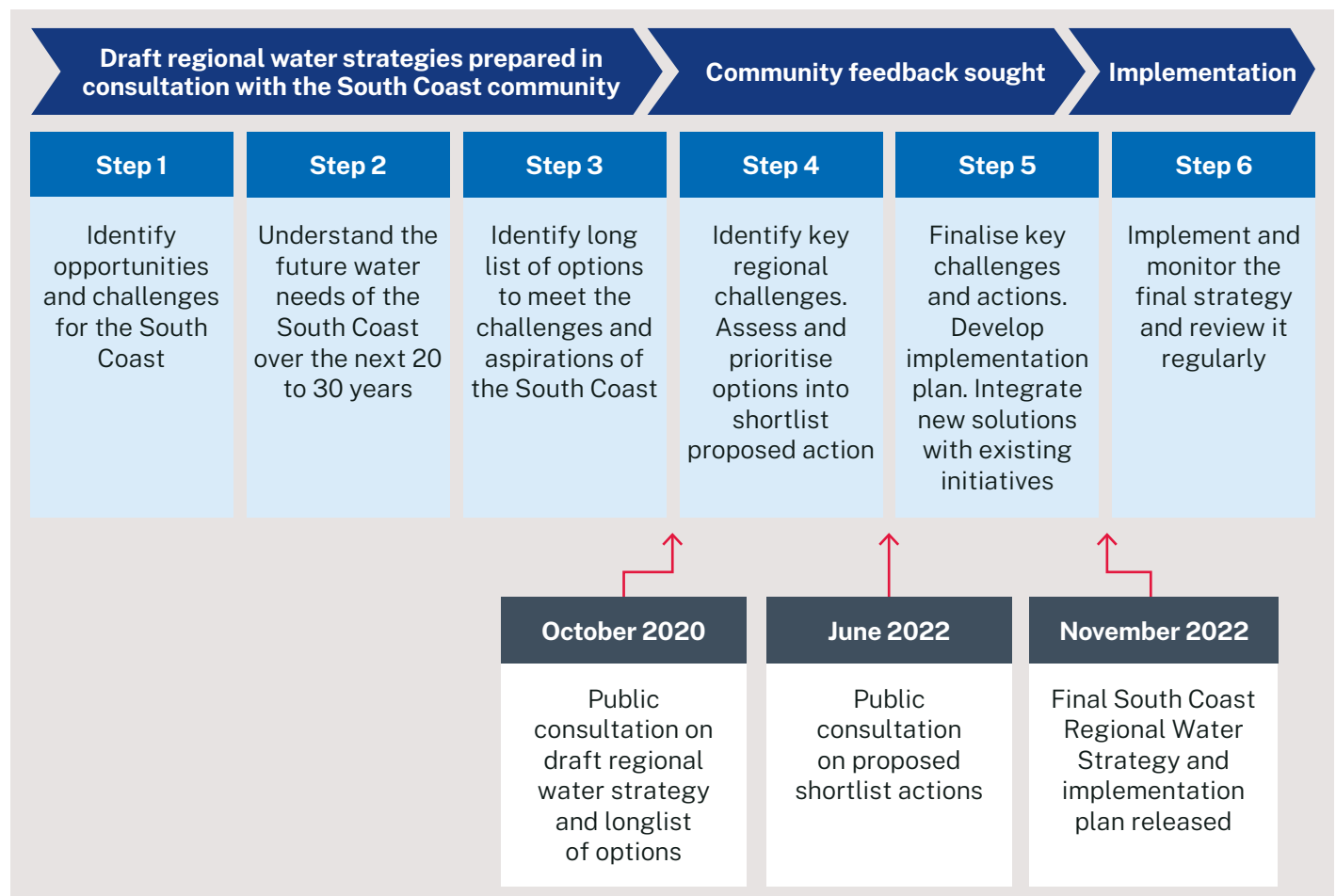
Image courtesy of Jaime Plaza Van Roon, Department of Planning and Environment. Waterfront of Clyde River, Batemans Bay, NSW.

2. Department of Planning, Industry and Environment 2021, *NSW Water Strategy*, dpie.nsw.gov.au/water/plans-and-programs/nsw-water-strategy/the-strategy
3. Department of Planning and Environment 2022, *Draft NSW Groundwater Strategy*, dpie.nsw.gov.au/water/plans-and-programs/nsw-groundwater-strategy
4. More information is available at: dpie.nsw.gov.au/water/plans-and-programs/town-water-risk-reduction-program
5. More information is available at: dpie.nsw.gov.au/water/plans-and-programs/water-efficiency/framework
6. NSW Government 2021, *A 20-Year Economic Vision for Regional NSW*, nsw.gov.au/a-20-year-economic-vision-for-regional-nsw-refresh
7. Infrastructure NSW 2022, *Staying Ahead: State Infrastructure Strategy 2022–2042*, infrastructure.nsw.gov.au/expert-advice/state-infrastructure-strategy
8. NSW Government 2018, *Marine Estate Management Strategy 2018–2028*, marine.nsw.gov.au/marine-estate-programs/marine-estate-management-strategy
9. Department of Planning, Industry and Environment, *Illawarra–Shoalhaven Regional Plan 2041*, planning.nsw.gov.au/Plans-for-your-area/Regional-Plans/Illawarra-Shoalhaven/Illawarra-Shoalhaven-Regional-Plan-2041
10. Department of Planning, Industry and Environment, *South East and Tablelands Regional Plan 2041*, planning.nsw.gov.au/Plans-for-your-area/Regional-Plans/South-East-and-Tablelands

Developing the South Coast Regional Water Strategy

The strategy has been developed using an evidence- and risk-based approach informed by extensive community consultation at each step of the process. The NSW Government has taken a 6-step approach to preparing and implementing regional water strategies as shown Figure 4.

Figure 4. Process for developing regional water strategies



What informed the South Coast Regional Water Strategy

We have used feedback from community, and the best evidence and most recent data taken from a wide range of sources, to inform the regional water strategies and ensure that they are based on a robust evidence base.¹¹ 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 we used to develop the strategy included:

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

11. The outputs and outcomes of the consultation process have been compiled into reports titled 'What We Heard'. More information is available at: dpie.nsw.gov.au/water/plans-and-programs/regional-water-strategies/what-we-heard/south-coast-regional-water-strategy

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 data¹² to give a modelling tool that generates 13,000 years of synthetic climate data. This information provides a much better understanding of the natural climate variability under current climate conditions. When combined climate change projections, we can better understand natural climate variability will be influenced by human induced climate change. We use both of these scenarios to assess risk to future water availability in each region.

This updated climate information has been used in developing the regional water strategy and comparing the effectiveness of the actions. It will also support all water users in making more informed decisions and better plan and prepare for climate risks.¹³

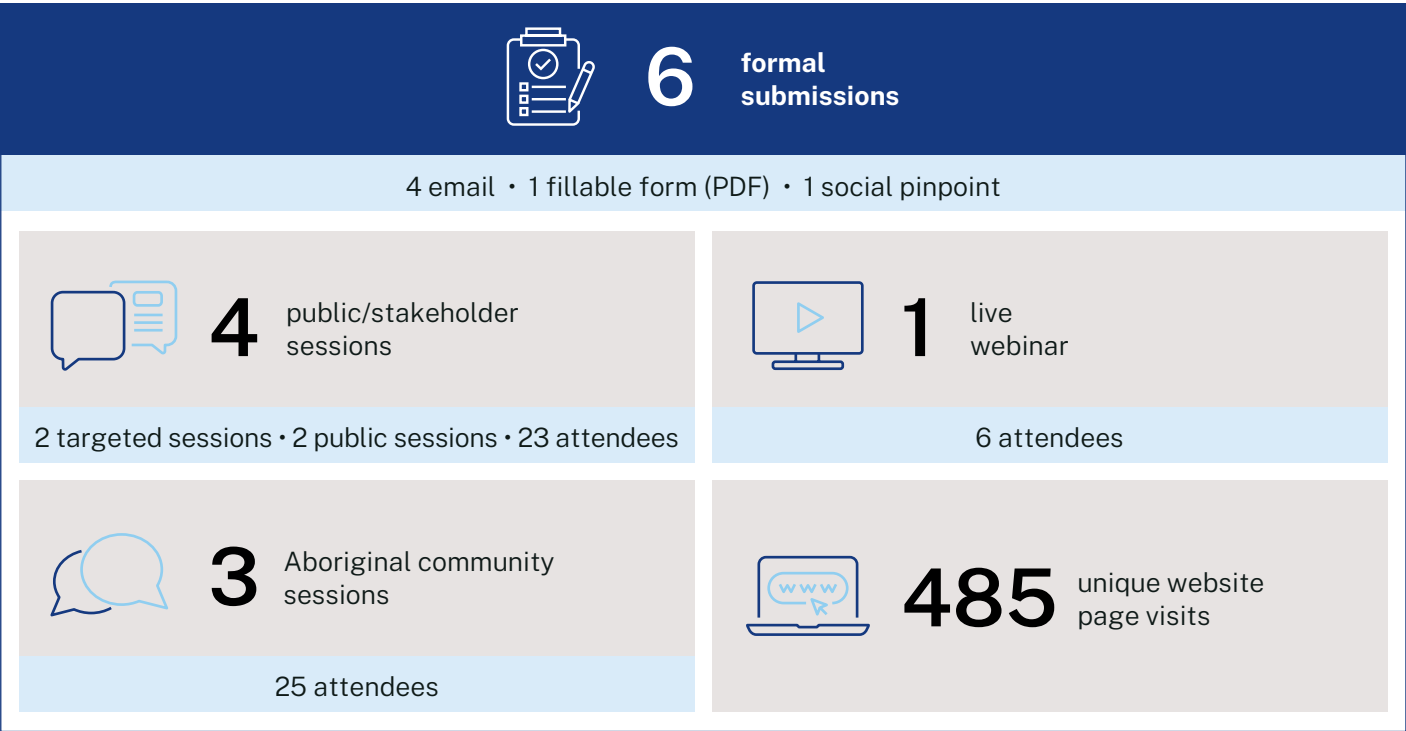
The section on *What the future climate could look like in the South Coast region* summarises the results from the analysis of the new climate data for the region. We will continue to use the best and latest evidence about the future climate to help develop solutions for water challenges in the region.

Extensive community consultation

Developing an effective and lasting regional water strategy requires input from the community that lives there. This includes Aboriginal people, landholders, community members, local councils, and industry and environmental groups. We would like to 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 Draft South Coast Regional Water Strategy through 2 public exhibition 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 is a summary of the consultation activities undertaken for the development of the South Coast Regional Water Strategy.

Figure 5. Stakeholder engagement that informed the South Coast Regional Water Strategy



12. Data was reconstructed from before instrumental records began, using sources such as tree rings, cave deposits and coral growth.
13. More information about these 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/climate-data-and-modelling
14. What We Heard reports and draft strategy documents are available at: dpie.nsw.gov.au/water/plans-and-programs/regional-water-strategies/what-we-heard/south-coast-regional-water-strategy

We heard important feedback during our consultation with primary producers, local councils, Aboriginal communities, and general public stakeholders. The key insights are provided in Figure 6 below.

Figure 6. Key insights from consultation on the South Coast Regional Water Strategy

Feedback theme	Feedback summary
Aboriginal knowledge and connection to Country	• There was strong support for integrating Aboriginal knowledge and culture into land and water management. There was also support for Aboriginal knowledge and connection to Country to also be considered during policy and planning for land and water management. • Aboriginal communities wanted assurances that providing input to the draft strategy would not be construed as, 'relinquishing or giving up First Nation peoples' sovereign rights to a proper and just settlement for the alienation and denial of our people from our waterways and water resources'. • There was continued support for creating economic and employment opportunities for local Aboriginal people.
Environmental and ecosystem health	• There was widespread support for the holistic approach that the draft strategy took to managing the catchment. This marked a shift from the public consultation phase 1, which expressed concern that the connectivity of the river systems was not reflected enough in the regional water strategy. • Maintaining regular river flow was also considered as essential to protecting ecosystem health. • There was support for improving hydrological flows as a means of improving nutrient flow, stimulating riverine activity and reducing sediment transport and salinity levels.
Water security and quality	• Water security remained an issue of high importance for communities in the South Coast region, including for local businesses that depend on reliable and safe water supply for their continued operation. There were growing fears that a lack of water security and increasing costs will impact agricultural businesses in particular. There was strong support for maximising on-farm storage options as a means of helping to address water security. There were also concerns that current approvals process for construction of on-farm storage is seen as a barrier. • The impact of rising sea levels on salinity of freshwater sources continued to be a focus for the region, with on-farm dams and barrages being recommended as key methods for mitigating this impact. • There were additional concerns that the operation and management of existing large dams needs to be improved.
Climate change and data modelling	• Regional resilience and the ability to respond effectively to the impacts of climate change remain a high priority. Proposed actions were strongly supported, however, concerns were raised over the application of a 'one size fits all' assessment and the use of 'worst-case scenario' modelling. • There was strong support from both community and industry stakeholders for recognising the significant challenges that climate change presents for the region. In particular, rising sea levels and preventing saltwater intrusion were frequently raised as issues of concern.
Finalising and implementing the strategy	• There was considerable feedback about the consultation process, with many people expressing their appreciation for the opportunity to provide feedback. • There was also a desire for more information on how the strategy and implementation plan would be finalised and transparency in how consultation feedback would be considered and actioned.

Economic, environmental and hydrological analyses

A range of robust assessments have been used to prioritise the actions in the regional water strategy, including:

- hydrologic analysis of options that had the potential to change the supply, demand or allocation of water
- cost-benefit and cost-effective 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 government agencies, Aboriginal people and the community.

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

The analyses in the regional water strategies is based on the best available information at the time they were completed. As with all types of analyses, a range of assumptions, uncertainties and qualifications are made.

Key assumptions used for the analyses include:

- **Town water supply risks:** focussed on surface water availability and do not include any consideration of existing alternative supply sources such as groundwater or desalination plants.
- **Population changes:** have been considered in accordance with the NSW Government's Common Planning Assumptions medium population growth forecasts. Bega Valley Shire and Eurobodalla Shire local government areas are not predicted to experience material growth in growth, under the Common Planning Assumption forecasts.¹⁶
- **Climate data:** Climate variability outside the bounds of the variability of the climate data sets used to inform this strategy may also necessitate a review of the South 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.¹⁷

In the South Coast region, this has included 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 South Coast Regional Water Strategy:

- WaterNSW 2018, *20 Year Infrastructure Options Study, Rural Valleys: Summary Report*¹⁸
- NSW Government's *NSW Marine Estate Management Strategy 2018–2028*¹⁹ and *NSW Marine Estate Threat and Risk Assessment*²⁰
- Department of Environment, Climate Change and Water 2006, *NSW Water Quality and River Flow Objectives*²¹
- Department of Planning, Industry and Environment 2017, *NSW Government water reform action plan*.²²

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

16. Population projections used in the Common Planning Assumptions can be accessed: planning.nsw.gov.au/Research-and-Demography/Population-projections/Projections

17. More information is in the Regional Water Strategies Guide, available at: water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies

18. More information is available at: waternsw.com.au/projects/infrastructure-studies/20-year-infrastructure-options-study

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

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

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

22. More information is available at: industry.nsw.gov.au/water/what-we-do/water-reform-action-plan

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 make sure that 95% of the potential water taken in NSW is accurately measured and monitored. Water users in the coastal NSW regions must have compliant equipment installed by 1 December 2024.²³

In 2020, the NSW Government also commenced implementation of all of the environmental water reforms that arose from the Water Reform Taskforce, that was set up following the *Independent investigation into NSW water management and compliance* report.²⁴

During the recent post-bushfire flood events, the NSW Government also assisted Bega Valley Shire Council to undertake water carting and emergency treatment plant works to address water quality issues.

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



Image courtesy of Jaime Plaza Van Roon, Department of Planning and Environment. Road through Merimbula city centre. Merimbula, NSW.

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

24. More information is available at: industry.nsw.gov.au/water/what-we-do/how-water-is-managed/independent-review-water-management-and-compliance

The South Coast region



Image courtesy of Jaime Plaza Van Roon, Department of Planning and Environment.
Dairy farm in the Bega Valley, NSW.

Figure 7. Snapshot of the South Coast region



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



120,000
population



Key towns include:

Vincentia, Milton-Ulladulla, Batemans Bay, Moruya, Narooma, Merimbula, Bega and Eden.



Councils include:

Shoalhaven City (southern portion), Eurobodalla and Bega Valley Shire.



Main rivers:

Clyde River, Deua River, Tuross River, Murrah River, Bega River, Towamba River.



Major water storages:

Brogo Dam (9 GL), which regulates the Brogo and lower Bega rivers.



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



Agriculture is the largest industry on the South Coast, with dairying being the major agricultural enterprise. Water entitlements for agriculture represent about 80% of available licensed water in the region.



Groundwater:

Groundwater is an important source of water for towns and industries. Main groundwater sources include: Lachlan Fold Belt Coast, Bega, Towamba and Tuross river alluviums, Araluen Creek alluvium, and South East Coastal Sands.

The South Coast region stretches from Jervis Bay south to the Victorian border and is bounded by the Great Dividing Range to the west and the Pacific Ocean to the east (Figure 8).

The region is located on the traditional lands of the Yuin people who have been the caretakers of this Country for over 60,000 years. Water is the lifeblood of Aboriginal people. It allows kinship, connection, stories, songlines and healing through medicine and food. Healthy waterways and groundwater systems are critical to Aboriginal people for wellbeing and culture.

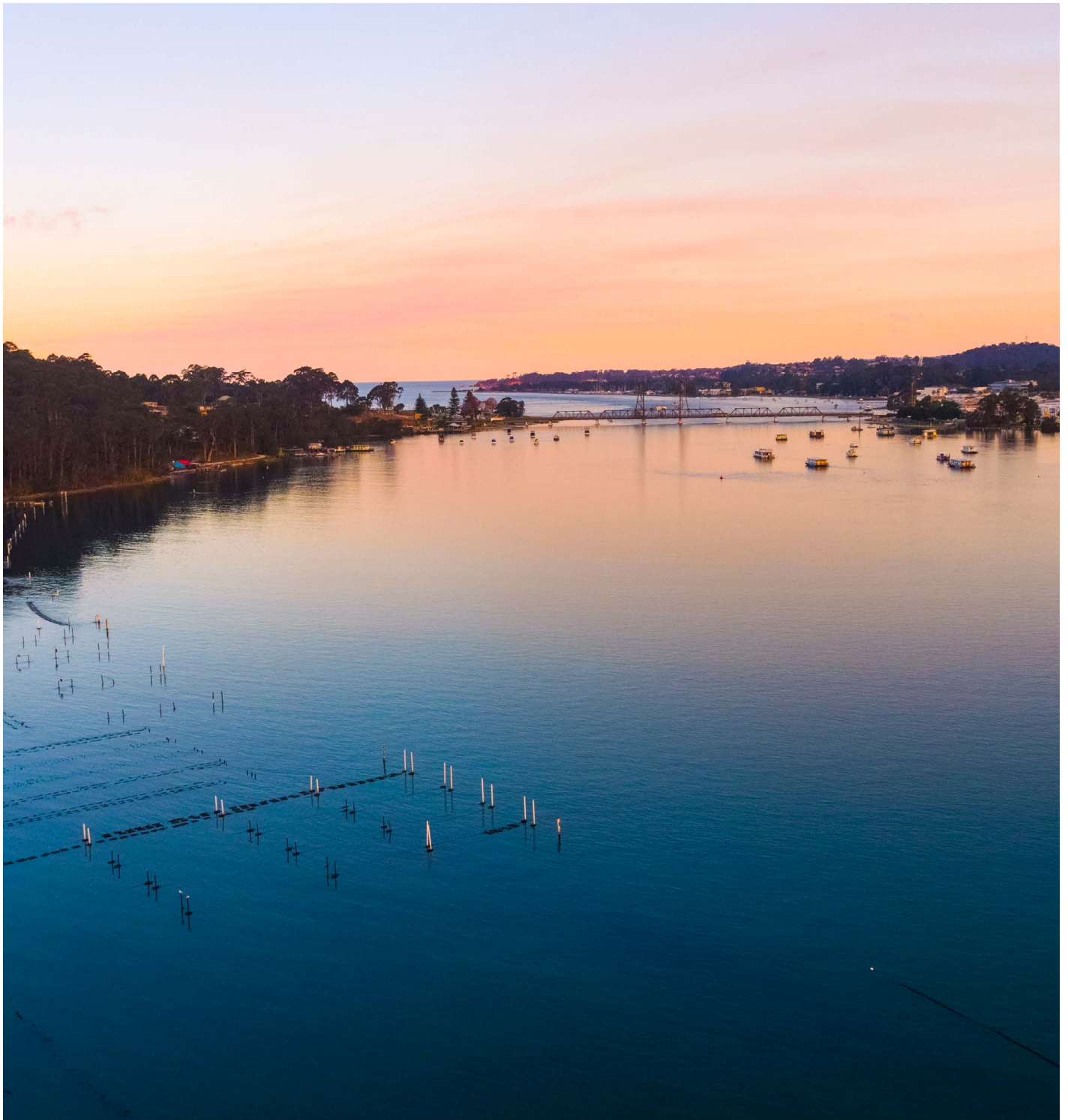
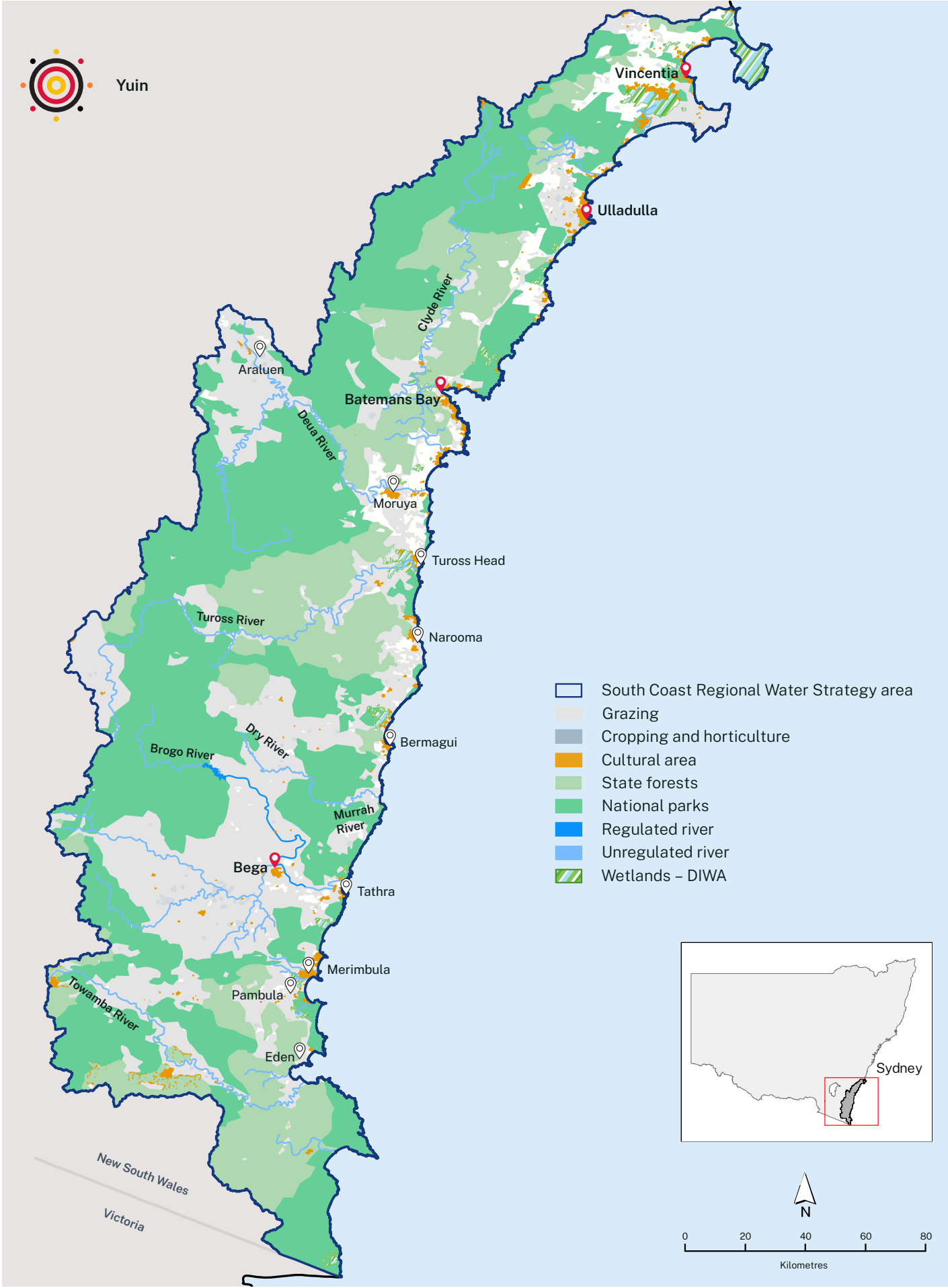


Image courtesy of Destination NSW. Wray Street Oyster Shed, Batemans Bay.

Figure 8. Map of the South Coast region



The South Coast region's major regional centres are Milton–Ulladulla, Vincentia, Batemans Bay and Bega. Other important centres include Moruya, Narooma, Merimbula and Eden.

The region has a diverse economy, underpinned by connections to Canberra, Sydney and Melbourne, and varied agriculture and tourism opportunities. Its coastal plains support a range of profitable agricultural enterprises, particularly dairy, beef, oysters and fishing. The region is home to Bega Cheese, an industry leader in dairy product manufacturing, as well as several specialist cheesemakers and milk processors. Tourism is a large employing sector in the region, with visitors attracted to the region's highly desirable coastline and marine environment, national parks, temperate climate and overall lifestyle amenity.

Water is critical to the health of the environment, the social fabric and liveability of the South Coast region and its economic prosperity. As well as meeting the daily needs of households and towns, water contributes to the region's amenity and liveability, and protects and conserves ecological assets and Aboriginal cultural heritage. Water also benefits many industry sectors, including agriculture, which is a significant driver of regional economic prosperity and local employment

The South Coast region includes 6 major, disconnected catchments – Clyde, Deua–Moruya, Tuross, Murrah, Bega and Towamba rivers – as well as 48 smaller catchments. The headwaters are primarily forested and the lower-reach, small-scale floodplains are cleared and used for settlement and production. The coastal zone is generally characterised by estuaries, coastal lakes and lagoons, remote beaches and rocky headlands. Compared to other systems in the state, particularly in the inland regions, streams in the South Coast region are relatively short and steep. Consequently, stream flows are flashy – that is, they peak dramatically within hours of heavy rain and usually return to medium flows within a few days.

Most of the South Coast region's rivers are unregulated, meaning there are no major storages to capture and control flows for water supplies in those rivers. These rivers rely on rainfall to generate stream flows. Brogo Dam, which has a capacity of 9 GL, is the region's main public storage and regulates flows in parts of the Bega–Brogo regulated river system. This system supports the town of Bermagui as well as industry and environmental water needs.

The South Coast region is home to many state and nationally significant wetlands and swamps supporting large areas of mangrove, saltmarsh and seagrasses. The Clyde River supports the largest area of estuarine wetlands of any estuary in the South Coast region, consisting of 54 discrete and protected wetlands. The region is also home to diverse native flora and fauna species including native fish and bird populations, some of which are listed as threatened, rare or endangered. National parks, state forests and public reserves, including several declared wilderness areas, cover a significant part of the region.

Groundwater provides important baseflows to rivers and creeks in the region, and there can be a high degree of connection between surface water and groundwater in the lower river reaches, coastal riverbeds and estuaries, lakes and lagoons. This means that the depletion of surface water sources can impact groundwater recharge and groundwater levels. Similarly, a drop in groundwater levels, through overextraction or drought, can lower surface water levels and reduce streamflows.

Protecting the water quality of coastal lakes and estuaries from stormwater, sewage overflows, and runoff from agricultural and forestry land is of vital importance to aquaculture and tourism industries, and is a major challenge for the South Coast region.



Image courtesy of Destination NSW. SAGE Farmers Markets, Moruya.

Water use in the South Coast region

Limited data exists on water use patterns in the region. Water extraction from surface and groundwater sources is largely unmetered and for the purpose of planning, usage is estimated based on unit shares.

The South Coast region's largest water user is agriculture, although irrigation is only conducted on a small scale due to the region's generally reliable rainfall. Many of the region's agribusinesses rely on a combination of rainfall and irrigation water.

Agricultural enterprises hold approximately 80% (66,000 ML) of all surface and groundwater entitlements which are used to support dairy farming, beef grazing, small-scale horticulture (mainly stonefruit) and lucerne production. Most irrigation occurs in the Bega River and Tuross River valleys.

About 64% (53,000 ML) of entitlements are for extraction from unregulated rivers, of which approximately 27,000 ML is in the Bega River catchment. A further 20% of entitlements are held in the Bega–Brogo regulated river system (Table 1).

The region's local water utilities hold water approximately 17% (14,300 ML) of water access entitlements per year, to supply their connected towns and villages. The remaining 3% of water is for stock and domestic uses.

Many landholders have harvestable rights dams. Harvestable rights dams allow landholders in most rural areas to collect a proportion of their basic landholder rights' runoff on their property and store it in farm dams.

Table 1. Entitlement (share component) volume for water resources across the South Coast region

Water source	Entitlement (ML)	Proportion of shares compared to total share pool (%)
Unregulated*	53,031	64
Regulated (Brogo – Lower Bega)	16,429	20
Alluvial groundwater	8,384	10
Groundwater – hard rock aquifers	4,732	6
Groundwater – coastal sands	389	<1

*Note: Includes unregulated river access licences and domestic and stock access licences. Eurobodalla Shire Council's local water utility access licence is included in the aquifer access licence total as all town water is extracted from the alluvial bores rather than from the river pump. This volume includes 902 ML of water extracted by Eurobodalla Shire Council through several bores located near the Tuross River.

What the future climate could look like in the South Coast region

3

Image courtesy of Destination NSW. Wray Street Oyster Shed, Batemans Bay.

Climate data and modelling used to develop the South Coast Regional Water Strategy

We have used 4 climate data sets to understand the key regional challenges and to assess options for this strategy:

- **historical data:** rainfall and evaporation data from Australian Government meteorological records
- **long-term climate variability data (stochastic data):** applied stochastic modelling to our 130-year historical record of past climate to develop 13,000 years of possible climate sequences. This approach provides more information on climate variability and shows the region could experience more severe drought and wet periods
- **dry climate change scenarios:** modified version of the long-term climate variability data, scaled up or down using the NSW and Australian Regional Climate Modelling (NARCLiM) climate projections, the Electricity Sector Climate Information project and research undertaken by the University of Newcastle. The following 2 dry climate change scenarios were applied to the 13,000-year dataset:
 - NARCLiM-informed future climate projections: These scaling factors compare the baseline period of 1990–2009 with climate projections for the periods 2020–2039 and 2060–2079. We apply these scaling factors to every climate timeseries used in the modelling.
 - One less east coast low event per year (ECL-1): For the South Coast region, east coast lows have been shown to be important for water security. We have used a database developed by the Bureau of Meteorology, which provides information on the historical occurrence of east coast lows. In addition, NARCLiM provides data on the potential changes in the frequency of east coast lows and intensity of rainfall associated with east coast lows as a result of climate change. We have chosen to present the scenario where one east coast low has been removed per year, as this is the closest outcome to the most conservative result from NARCLiM.²⁵

Combined, these datasets provide us with a range of plausible climate futures, that cover a range of wet and dry sequences.²⁶

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

The regional water strategies have planned for climate change by using a dry worst-case climate change scenario. 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 around the world are already taking action on climate change. However, using this worst-case scenario helps us to plan strategically and to focus on the key challenges facing a region. It also helps us understand how different options might work in a very dry climate in the future.

Considering the worst-case climate scenario together with current climatic conditions is appropriate for this type of strategic-level assessment. It allows us to assess the full range of risks to the water system. We will need to complete more refined assessment of climate change risk when we implement many of the regional water strategy actions. These additional assessments will be based on both the action’s planning horizon and the latest climate science.

25. East coast lows are intense low-pressure systems that occur off the east coast of Australia. The Electricity Sector Climate Information project found that east coast lows are the dominate signal to cause a change in rainfall in the South Coast region. Regional water security over the South Coast is subsequently affected by east coast low behaviour, as these systems can bring heavy soaking rainfall that replenishes streams and rivers in the South Coast. Further information can be found in the Intense east coast lows and climate change in eastern Australia brochure, available at: nepsclimate.com.au/outreach-publications/

26. More information is available at: water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies/climate-data-and-modelling

Climate snapshot

The South Coast region has a naturally variable climate

Over the past 130 years the South Coast region has experienced extreme droughts as well as floods.

The most well-known droughts are the:

- Federation Drought (1895–1903)
- the World War II Drought (1939–1945)
- the Millennium Drought (1997–2009)
- the most recent drought (2018–2020).

Flooding in the region can occur at any time but shows strong seasonality. Most floods in the historical record have occurred in the first half of the year, with the peak period between February and April, resulting predominantly from rainfall generated from east coast lows.

The South Coast's climate could become more variable

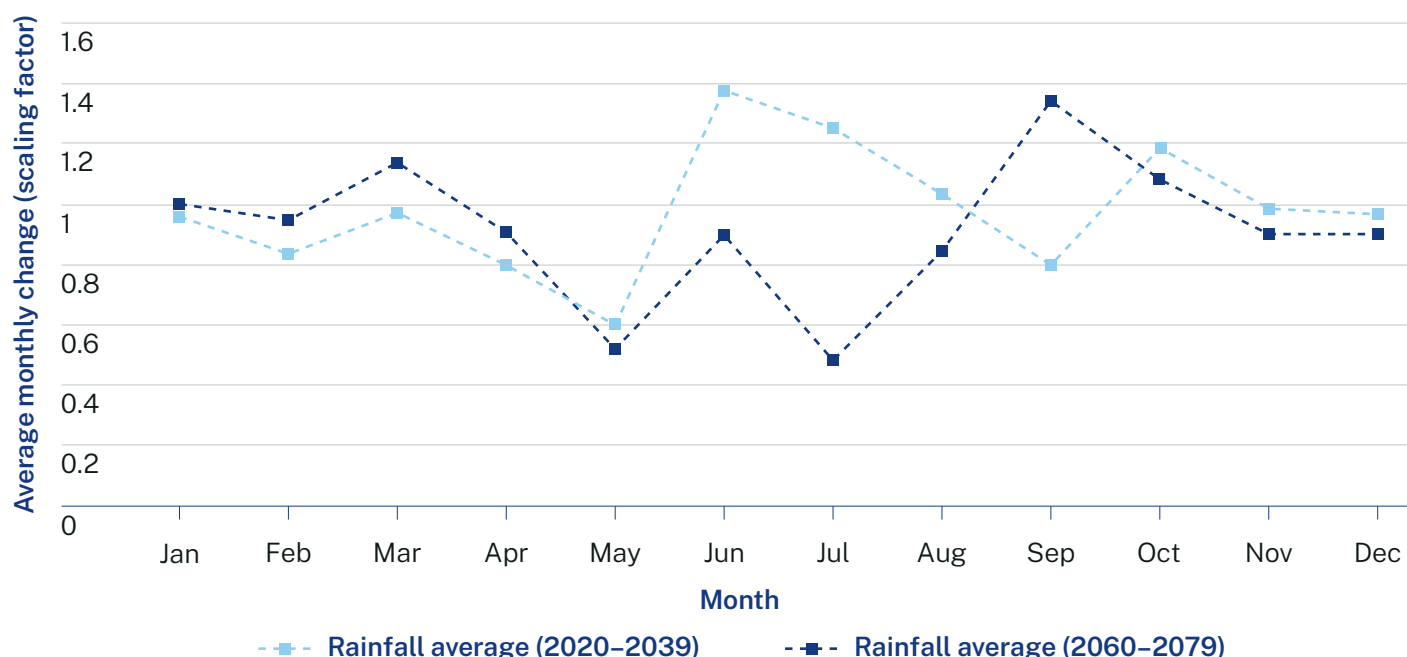
The NSW Government has invested in new climate datasets. This new data has improved our hydrological modelling and gives us a better understanding of the natural variability of the South Coast region's climate beyond the observed historical records.

Even though the region has experienced significant droughts in the last 130 years, our modelling suggests we have not seen anywhere near the worst conditions that are considered plausible to occur. For both very short dry periods (1–2 years), and longer droughts (2–10 years), the long-term climate variability data shows that more intense conditions with significantly less rainfall are possible. For example, the lowest 5-year rainfall total on the historical record for the Bega and Tuross catchments is about 3,050 mm. The long-term climate variability data set shows that for 5-year droughts, rainfall is more likely to be between 2,700 mm and 3,000 mm. It also shows 5-year periods with as little as 2,300 mm of rainfall. We haven't seen these conditions in the past 130 years but they are likely to occur in the future.

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

- changing rainfall patterns – shifts in seasonal rainfall patterns are expected to cause a decrease in rainfall in late summer and autumn, with an increase in winter rainfall with a slight reduction in mean annual rainfall (Figure 9) and heavy rainfall events are likely to become more intense by 2070
- sea levels are projected to rise in the region between 0.09 m and 0.19 m by 2030, and between 0.24 and 0.59 m by 2070. Flooding and inundation will become more common in low-lying areas along the coast
- average fire weather is projected to increase in spring and summer, with the number of days of severe weather increasing by up to 2 more days every 5 years by 2030.

Figure 9. Possible future changes to rainfall in the South Coast region (compared to the 1990–2009 average)



Source: NARcliM climate change modelling

Climate change will probably cause more extreme weather in the future

We don't know for certain what the future climate will be like. Our analysis of different climate projections for the South Coast region tells us there could be more extreme wet and dry periods than we have observed in our lifetimes. 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)

- a decrease in total annual rainfall by up to 8% per year with larger decreases possible during winter months
- an increase in the rate of evapotranspiration by up to 6% by 2070
- a rise in the sea level in the region of between 0.09 m and 0.19 m by 2030 and between 0.24 m and 0.59 m by 2070.

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



Image courtesy of Department of Planning and Environment. Cleared Land, South East Forests National Park.

Future climate impacts on water supplies

Future climate change

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

Our analysis suggests that while inflows into Brogo Dam could decrease, the dam will continue to be a reliable supply of water. Even under the worst-case dry climate change scenario, the storage is expected to be full or spilling for 54% of the time and greater than 50% full for 97% of the time.

Our new modelling showed that 24-month minimum inflows into Brogo Dam could be much lower than previously experienced. The observed historical record shows a 24-month minimum inflow sequence of 15,000 ML that included a wet period which is likely to have refilled the dam. Our modelling showed that 24-month inflows could drop to around 2,000 ML under a worst-case dry climate change scenario (Figure 10).

Figure 10. Worst minimum inflow into Brogo Dam over 24 months under observed historical data, long-term climate (stochastic) and long-term worst case dry climate change scenario

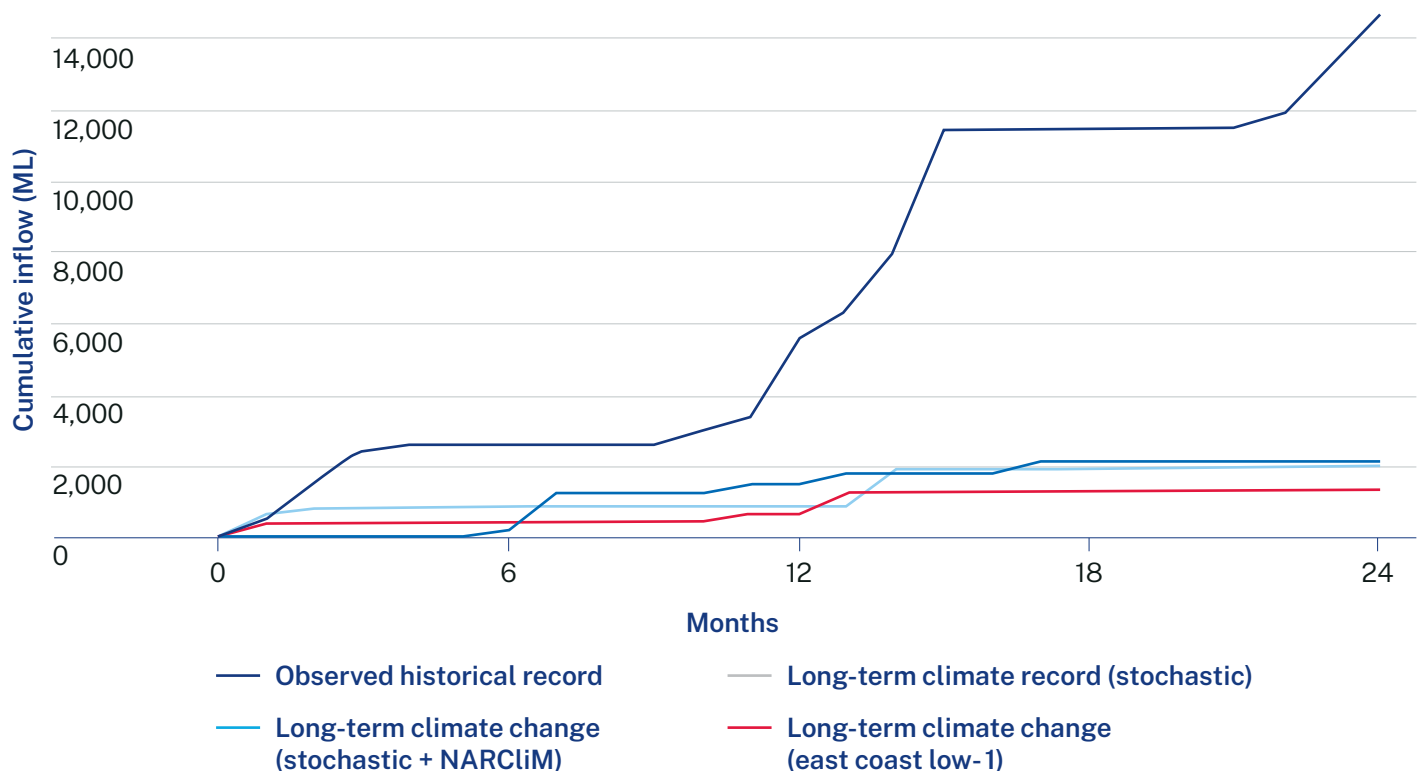


Table 2 shows a summary of what current conditions and conditions under climate change could look like, on average. It shows the annual average river flows that we have modelled using the 4 data sets explained above.²⁷

The impacts of climate change on flows are expected to vary across the region. The right-most columns show the average decrease in flows due to climate change. It compares the historical data and both the dry climate change scenarios (NARcliM and ECL-1 (one less east coast low event per year)).

Table 2. Average future water availability: annual flows in the major South Coast region rivers

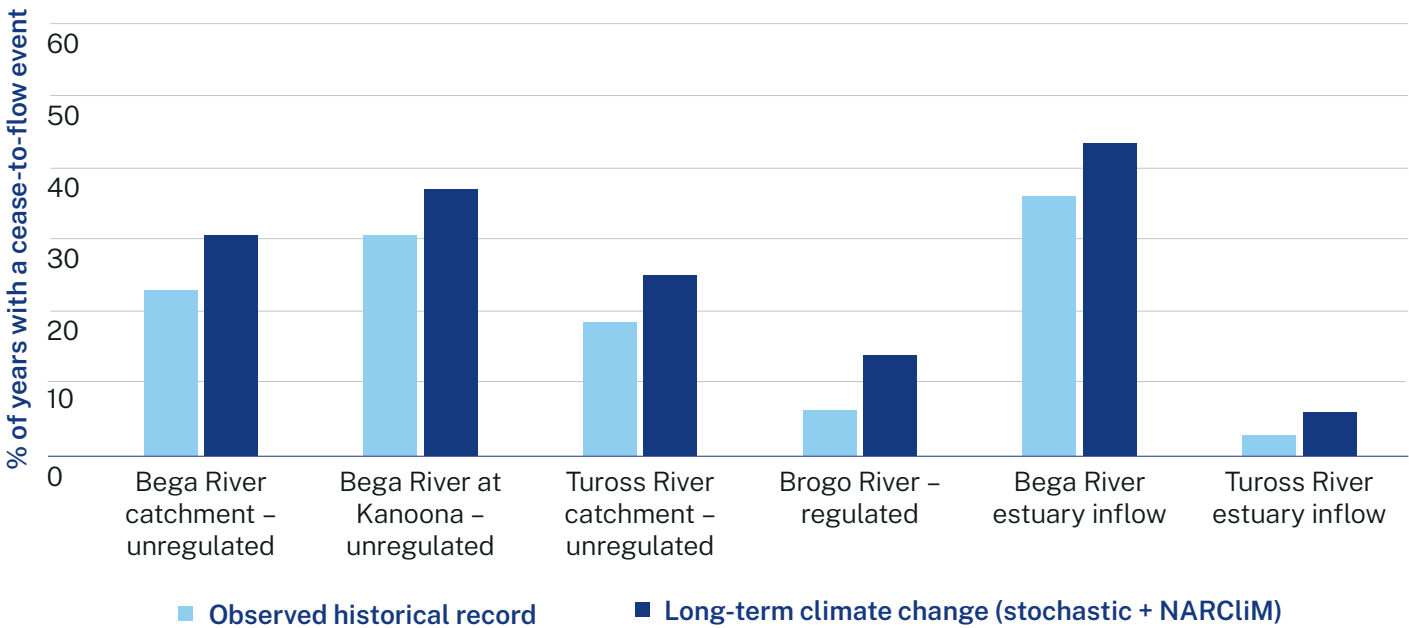
Gauge/river	Average Annual Flow (GL/year)					
	Historical data*	Long-term climate variability data	Dry climate change scenarios		Dry climate change scenarios compared to historical data (% difference)	
			NARcliM	ECL-1	NARcliM	ECL-1
219013 – Brogo River @ North Brogo	74.3	85.0	66.3	49.5	-11%	-33%
219025 – Brogo River @ Angledale	117.0	140.0	104.8	73.2	-10%	-37%
219021 – Bemboka River @ Bemboka	32.0	33.3	29.6	25.6	-8%	-20%
219003 – Bemboka @ Morans Crossing	61.6	64.1	55.8	43.9	-9%	-29%
219022 – Candelo Dam site	29.6	32.4	27.3	20.2	-8%	-32%
219032 – Bega River @ Kanoona	95.4	100.0	84.5	61.0	-11%	-36%
219026 – Bega River @ Warraguburra	234.3	263.0	201.8	134.5	-14%	-43%
218002 – Tuross River at Belowra	117.0	122.8	102.5	90.2	-12%	-23%
218005 – Tuross River D/S Wadbilliga River Junction	180.4	191.0	163.9	134.2	-9%	-26%
218008 – Tuross River at Eurobodalla	220.6	231.6	193.1	155.2	-12%	-30%

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

The percentage of years with a cease-to-flow event is predicted to increase from 6% to 14% in the Brogo unregulated system, from 23% to 31% in the unregulated rivers in the Bega catchment, and from

18% to 25% in the unregulated rivers in the Tuross River catchment (Figure 11). The average duration of each cease-to-flow event ranges from one to 13 days and is not expected to increase significantly.

Figure 11. Impacts of long-term climate risks on the flow regime (cease-to-flow events)



These impacts will be in addition to any impacts from sea level rise, which have not been modelled in this analysis.

Sea levels are projected to rise in the region by between 0.09 m and 0.19 m by 2030 and between 0.24 m and 0.59 m by 2070. As sea levels rise, saltwater will intrude further into estuaries, coastal lakes and groundwater sources. The effect of sea level rise on salinity levels in fresh water sources may be magnified

as surface water inflows reduce. The lack of freshwater flows entering the estuaries during will change the salinity gradient and decrease the size of the tidal pool where freshwater is found above the more saline water below, generally resulting in saline water moving further upstream.

Flooding an inundation will become more common in low-lying areas along the coast, especially if flood-producing rainfall events increase in severity.



Image courtesy of Destination NSW. Tathra Beach, Tathra.

Future climate variability

The long-term climate variability data doesn't reveal much about average conditions. But it does show that extreme conditions in the past are likely to have been worse than what we have seen in the historical record.

Table 3 shows the worst 1% of river flows that we modelled using the 4 climate data sets. It shows that more severe droughts are likely to have occurred in all the catchments of the South Coast. Climate change will further increase the likelihood of these events occurring in the future.

Table 3. Extreme dry conditions water availability: lowest 1% flows in the major South Coast region rivers

Gauge/river	Extreme dry conditions, 1% probability (GL/year)					
	Historical data*	Long-term climate variability data	Dry climate change scenarios		Dry climate change scenarios compared to historical data (% difference)	
			NARClIM	ECL-1	NARClIM	ECL-1
219013 – Brogo River @ North Brogo	6.0	5.8	3.6	3.2	-40%	-47%
219025 – Brogo River @ Angledale	6.9	7.4	4.5	3.9	-35%	-44%
219021 – Bemboka River @ Bemboka	8.7	8.1	6.9	6.7	-21%	-23%
219003 – Bemboka @ Morans Crossing	6.8	6.4	5.0	4.7	-27%	-31%
219022 – Candelo Damsite	1.0	1.5	0.8	0.5	-20%	-50%
219032 – Bega River @ Kanoona	4.9	5.2	3.5	3.1	-29%	-37%
219026 – Bega River @ Warraguburra	10.4	10.3	5.5	4.8	-47%	-54%
218002 – Tuross River at Belowra	12.7	11.7	8.5	7.8	-33%	-38%
218005 – Tuross River D/S Wadbilliga River Junction	15.3	13.8	10.7	8.6	-30%	-44%
218008 – Tuross River at Eurobodalla	16.2	16.1	11.7	9.4	-28%	-42%

Key challenges in the South Coast region – what we will focus on first

4

Image courtesy of iStock. Ulladulla, NSW.

The region is located within the traditional lands of the Yuin people who have been the caretakers of the South Coast region for over 60,000 years.

Like all regions across Australia, the South Coast region faces a warmer and more variable climate. We need to prepare now for the transition to a scenario where we do more with less water, make wise decisions about our water use and management armed with better knowledge and information, and protect our most critical water needs.

We have identified 5 challenges that are the 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 the South Coast towns and industries.

Addressing these challenges will help us meet the vision and objectives we have set for the South Coast Regional Water Strategy.



Image courtesy of Jaime Plaza Van Roon, Department of Planning and Environment. Farmland outside of Bega, NSW.



Challenge: Declining catchment and river health

Poor catchment and riparian management, combined with changes in catchment and river hydrology, are affecting river health, hydrologic connectivity and raw water quality.

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 impacts Aboriginal people's 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 recreation. Furthermore, industries are 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.

Land use change, low soil carbon levels, poor riparian (streambank) management and uncontrolled stock access has led to riverbank and riverbed erosion and the mobilisation of sediment, nutrients, pathogens and debris during rainfall events. These impacts are particularly acute during rainfall events following bushfire.

As a result of land use change and low soil carbon levels, water now moves more quickly and with more energy through the region's catchments than expected in its natural state. This fast-moving water erodes land and waterways, as does stock access to the region's rivers and creeks. The sediment contributed by bank erosion and other sources increases water pollution and leads to less water stored in the landscape. Cattle can also be a direct source of pathogen (bacteria and virus) contamination.

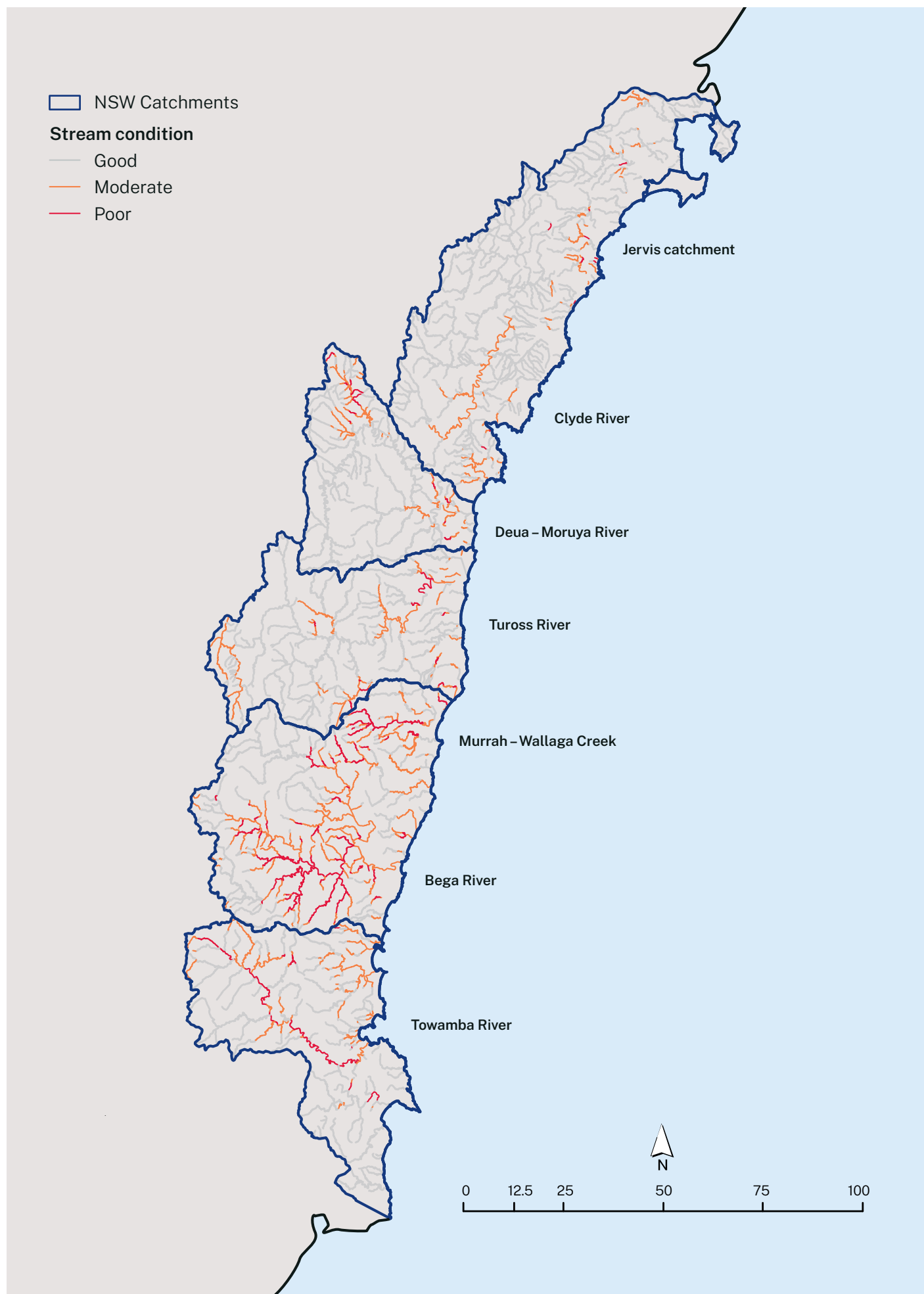
Current geomorphic and riparian condition

Across the South Coast region, 4,377 km (70%) of river lengths are in good condition. River sections in moderate geomorphic condition account for approximately 22% of total river lengths. River sections in poor geomorphic condition account for approximately 8% of the total length of river across the region and are mainly located within reaches in the Bega River catchment south and west of Bega; Towamba River; Tuross River; and Narira Creek between Cobargo and Wallaga Lake. Areas in poor condition are dominated by riverbanks with little or no native vegetation and higher levels of weed infestation (Figure 12).



Image courtesy of Lachlan Edwards, Department of Planning and Environment.
Stretch of Tantawangalo Creek in poor riparian condition, Tantawangalo.

Figure 12. Distribution of poor and moderate condition river reaches across the South Coast region



Water quality

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

The impacts of land use change and development are heightened during the extreme rainfall events, which are characteristic of the South Coast region during east coast lows. Rainfall runoff from these events is typically high in nutrients and sediment. This causes elevated nutrient loads and smothering vegetation, and subsequent deoxygenation and further release of nutrients. These impacts are particularly acute during rainfall events after bushfire and can lead to increased river toxicity and fish deaths.

In the last round of community consultation, we heard that the public and Aboriginal communities have significant concerns about the continued impact of catchment land use on the quality of the region's highly valued waterways. The local councils in the region cannot treat water when turbidity is high. This restricts the availability of water for town water supply, and has been a critical issue when rainfall follows extended dry periods.

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. We lack an overarching framework for managing water quality and waterway impacts. This impedes planning, collaboration, coordination and reconciliation of state and local priorities. It also impacts the development and delivery of environmental catchment programs at different scales and makes it difficult to ensure that water quality and quantity meet environmental needs throughout the catchment and into the estuaries.

During consultation, we heard that a reduction in the uptake of best practice is being driven primarily by a lack of social willingness of users and landholders and complicated natural resources regulation.

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

Effects of declining quantity of freshwater inflows

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 needed to support habitat diversity and productivity. Reductions in inflows may affect salinity gradients and fish movement. This would detrimentally impact estuarine ecology, particularly in the tidal pools at the upper limits of the estuaries, and push salinity upstream where water is drawn for agricultural purposes.

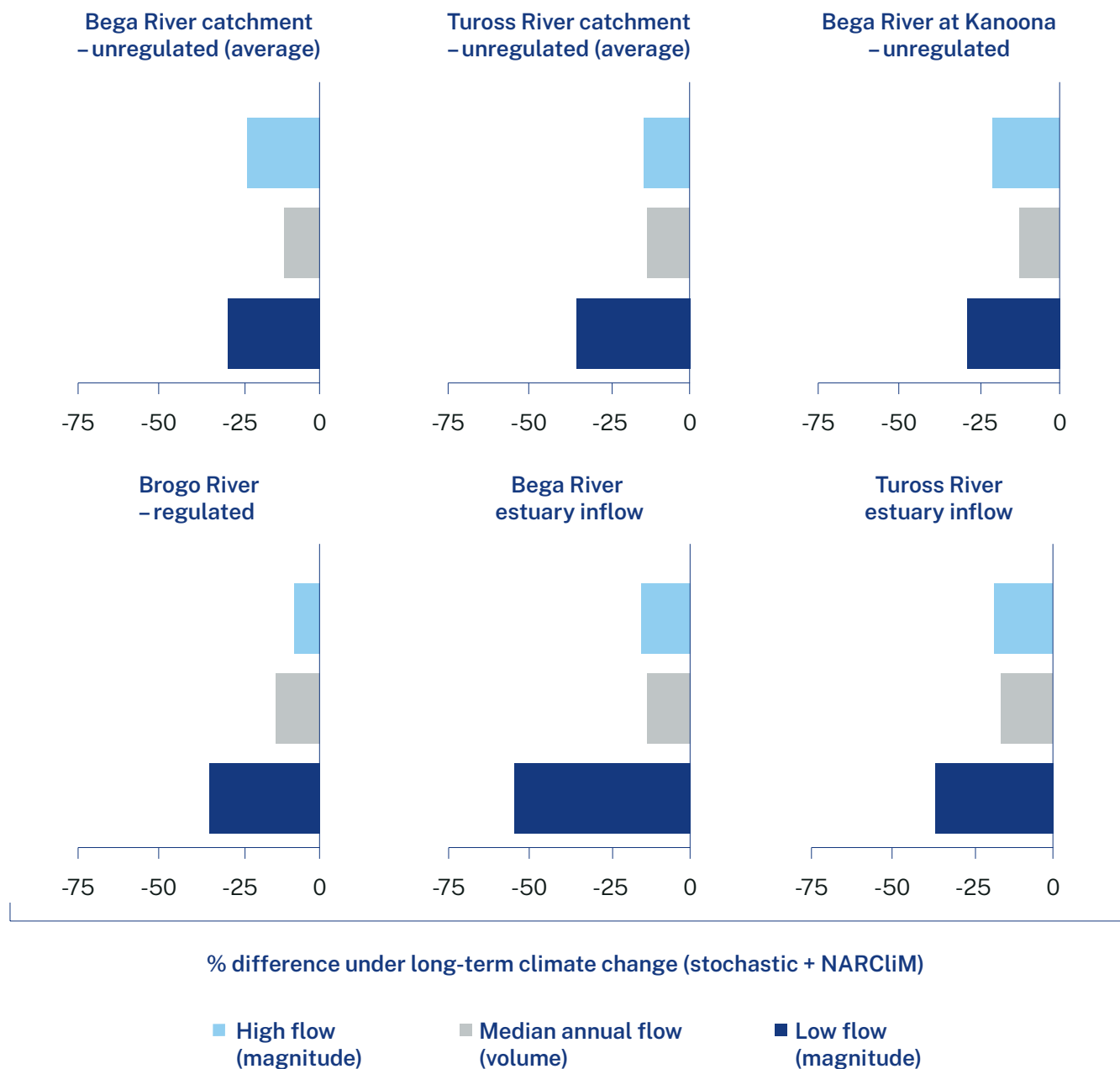
Intermittently closed and open lakes and lagoons are particularly sensitive to modified freshwater flows, which can significantly impact water quality, geomorphology and entrance opening regimes. It can also impact the health and extent of mangroves, saltmarsh and seagrass, which are important fish habitats.

The *Marine Estate Management Strategy*²⁸ has flagged the regulation and extraction of freshwater flows as a priority threat to help address these issues.

Our new climate data and hydrologic modelling show that the annual volume of flows in the Bega and Tuross catchments may decrease by up to 16% under a dry climate change scenario, and that all parts of the flow regime may be impacted (Figure 13). Additionally, high-flow events may reduce in magnitude by up to 15% for the Bega River estuary and up to 18% for the Tuross River estuary. Reductions in medium- to high-flow events would affect sediment and nutrient transport that stimulate riverine productivity, system flushing, and limit the number of events that trigger fish movement and spawning.

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

Figure 13. Projected impacts of climate change on the flow regime in the Bega and Tuross rivers



Effects of declining quality of freshwater inflows

High-quality freshwater inflows are important to estuarine health and to the communities and industries they support. Oyster farming is a developing industry in the lakes and estuaries of the South Coast region and can be heavily impacted by poor quality freshwater inflows.

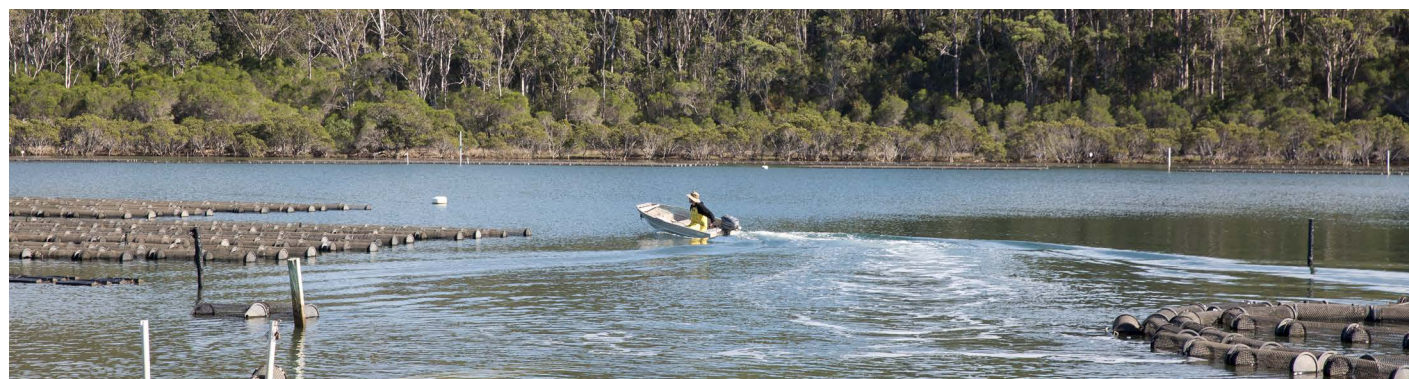


Image courtesy of Destination NSW. Tathra Oysters, Tathra.

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

Although most South Coast region's rivers and streams are considered unregulated, there are still many instream structures to control and modify flows. These structures alter the natural flow of rivers and streams, and their 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. Cold water pollution from dams can adversely impact aquatic organisms and ecological processes. Cold water pollution has previously been identified as a possible issue at Brogo Dam.²⁹

We know of many species that are directly affected by instream structures and their operation in the South Coast region, including:

- the endangered Australian grayling (*Prototroctes maraena*)
- river blackfish (*Gadopsis marmoratus*).

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

- black bream (*Acanthopagrus butcheri*)
- 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 (*Perca latipes*).

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

Aboriginal people raised concerns about the impacts of instream water infrastructure on connectivity and the movement of fish. We also heard that good connectivity contributes to the health of freshwater and saltwater ecosystems as well as cultural and economic fishing practices.



Image courtesy of Scott Nichols, Department of Primary Industries Fisheries. Bettowind Creek.

29. NSW Department of Primary Industries 2012, *NSW Cold Water Pollution Strategy – report on the implementation of stage one*, NSW Government, available at: water.dpie.nsw.gov.au/science-data-and-modelling/surface-water/water-quality

30. Diadromous fish migrate between fresh and saltwater.



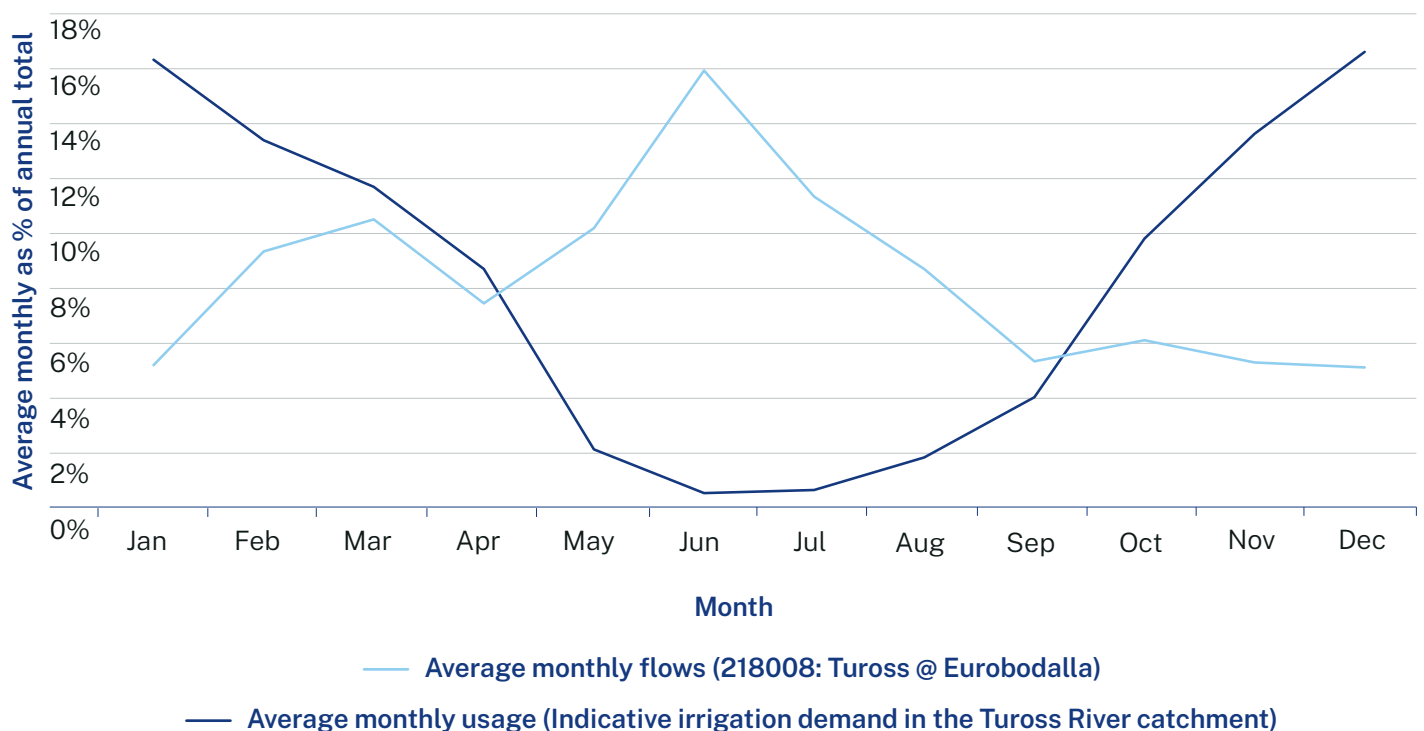
Challenge: Competition for low flows

Competition for water during low-flow periods is restricting access for landholders and industries and placing many of the region's waterways under stress.

There is generally enough water across the South Coast region to meet urban and rural water demands each year on average. However, competition for low flows³¹ during the drier spring and summer months places many of the region's rivers and creeks under increased hydrologic stress.

The periods of greatest agricultural water demand usually coincide with periods of lower stream flows (Figure 14). Competition for low flows is likely to increase in the future with projected climate change. Our new modelling suggests extended droughts are not unique and it is plausible they could be more frequent and more severe in the future. Irrigators reliant on rainfall will become more dependent on surface water or groundwater sources.

Figure 14. Modelled water demand (irrigation) versus stream flow, Tuross River



31. Flows in the 95th percentile on a flow duration curve. Upper percentiles, such as the 95th percentile, typically represent low or very low flows, while lower percentiles, such as the 5th percentile, represent high flows or flooding.

Low flows need to be protected in streams to maintain connectivity between river pools, to provide riffle flow and aeration, and to provide freshwater inputs to sensitive estuaries and intermittently closed and open lakes and lagoons. These river functions are critical for supporting river and ecosystem health, and water-dependent industries such as commercial fishing and the region's oyster industry.

Competition for low flows also impacts groundwater systems. Many of the region's alluvial and coastal sand groundwater systems are highly connected to surface water flows and reductions in surface flows can affect recharge rates. This impacts both the health of groundwater dependent ecosystems and consumptive users of groundwater, including the Bega-Tathra town water supply system.

Competition for water also adversely impacts the reliability of water accessed for irrigated agriculture and stock and domestic uses, of which dairying is the largest industry in the South Coast region. Irrigated agriculture in the region is mostly dependent on unregulated water sources. Unreliable water supplies can seriously threaten the long-term viability of dairying, especially if enterprises have to reduce stock numbers due to insufficient feed or water. Re-establishing pastures and re-stocking is expensive, and it can take several years to re-build enterprises. Water insecurity also discourages future investment in emerging industries.

Catchment conditions and limited data are constraining our ability to set effective rules to manage competing demands for low flows. Protecting low flows to reduce

the stress on the region's rivers and to protect water for downstream users relies on cease-to-pump rules. These rules require licenced water users to stop taking water under low flow conditions and are based either on gauged flow rates or visible flow conditions, and the setting of 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, and many new gauges would be required to cover all streams where extraction occurs. Consequently, increasing the coastal gauging network would come at a considerable cost to water users, which may be difficult to justify given the low volume 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 and setting limits 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 infrastructure and coordination, including stream flow gauges, water meters and coordinated rostering among users.



Image courtesy of Scott Nichols, Department of Primary Industries Fisheries. Merrica River, NSW.

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 so 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 under harvestable rights during wet periods to improve their preparedness for dry periods. However, a range of stakeholders are also concerned about the impact this approach 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 impacts on the environment and licensed water users. Additionally, many harvestable rights dams in the region have been found to be significantly larger than the permissible size. This could impact baseflows to downstream waterways. Changes to harvestable rights in coastal-draining catchments were announced in October 2021, allowing an increase in rights from 10% to 30%, subject to limitations and mitigation measures intended to ameliorate low-flow impacts. Further detailed catchment analysis, commencing in 2022, will confirm the suitability of these changes to harvestable rights in coastal-draining catchments.

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 so for rural residential sub-divisions 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 nor guidelines about how the right can be used, although basic landholder rights cannot be traded. Consequently, increases in these rights could compromise the effectiveness of any cease-to-pump conditions aimed at protecting the environment and downstream users. Under the *NSW Water Strategy*,³² we will review how domestic and stock basic landholder rights are regulated. This will include estimating the quantity of water extracted under these rights.

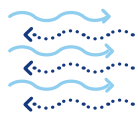
The low numbers of metered pumps makes it difficult to understand the extent of low flow competition and to manage water sharing among users

Protecting low flows requires water users to comply with the rules. However, very few pumps for surface water or groundwater are currently metered in coastal catchments. 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-take rules is managed through community-operated water user associations. However, management is difficult without meters or adequate gauging.



Image courtesy of Peter Simpson, Department of Primary Industries. Water meter.

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



Challenge: Saltwater intrusion into freshwater sources

Changes in catchment hydrology and sea level rise are projected to significantly impact coastal waterways and aquifers. We need to better understand the magnitude of this threat and how best to manage it.

Global sea levels are rising, mostly from increasing greenhouse gas concentrations in the atmosphere and associated glacial and ice sheet melt.³³ Between 1966 to 2009, sea levels around the coastline of Australia have risen at an average rate of 1.6 mm/year,³⁴ 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 impact:

- coastal wetlands, 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 it rises 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 2070.³⁵ For the South Coast region, the average projection is between 0.24 m and 0.59 m by 2070 (Table 4).

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, and the likely global mean sea level rise by 2100 is up to nearly 2 m (for a very high greenhouse gas emission scenario). Storm surges may also contribute to higher sea levels during the more frequent and intense low-pressure systems caused by climate change.

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



Image courtesy of Christina Bullivant, Department of Planning and Environment. Lake, Eurobodalla National Park.

33. 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.
34. 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
35. CoastAdapt 2017, *Sea-level rise and future climate information for coastal councils*, coastadapt.com.au/sea-level-rise-information-all-australian-coastal-councils

Table 4. Sea level rise projections for the South 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 (0.10–0.19)
2050	0.24 (0.16–0.32)	0.27 (0.19–0.36)
2070	0.36 (0.24–0.48)	0.45 (0.32–0.59)

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.

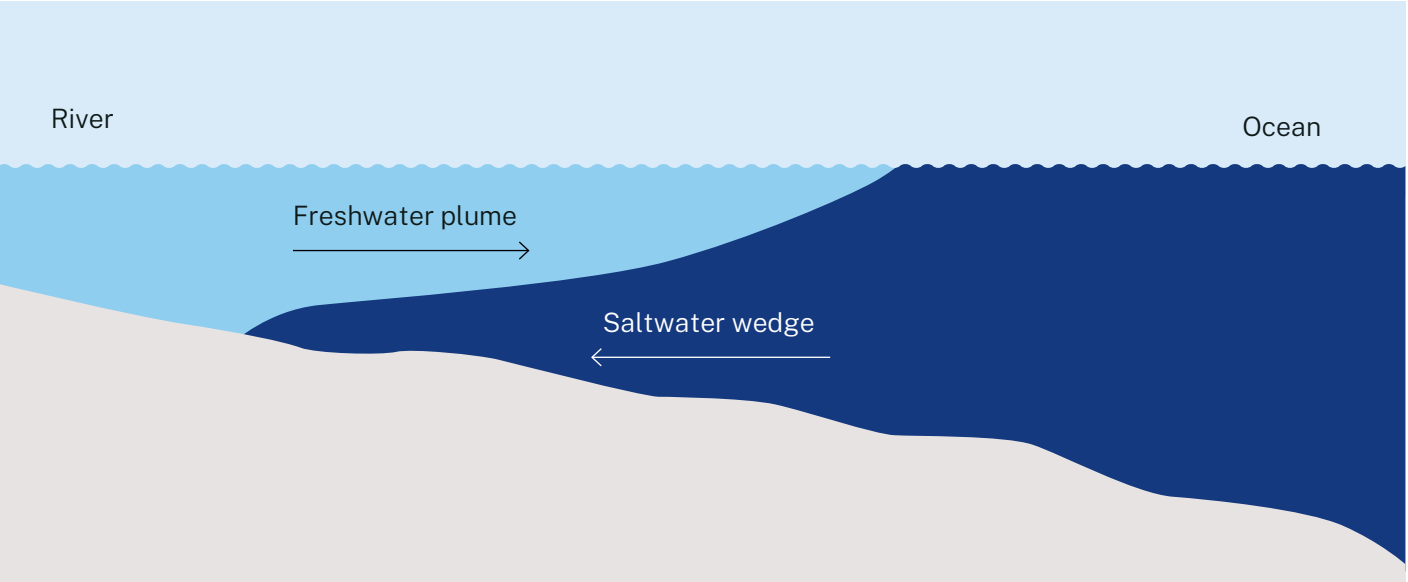
Possible reductions in river flows are likely to increase the effects of sea level rise

The high-tide footprints of the South Coast region’s major rivers range between 5 km (Murrumbidgee River) and 35 km (Clyde River) upstream. Sea level rise is likely to cause estuarine zones to migrate 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. We expect this will 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 (as illustrated in Figure 15). This change allows the salt wedge that usually sits below the freshwater in tidal pools to move further upstream.

Figure 15. Concept of a tidal saltwater wedge in a permanently open estuary³⁶



Note: Salt fronts form when freshwater moving downstream meets tidal water moving inland.

36. Adapted from 360.yale.edu/features/as-sea-levels-rise-will-drinking-water-supplies-be-at-risk

Our modelling shows that the magnitude of low flows in the Bega River catchment may be 35% smaller under a worst-case climate change scenario. The frequency of cease-to-flow events could increase from 6% to 14% in the Brogo regulated river system, from 23% to 31% in the unregulated rivers in the Bega River catchment and from 18% to 25% in the unregulated rivers in the Tuross River catchment.

Saltwater intrusion in freshwater and estuarine systems and the associated increase in salinity levels in freshwater systems is a significant future risk to water users in low-lying areas across the region. Even a small rise in sea level will reduce the suitability of water sources for local town water supplies, irrigation, dairy washdown, stock and domestic supplies.

Historically, sand barrages have been used on the Tuross and Bega rivers to limit the impact of saltwater intrusion on freshwater sources. Dairy and beef farmers in the Tuross River catchment told us that saltwater intrusion is the biggest risk to the ongoing viability of their operations.

Saltwater intrusion may also compromise water and wastewater treatment plants and infrastructure through corrosion and inundation of assets. Bega Valley Shire Council has identified low-lying water and sewer infrastructure as a key vulnerability in its *Climate Resilience Strategy 2050*.³⁷ Similarly, Eurobodalla Shire Council is currently developing a Climate Resilience Plan with a draft expected to be considered by Council identified risk posed by sea level rise to its wastewater and water supply assets in its *Eurobodalla Climate Action Plan 2022–32*.³⁸ Councils are responsible for developing and maintaining asset management plans, including planning for water and sewer assets at risk from gradual sea level rise.

Sea level rise is likely to cause impacts on coastal environments such as low-lying coastal wetlands, which would become inundated for longer or, at the most extreme, inundated permanently. The *Marine Estate Management Strategy*³⁹ recognises this as a key threat to the NSW coastal, estuarine and marine environment and has identified several actions that 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 the industry and 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.

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

It is critical that we 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, particularly for low-lying areas with high volumes of extraction

Saltwater intrusion into groundwater is caused by sea level rise and over-extraction of groundwater and freshwater. Areas particularly 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 in the South Coast region that are vulnerable to saltwater intrusion include coastal sands, floodplain alluvials and some upriver alluvials. Groundwater from these resources is important to the region's towns – particularly Bega and Tathra – tourism and industries. The impacts of saltwater intrusion are currently managed by ensuring coastal aquifers are not over-extracted by limiting licensed extraction and managing water levels in areas of high extraction.

37. Bega Valley Shire Council n.d., *Climate Resilience Strategy 2050*, begavalley.nsw.gov.au/services/climate-resilience-strategy

38. Eurobodalla Shire Council n.d., *Eurobodalla Climate Action Plan 2022–2032*, esc.nsw.gov.au/environment/climate-and-emissions

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



Challenge: Aboriginal people's rights and access to water

Historical dispossession of land, effects of colonisation and government water management processes continue to impact Aboriginal people's access to water and their ability to care for Country.

The Yuin people have been the custodians of the lands and waterways in the South Coast region for 60,000 years. Water is deeply entwined with Aboriginal culture. Healthy waterways are essential to the culture and wellbeing of Aboriginal communities across the South Coast region, providing food, kinship, connection, recreation, stories, songlines and healing.

Aboriginal people have lost access to waterways

The historical dispossession of land and the effect of colonial-era settler laws continue to impact the Yuin people's access to water and ability 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 impact important cultural sites and traditional water and food sources. Access to Country and waterways and the important sites they hold is critical to providing a purpose and pathway for young people to connect to culture. It also provides spaces for healing, as well as for food, medicine, and teaching.

There are already steps 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. It is anticipated the new model will provide for the potential handback of title to all NSW national parks – covering nearly 10% of the State – over a 15 to 20-year period, subject to the land being leased back (long term and for nominal rent) to the NSW Government for its continued use and management as national park.

Yuin people want a 'seat at the table' when it comes to decision making

Current water legislation and water management processes do not adequately bring the Yuin 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 that the Yuin people have of their traditional lands, water bodies and the flora and fauna that inhabit them. This is compounded by the limited involvement of the Yuin people in water consultation processes. Most often this lack of involvement has been because:

- Aboriginal people have 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.
- 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.

The Yuin people want a ‘seat at the table’ when it comes to decision making, both at the state and local levels. Government, at all levels, 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 the Yuin people the opportunity to improve outcomes for Country and for their communities
- improving natural resources management with a rich and holistic approach to water and land management that the Yuin people have been practising for thousands of years.

Aboriginal communities we consulted asked that the following statement be included in the strategy, **‘Be it known that First Nation people’s input into NSW regional water strategies is not to be treated as a relinquishment (to give up) of First Nation people’s sovereign rights to a proper and just settlement for the alienation and denial of our people from our water ways and water resources’.**



Image courtesy of Lucas Boyd, Department of Planning and Environment. Murramarang Aboriginal Area walking track.



Challenge: Water security for South Coast towns and industries

The viability and growth of regional industries is constrained by the uncertainty of future access to water supplies. Town water supplies are generally secure, but could become less reliable under climate change scenarios.

Water-dependent industries such as agriculture, aquaculture, forestry and food product manufacturing 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 we originally thought, and may reduce in the future. Saltwater intrusion also threatens existing supplies of high-quality surface water in low-lying areas close to the coast and coastal groundwater systems.

The *South East and Tablelands Regional Plan 2041*⁴⁰ identifies Bega as a strategic centre acknowledging its contribution to the broader region's agricultural and aquaculture industries, and tourism industry. Bega will continue to grow and attract new residents and tourists. Batemans Bay and Moruya form a 25 km corridor as a strategic cluster, incorporating the tourist destination of Mogo and the North Moruya Industrial Area, recognising the important role Moruya will play in supporting growth in the area. The *Illawarra Shoalhaven Regional Plan 2041*⁴¹ also identifies Milton-Ulladulla as a strategic centre that is becoming more important as tourism in the region increases and the population grows.

We have also heard that gaining access to additional water to mitigate these risks or support new or expanding industries is a challenge for existing and prospective South Coast region businesses.

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

Historically, the need to store large volumes of water for irrigation across the South Coast region has been largely unnecessary. 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 2018–2020 drought highlighted a need to shift from a reactive to a proactive management approach to weather extremes. The 2020 bushfires in the South Coast region impacted farm infrastructure such as tanks, pumps and troughs, further reducing local water supplies. Water quality, as discussed in the *Declining catchment and river health* challenge, was also severely impacted, especially after rain.

Our modelling shows that dry periods are likely to increase in frequency and intensity and therefore, traditional surface water sources may be less reliable than we 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.

Brogo Dam and Cochrane Dam provide central storage for water users with access to the main stems of the Brogo, Bemboka and Bega rivers. However, outside these corridors there is limited stored water available.

40. NSW Department of Planning, Industry and Environment, *South East and Tablelands Regional Plan 2041*, planning.nsw.gov.au/Plans-for-your-area/Regional-Plans/South-East-and-Tablelands

41. NSW Department of Planning, Industry and Environment, *Illawarra-Shoalhaven Regional Plan 2041*, planning.nsw.gov.au/Plans-for-your-area/Regional-Plans/Illawarra-Shoalhaven/Illawarra-Shoalhaven-Regional-Plan-2041

The resource potential of the region's hard rock aquifers is not well known. Further, the location of the region's sewage treatment plants generally do not lend themselves to developing large-scale recycled water schemes for irrigation. While Eurobodalla Shire Council and Bega Valley Shire Council both own and operate several small non-potable recycled water systems, the only major scheme in the region is the reclaimed water management scheme operated by Shoalhaven Water around Nowra and Bomaderry.

Water extraction limits are restricting development opportunities in some 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 South 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 these 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 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*.⁴²

Plantation forestry covers an estimated 22% of the South Coast region and up to 50% the Clyde, Tuross and Towamba river catchments. Plantation forestry can intercept surface runoff and throughflow. Water planners have been considering how such interception should be included in catchment hydrology calculations and incorporated into catchment extraction limits. Water sharing plans across NSW historically do not require plantation managers to hold water access licences. An amendment clause will be included in all future water sharing plans, including the draft Water Sharing Plan for the Bega River Area Regulated, Unregulated and Alluvial Water Sources 2023,⁴³ which will include provisions for any significant expansion of plantation forestry to be licensed.

We have also heard that agricultural production in the South Coast region is constrained by existing harvestable rights limits. Harvestable rights allow landholders to collect a proportion of the average regional rainfall run-off 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 recently announced increase in the harvestable rights limit in coastal draining catchments recognises the strong interest received from 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. It excludes the use of this water for intensive agricultural uses such as horticulture and aquaculture.



Image courtesy of Department of Planning and Environment. Dairy cattle in pasture, Bega Valley.

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

43. NSW Government 2022, *Draft Water Sharing Plan for the Bega River Area Regulated, Unregulated and Alluvial Water Sources 2023*, industry.nsw.gov.au/water/plans-programs/water-sharing-plans/recently-on-public-exhibition/bega-river

Water users are not taking up opportunities 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 trade of water access licences or temporary trade of water allocations in line with water sharing rules. The rules aim to maximise flexibility for water users without adversely impacting the environment or the reliability of other water access licences.

Very little trade has occurred in the region's catchments, despite trade being allowed and annual water usage in most areas generally being well below long-term average annual extraction limits. There are no examples of temporary trades in the South Coast region's unregulated rivers and only 5 water access licences, totalling about 300 ML, have been traded permanently in the South Coast region since 2011. Only 6 temporary trades, totalling 290 ML, occurred in the Bega–Brogo regulated river system in 2018–2019.

Water users have noted many barriers to trade, including limited water market information, restrictive trade rules, long processing times and lack of meters, which are required to trade water allocations. Water sharing plan rules allow for low-flow to high-flow conversions in many South Coast region water sources. Although the main intent of this rule 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, no licence holders in the region have taken up this opportunity.

Water entitlements in the Bega–Brogo regulated river system are underutilised

Brogo Dam is small and has historically filled and spilled regularly due to reliable rainfall. However, the Bega–Brogo regulated river system faces several challenges, including:

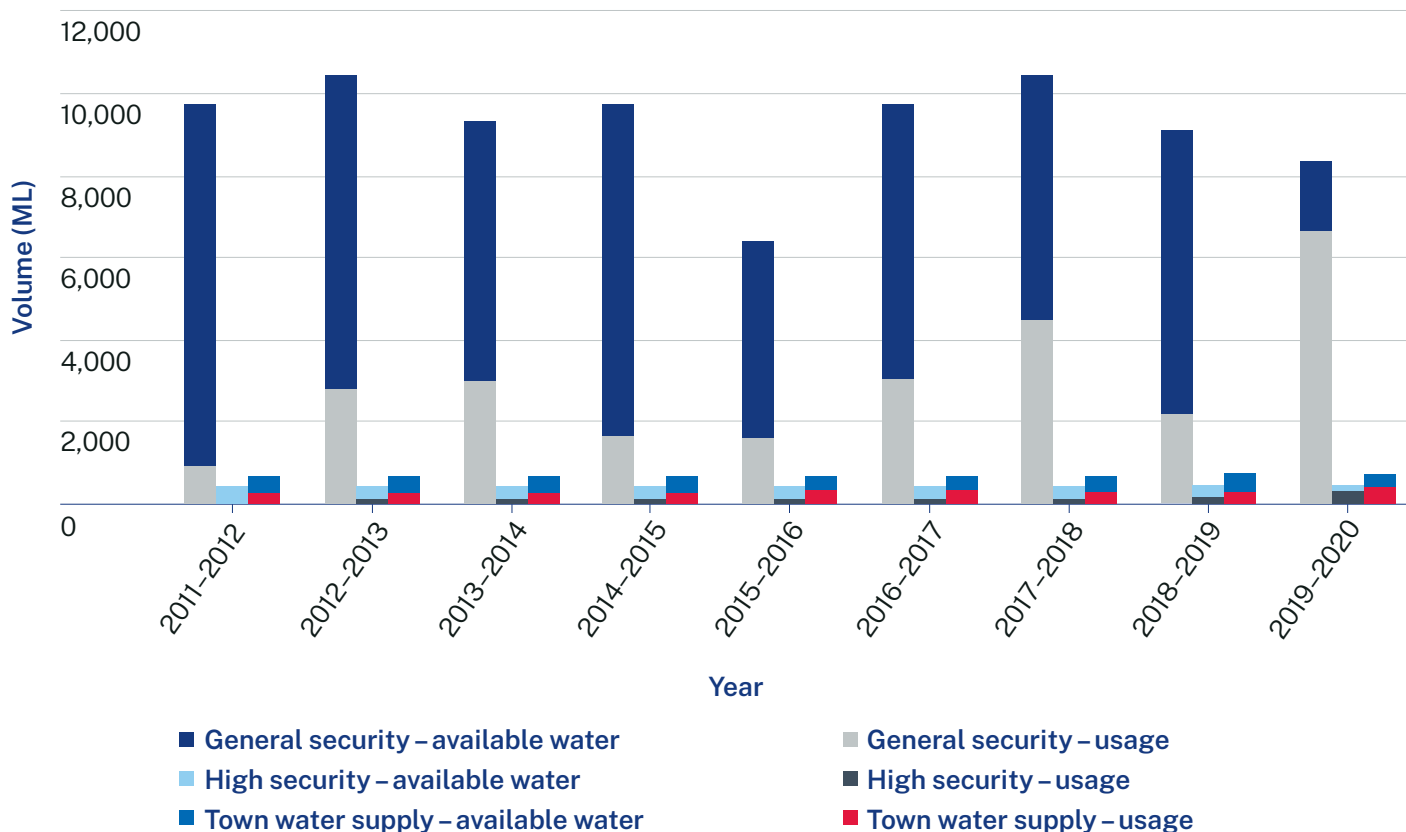
- Brogo Dam's capacity is far less than the volume of water entitlements
- irrigation demands occur when inflows to the dam are low
- a large proportion of irrigators are located at the end of the system, which is increasingly being impacted by saltwater intrusion
- there is a relatively large proportion of inactive water entitlement.

The combined impact of these challenges is that the Bega–Brogo regulated river system is underused during most years; rarely provides full allocations to general water security licences (Figure 16); and only provides short-term water security for water users during droughts. This is constraining economic growth and increasing the vulnerability of water users to increased climate variability.



Image courtesy of WaterNSW. Brogo Dam, NSW.

Figure 16. Available water determinations compared with water usage in the Bega–Brogo regulated river system



Town water supplies are generally secure but could become less reliable under climate change

Residents of towns and villages in the South Coast region expect safe and reliable water services to their homes and businesses. Providing sufficient water for domestic needs and essential services is the NSW Government's highest priority during drought. Communities also value water for recreation and amenity. Extended future droughts, sea level rise and poor water quality could place greater stress on town water supplies.

Most towns in the South Coast region, with the exception of Bermagui, have a relatively secure water supply because of the reliable catchments from which they source water. When complete, the Southern Water Storage project will address the existing water security risk for towns in Eurobodalla.⁴⁴

Extended future droughts could place Bermagui's water supply at risk

The water security risks for Bermagui were highlighted during the last drought. Brogo Dam fell to historic low levels in January 2020 and dam releases were curtailed to other water users to secure the town water supply and prevent Bermagui running out of water. These very low river levels resulted in a water pool of insufficient depth for the pumps that supply Bermagui to operate properly, requiring WaterNSW to make operational adjustments to raise the height of the river to enable town water extraction. While Brogo Dam is expected to be full or spilling for most of the time in the future, a severe climate change scenario could result in droughts longer than what we have experienced in our historical record. If nothing changes, these risks to Bermagui's town water supply increase.

44. More information is available at: esc.nsw.gov.au/council/major-projects/current-projects/roads-bridges-water/southern-water-supply-storage

Poor quality water can impact water supply for some towns

Heavy rainfall following extended dry periods or bushfires can result in poor quality water, which constrains the ability of town water treatment facilities to effectively treat and maintain adequate supply to towns and communities in the region. For example, Bega Valley Shire Council has been impacted by poor raw water quality in recent years with 'boil water' notices being issued. For Bermagui, heavy rainfall in February 2020 following an extended drought and severe bushfires resulted in a significant deterioration in water quality and prevented potable water supply to Bermagui.

More intense storms as a result of climate change and increased likelihood of bushfires will increase town water quality risks in the future. Councils are preparing for the possibility of poorer water quality by investing in upgrades to water treatment facilities. The regional water strategy will investigate what can be done to improve water quality in the region.

Sea level rise could impact town alluvial groundwater sources and water supply infrastructure

Alluvial groundwater sources are highly connected to river flows. Decreased river flows from a drier climate and sea level rise could result in saltwater ingress into alluvial sands groundwater sources. This risk is amplified for the Bega Valley Shire Council town water supply network, which relies on the Bega River and Towamba River alluvial sands groundwater sources for supplying town needs for Bega-Tathra, and Boydtown-Eden-South Pambula respectively. Sea level rise could significantly impact the availability of good quality groundwater for Bega Valley Shire Council. Further analysis is required to better understand this risk.

Councils in the region are planning for the vulnerabilities facing their water and wastewater treatment plants and infrastructure because of projected sea level rise. Potential increased corrosion and inundation of these assets could significantly impact delivery of water and wastewater services for their populations.



Image courtesy of Jaime Plaza Van Roon, Department of Planning and Environment. Road through Edén looking into Nullica Bay. Edén, NSW.

Responding to the challenges

5

Image courtesy of Lachlan Edwards, Department of Planning and Environment.
Rehabilitated stretch of Tantawangalo Creek, Candelo.

The vision for the South Coast 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.

There is no single solution that can address the challenges ahead, and it is important that this strategy does not preference one interest group over another. Although sometimes interests compete, harnessing the synergies of various objectives will deliver maximum possible benefit for the whole region.

To help us achieve this vision and address the challenges in the South Coast region, we have set 3 priorities and identified actions under each (Figure 17 and Figure 18).

The regional priorities are:

- Take a holistic approach to land and water management
- Ensure water resource development and use is sustainable and equitable
- Prepare for future climatic extremes.

Together these actions can improve the South Coast region's readiness to adapt to a more variable climate and support the difficult decisions we need to make to deliver healthy, reliable and resilient water resources for the region's future.

The regional priorities do not override the priorities around water sharing set out in the *Water Management Act 2000*. The priorities help identify the range of actions that need to be progressed in the region over the coming decades. Each priority contributes to all of the objectives of the regional water strategies. The actions are not listed in any priority order.



Image courtesy of Department of Planning and Environment. Biamanga National Park, NSW.

Figure 17. South Coast Regional Water Strategy: overview of strategy vision, objectives, water security challenges and priorities

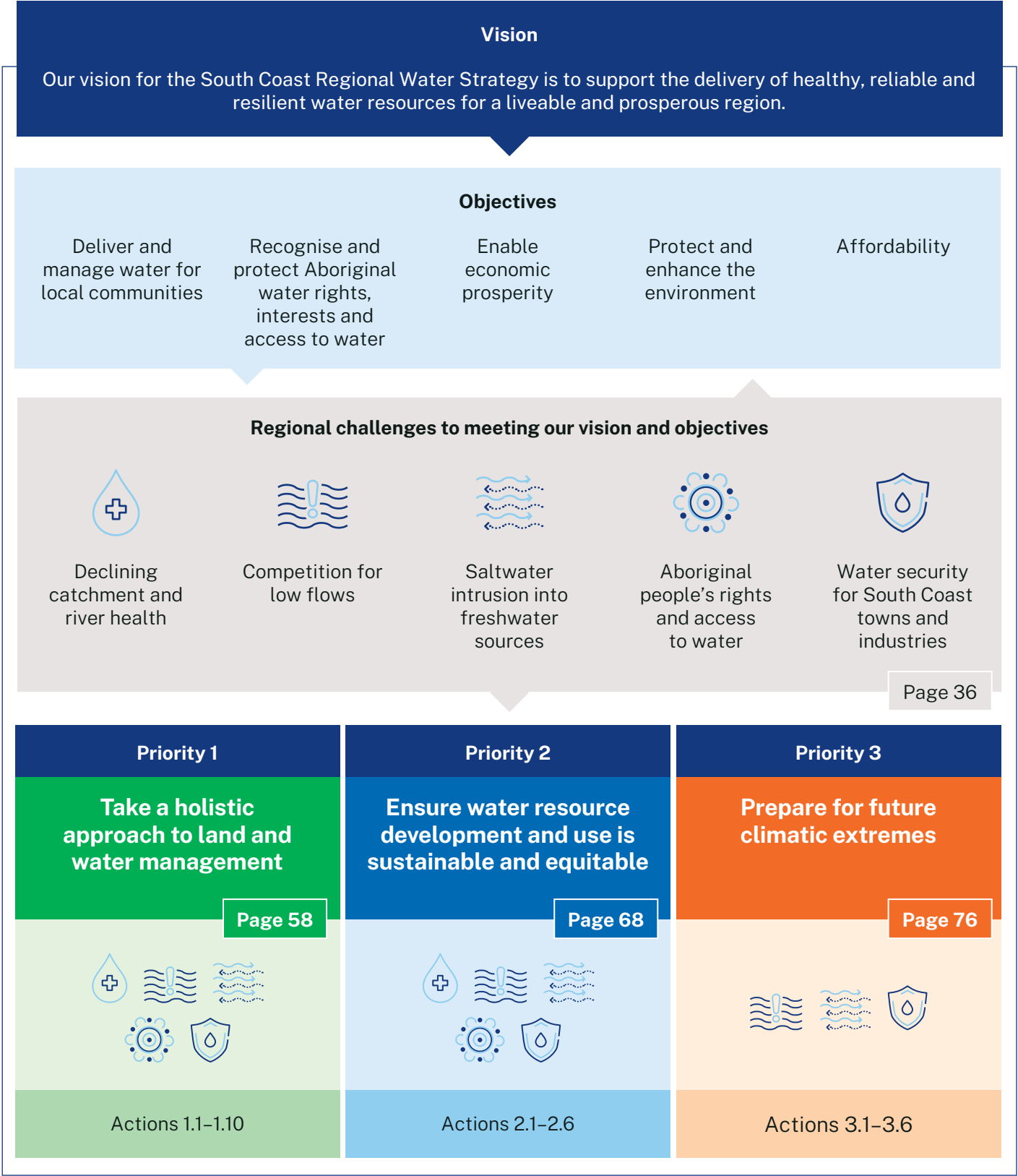
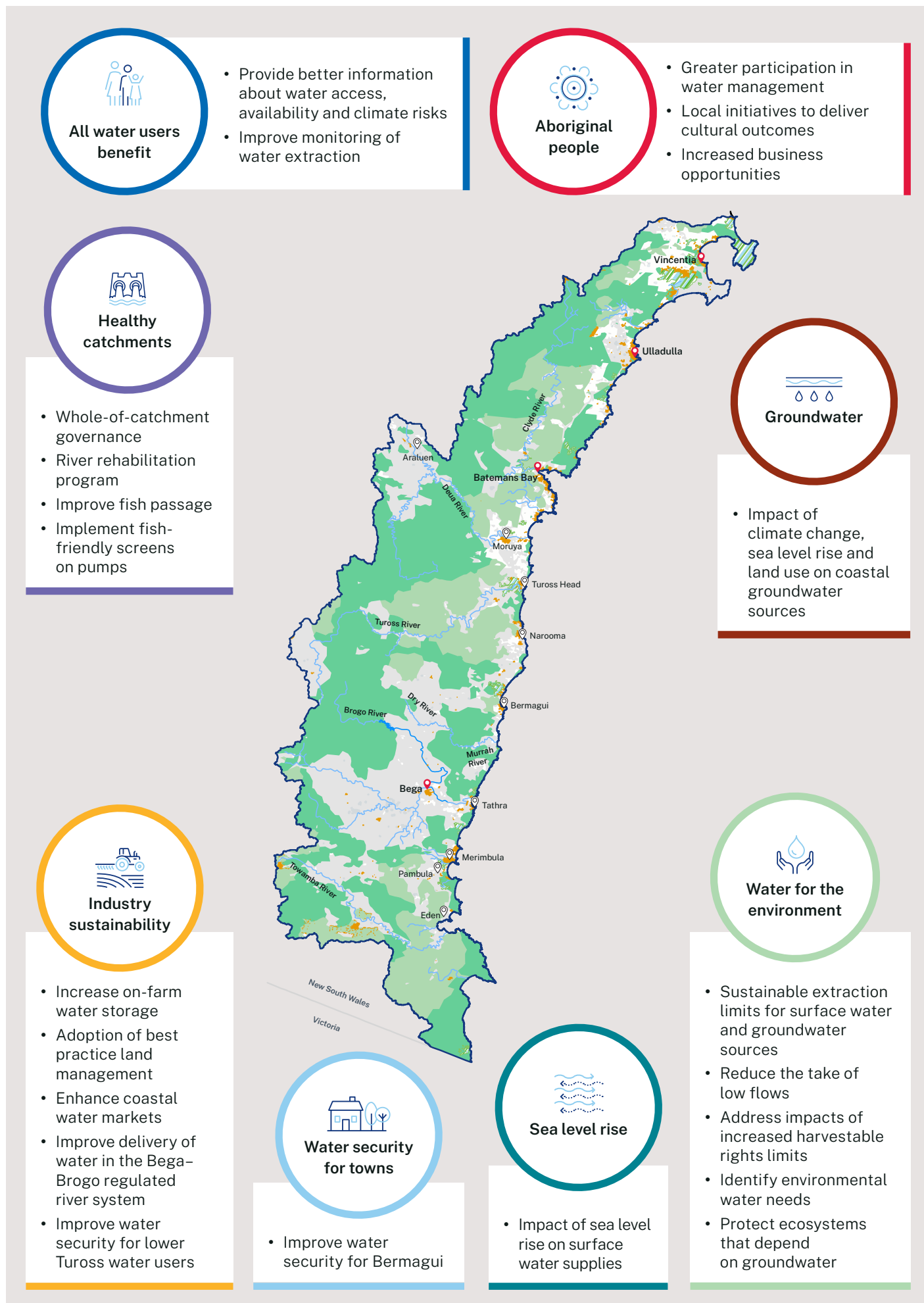


Figure 18. Summary of South Coast Regional Water Strategy actions



Priority 1

Take a holistic approach to land and water management

Water resources in the South Coast are recognised as part of an interconnected ecosystem, and our planning, decision-making and on-ground efforts reflect this.

Land and water management actions are integrated and informed by Aboriginal knowledge and culture, and western science.

Our starting point

The **NSW Water Strategy**⁴⁵ commits to actions to improve river, floodplain and aquifer ecosystem health and system connectivity (Priority 3 of the *NSW Water Strategy*), for example 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/Aboriginal people's water rights and interests in water management and help address the statewide systemic issues to better enable the exercise of First Nations/Aboriginal people's rights and access to water.

The **Marine Estate Management Strategy**⁴⁶ 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 of the *Marine Estate Management Strategy*). Actions such as on-ground activities to 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.

Coastal management programs,⁴⁷ 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, including impacts that originate from higher up in the catchment.

The NSW Government is developing the **NSW Groundwater Strategy**⁴⁸ that identifies the key risks to our groundwater resources and the associated management challenges for NSW. The strategy sets out the actions required to respond to these challenges and provide a logical framework for funding of groundwater management reform work over the next 20 years.

The NSW Government is implementing the new **non-urban metering framework**⁴⁹ through the *NSW Government water reform action plan*. Under the framework, all surface water and groundwater works covered by the rules in the South Coast region will need to be fitted with compliant metering equipment by 1 December 2024.

The **Protecting Our Places Grants Program**⁵⁰ is a contestable grants program for Aboriginal community organisations and groups, seeking to achieve long-term beneficial outcomes for the environment.

The NSW Government is running a suite of **natural capital programs** that can benefit farmers who voluntarily want to manage biodiversity and carbon while enhancing their land for productive use.⁵¹

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

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

47. More information is available at: environment.nsw.gov.au/topics/water/coasts/coastal-management/programs

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

49. More information is available at: dpie.nsw.gov.au/water/nsw-non-urban-water-metering

50. More information is available at: environment.nsw.gov.au/funding-and-support/nsw-environmental-trust/grants-available/protecting-our-places

51. More information is available at: environment.nsw.gov.au/research-and-publications/our-science-and-research/our-research/social-and-economic/natural-capital

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 South Coast towns and industries

Figure 19. Actions to address Priority 1: Take a holistic approach to land and water management

Action number	Action name	Challenges addressed
Incorporate Aboriginal knowledge and culture into land and water management		
Action 1.1	Foster ongoing arrangements for participation of 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	 
Improve our understanding and management of the region's water resources		
Action 1.6	Assess the vulnerability of surface water supplies to sea level rise and saltwater intrusion	 
Action 1.7	Identify environmental water needs to support healthy coastal waterways	 
Action 1.8	Characterise and plan for climate change and land use impacts on coastal groundwater sources	 
Action 1.9	Protect ecosystems that depend on coastal groundwater	 
Action 1.10	Improve monitoring of water extraction	 

Incorporate Aboriginal knowledge and culture into land and water management

As custodians of Australia's land and water for 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 their 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-catchment governance structures that are supported and understood by Aboriginal people and give Aboriginal people direct input to water management decision making. We will also provide Aboriginal people with opportunities to manage water using their culture and knowledge and to create improved economic opportunities and environmental outcomes. Restoring degraded spiritual and cultural sites are important acts of reconciliation.

Action 1.1: Foster ongoing arrangements for participation of local Aboriginal people in water management

An effective governance, engagement and knowledge sharing process is the first step in fundamentally improving Aboriginal people's involvement in water management and supporting cultural, environmental, social and economic outcomes. For it to be successful, the makeup and function of groups need to be led by local communities. Experience has shown that government-dictated governance models for Aboriginal communities do not work.

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*⁵² to enter formal partnerships and decision-making arrangements and develop place-based partnerships to respond to local priorities.

Local Aboriginal groups in the South 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.

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

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

In the South Coast region, this could include building 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
- improving access to Country, including locations of significance, by opening up local parcels of land that have access to waterways but are otherwise gated or locked
- a restoration reach, which would use cultural knowledge and science to rehabilitate riparian land, planting native species and caring for Country
- supporting other local Aboriginal communities develop 'Caring for Country' programs that engage young Aboriginal People in water and landscape management, with the objectives of building cultural awareness and giving a sense of ownership and cultural connectivity.

52. Various parties 2019, *National Agreement on Closing the Gap*, closingthegap.gov.au/national-agreement

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

Many strategies, programs and on-ground projects have tried to improve the health of the region's aquatic environment. These have mainly focused 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 Strategy*,⁵³ the *NSW Coastal Management Framework*⁵⁴ and supporting coastal management programs, and 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 aim to apply a whole-of-catchment approach to planning, decision making and project delivery. They would build on existing programs that focus on managing the impact of diffuse pollutants from urban and rural land on the coastal, estuarine and marine environments. Catchment planning will help target and coordinate these programs under one framework. Catchment planning 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 governance arrangements have been criticised as being fragmented, which 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 has proposed a new governance framework, starting with a pilot program for the Richmond River catchment in the Far North Coast region.

These issues are not unique to the Far North Coast region or the coastal environment; they impact the delivery of good environmental management outcomes across all coastal and riverine environments.

The NSW Government will review learnings from the Richmond River pilot program to support whole-of-catchment planning, coordination, decision making and project delivery for South Coast region river catchments (see Action 1.4 and Action 1.5).

Action 1.4: Deliver a river rehabilitation program

The health and resilience of rivers and the ecosystems they support is directly linked to their geomorphic condition and that of the surrounding floodplain.

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 success. The framework will support evidence-based prioritisation by using important river health metrics such as:

- the River Styles classification system,⁵⁵ 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 ecosystem
- local Aboriginal knowledge and cultural water needs.

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

54. NSW Government 2018, environment.nsw.gov.au/topics/water/coasts/coastal-management/framework

55. More information is available at: riverstyles.com/river-styles-framework/

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

The Department of Planning and Environment, Local Land Services, and 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, we have heard that some landholders need support to recognise potential improvements to their land and water management. Feedback we 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 and quality of water. This action will build on existing programs to support private landholders to adopt best practice land management to improve water quality of priority waterways across the region.

Support will largely be provided through natural resource management and sustainable agriculture advisory services and on-ground projects, with a focus on:

- stock grazing management
- soil disturbance and erosion management
- native vegetation and biodiversity management
- streambank and riparian vegetation protection and restoration
- drainage and fertiliser use management.

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

The delivery of this program will align with the framework developed in Action 1.4 and the environmental water requirements established under Action 1.7. This approach will ensure that improvements in private landholder land and water management practice are directed to catchments where either river reaches have a high recovery potential or improvements are critical to achieving key environmental objectives.

Landholders – as stewards of the land – are engaged in natural resource management and play a key role in generating natural capital value and improving ecosystems and habitats through best practice land management. Natural capital refers to the world's stocks of natural assets, and the services that flow from them, which include geology, soil, air, water, and all living things.

Natural capital investment, by both government and the private sector, can support active land stewardship among and alongside productive land activities.

The NSW Government is running a suite of natural capital programs⁵⁶ which focus on farmers who voluntarily want to manage biodiversity and carbon while enhancing their land for productive use. Farmers can achieve accreditation through agreed sustainability actions including using best practice approaches to fertiliser use.

Implementation of this action will be delivered collaboratively with other government agencies, local councils, established research groups, local Aboriginal and community groups, and universities.

56. More information is available at: environment.nsw.gov.au/research-and-publications/our-science-and-research/our-research/social-and-economic/natural-capital

Improve our understanding and management 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 key to us fulfilling this role. Targeted investigations are required to properly understand the cumulative impacts of climate change, water extraction, and sea level rise on the South Coast region's water resources. This understanding will allow us more flexibility in sharing and managing these resources.

The following actions are important steps to improving our understanding and future management of the region's water resources. They will build on the initiatives of other strategies, particularly the *NSW Water Strategy*,⁵⁷ the *Marine Estate Management Strategy*⁵⁸ and the *Draft NSW Groundwater Strategy*.⁵⁹

Action 1.6: 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 South 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 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 these existing studies. We will:

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

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

This action provides 3 key benefits:

- *Reduces cost to government and water users in the long-term:* Formulating policy for sea level rise challenges 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, little has been 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 impacted 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 1.8 of this strategy. The outputs from Action 1.6 will be important inputs to the groundwater models developed for Action 1.8.

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

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

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

Action 1.7: Identify environmental water needs to support healthy coastal waterways

This action will establish the objectives and water requirements to protect important species, ecological communities, and aquatic ecosystems in the region.

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. However, many species and aquatic ecosystems in the South Coast region have not been studied enough to describe these requirements and target them through management actions.

Environmental water requirements often include information about the volume, frequency, timing, and duration of flows, and water quality. They may also define the ecological risks and constraints and complementary non-water measures.

Coastal water sharing plans currently define ecological objectives. However, they are difficult to evaluate for 2 reasons:

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

To address these difficulties, this action will provide a framework to identify and prioritise data and monitoring gaps. It will also develop methods to address these gaps. These methods 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 network may support this framework. Alternative management approaches that can protect important flows without relying on flow gauges will also be considered. The recently announced increase to the harvestable rights limits in coastal-draining catchments will also help inform this consideration.



Image courtesy of Jaime Plaza Van Roon, Department of Planning and Environment. Coast of Tathra, NSW.

Action 1.8: Characterise and plan for climate change and land use impacts on coastal groundwater sources

There is currently a lack of data and information about groundwater sources across the coast, including the South Coast region. Data is essential to ensure future management decisions effectively mitigate the potential impacts of climate change, particularly saltwater intrusion, and associated changes to catchment hydrology, sea level rise, and over-extraction.

This action will develop a climate change risk profile for key groundwater resources across the region, focusing on the Bega Sands and Towamba River alluvial aquifers and the South East Coastal Sands. These groundwater resources have been prioritised because they are the main water sources for Bega, Tathra, Eden and South Pambula, and are also used by industry and rural landholders.

Data sources for this action will include initial satellite imagery and field investigations⁶⁰ 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 would be supported by a review and potential expansion of the bore monitoring and metering network. The major output of this work will be a conceptual model of key groundwater resources across the South Coast region. This model will provide decision makers with a better idea of how much groundwater is available, how it recharges, where it discharges, and how extraction impacts on the resource. We may need to conduct more detailed modelling depending on what we learn from the conceptual model.

This action will also consider how this information is made available to water users to inform individual decision-making and co-design potential projects with local stakeholders and universities to mitigate the identified key impacts of climate change and land use.

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

Action 1.9: Protect ecosystems that depend on coastal groundwater

Groundwater dependent ecosystems are classified broadly as terrestrial (vegetation communities), aquatic (wetlands and springs), or subterranean (aquifers).

Our knowledge of these communities is still developing. Through the NSW Groundwater Strategy,⁶¹ this action will develop a method for identifying groundwater dependent ecosystems across the South Coast region that are reliant on surface water flows (i.e. baseflows). We will also develop a method for monitoring the condition and extent of the associated vegetation community.

The ability to implement this action will rely on the adequacy of the monitoring bore network and metering coverage across the South Coast, both of which are being considered as part of other actions (see Action 1.10 and Action 2.3).

Outputs from this action will be critical to informing environmental water requirements for the region's catchments (see Action 1.7). They will also be critical for reviewing the effectiveness of associated water sharing plan rules in protecting groundwater dependent communities.



Image courtesy of Destination NSW. Ben Boyd National Park, Green Cape.

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

Action 1.10: 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 key to understanding these effects. Current monitoring and data collection in the South Coast region's water sources is not sufficient to provide these insights.

This action aims to improve the way we monitor water extraction in the South 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.

Non-urban metering framework

The non-urban metering framework will ensure around 22% of surface water supply works and around 27% of groundwater supply works will be metered in the South Coast region by 2024. This metering will provide a good starting point to better understand the impact of water extraction in the region. However, metering in coastal catchments is challenging because:

- the flashy nature of coastal floods – that is, they peak dramatically within hours of heavy rain and usually return to medium flows within a few days – can damage or wash meters downstream
- the metering reforms target large water users, but the combined impacts of smaller water users in smaller waterways can be large.

This action will build on the NSW Government's non-urban metering reforms by investigating other opportunities for improving water extraction monitoring across the region, including improving awareness of current exemptions that apply, financial support, and the availability of compliant metering solutions such as specifications for metering moveable pumps.

Coastal harvestable rights

The recently announced increase to the harvestable rights limits in coastal-draining catchments may increase unmetered water take across the South Coast region.

As part of the changes to harvestable rights limits, there are 2 important initiatives that can support and inform this action:

- 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 Natural Resources Access Regulator (NRAR) of these changes.

Other initiatives

A number of other initiatives will inform and support implementation of this action. These initiatives include work funded through the Australian Government's Hydrometric Networks and Remote Sensing Funding Program.

This action will complement and link to the Draft NSW Groundwater Strategy⁶² Action 3.1 (Develop a groundwater knowledge plan to improve how we use groundwater information to make decisions).

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



Image courtesy of Destination NSW. Deua National Park, Deua.

Priority 2

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 South Coast region will require improved management of water use between various users, as well as reducing the impact of infrastructure on waterway health.

Our starting point

The **NSW Water Strategy**⁶³ 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 the development of the NSW Groundwater Strategy.

The Department of Planning and Environment is applying a **new risk-based assessment process** to help understand the relative impact of various water sharing plan rules on key environmental functions, for example, impacts on low flows, freshes and water quality due to reduced inflows. 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 main-stem rivers and key off-channel habitats across NSW. Under the **Marine Estate Management Strategy**⁶⁴, 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 (Department of Primary Industries Fisheries), and provide a framework for prioritising restoration work across the state and South Coast region.

The NSW Government is currently updating the **Illawarra Shoalhaven**⁶⁵ and **South East and Tablelands**⁶⁶ **regional plans**. The regional plans set a 20-year framework, vision and direction for strategic planning and land use to ensure regions have the housing, jobs, infrastructure, a healthy environment, access to green spaces and connected communities to continue to be vibrant places for people to live, work and visit. The objectives of these plans recognise the need to think holistically about water management and to encourage innovation in water efficiency and whole-of-water-cycle management.

The NSW Government has assisted local council to develop **Regional Economic Development Strategies** based on the concept of a Functional Economic Region. The regional economic developments strategies provide a clear economic development strategy for the region and are currently under review.⁶⁷

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

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

65. Department of Planning, Industry and Environment, *Illawarra–Shoalhaven Regional Plan 2041*, planning.nsw.gov.au/Plans-for-your-area/Regional-Plans/Illawarra-Shoalhaven/Illawarra-Shoalhaven-Regional-Plan-2041

66. Department of Planning, Industry and Environment, *South East and Tablelands Regional Plan 2041*, planning.nsw.gov.au/Plans-for-your-area/Regional-Plans/South-East-and-Tablelands

67. More information is available at: nsw.gov.au/regional-nsw/regional-economic-development-strategies

Review of Harvestable Rights

From May 2022, landholders in the South Coast region are able to capture a maximum of 30% of the average regional rainfall runoff from their property in harvestable right dams that are built on non-permanent flowing minor streams, hillsides and gullies. The remaining runoff will continue to flow down-catchment into licensed dams and the local river systems, where it is shared among the environment and other downstream 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.⁶⁸ It provides landholders in these regions with better access to water storage for domestic and stock and extensive agriculture, such as stock grazing and pasture irrigation. It excludes 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:

- further 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 Resource Access Regulator (NRAR), on monitoring and enforcement issues
- replacing the Harvestable Rights Order applying to the Central and Eastern Division with 2 separate new Orders.

The South Coast Regional Water Strategy will provide a path for supporting the implementation of these changes while effectively managing future impacts from an increased uptake in the higher limit on downstream water needs, including those of the environment. Commencing in 2022, the Department of Planning and Environment Water will assess whether the increase to a 30% harvestable rights limit is appropriate at the water source scale, noting the limitations and mitigation measures announced as part of the 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.

Through this type of action, the South Coast Regional Water Strategy can help ensure these changes not only improve water security for rural landholders but also consider the impacts on the downstream environment and licensed users.



Image courtesy of Jeremy Kinley, Department of Planning and Environment. On-farm dams in the Bega Valley.

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

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 South Coast towns and industries

Figure 20. Actions to address Priority 2: Ensure water resource development and use is sustainable and equitable

Action number	Action name	Challenges addressed
Reduce the impact of water infrastructure on native fish populations		
Action 2.1	Improve fish passage	 
Action 2.2	Implement fish-friendly water extraction	 
Better manage competing demands for water		
Action 2.3	Establish sustainable extraction limits for surface water and groundwater sources	    
Action 2.4	Reduce the take of low flows	    
Action 2.5	Address catchment-based impacts of increased harvestable rights limits	  
Action 2.6	Support Aboriginal business opportunities	 

Reduce the impact of water infrastructure on native fish populations

Many native fish species in the South 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 2.1: Improve fish passage

Physical barriers to fish passage can limit fish movement, leading to a decline in the health and viability of native fish populations. Removing barriers to fish movement and allowing fish to move to breed, find food and ideal habitat is critical to supporting native fish populations in the South Coast region.

The NSW Fish Passage Strategy and the action Reconnecting fish habitat from the *Marine Estate Management Strategy*⁶⁹ aims to address high priority fish barriers remaining in NSW. There are 6 high-priority barriers identified in the South Coast region: Buckenbowra Dam, Currowan Creek–Western Distributor pipe culvert, Shallow Crossing causeway, Clyde Ridge Road crossing, Burra Creek Weir and Wadbilliga Road causeway.

Action 2.2: 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 of water pumps and channels, at any size. 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 represents an opportunity to reduce fish losses at water diversions, improve recovery of threatened species, and reduce energy costs and downtime for water users. Screening infrastructure also improves pump operation, water delivery and extraction efficiency for asset owners through fewer blockages caused by debris.

This action includes building awareness among water users of the benefits of modern screening technology. The implementation of the NSW Government's non-urban metering framework⁷⁰ by December 2024, in addition to improving monitoring of water extraction (Action 1.10), will collect valuable information on locations and sizes of pumps in the region. This action will analyse this information to help prioritise locations for installation of screens.



Image courtesy of Scott Nichols, Department of Primary Industries Fisheries. Buckenbowra River.

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

70. More information is available at: dpie.nsw.gov.au/water/nsw-non-urban-water-metering

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 water extraction is regulated across the region to ensure that we appropriately 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 Yuin people to gain access to water.

The following actions will help 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 2.3: Establish sustainable extraction limits for surface water and groundwater sources

Extraction limits

The *Water Management Act 2000* (Water Management Act) 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 Water Management 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 Water Management Act.

Water sharing plans can define different types of extraction limits. These include 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 South Coast region do currently 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.

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

What establishing sustainable extraction limits will do

This action would 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. It will then 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 by:

- understanding different methods for setting extraction limits
- testing one or more methods on a pilot water source
- establishing the appropriate extraction limits for water sources across the region
- investigating the feasibility of implementing and setting daily extraction limits.

Benefits of sustainable long-term average annual extraction limits

Defining sustainable LTAAELs in water sharing plans across the region would provide a number of benefits. It would:

- 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.

Benefits of daily extraction limits

Daily extraction limits restrict the rapid removal of water during peak irrigation periods (Figure 21). They are included in water sharing plans to protect low and medium flows, which reduces 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, 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 21. Daily extraction limit concept

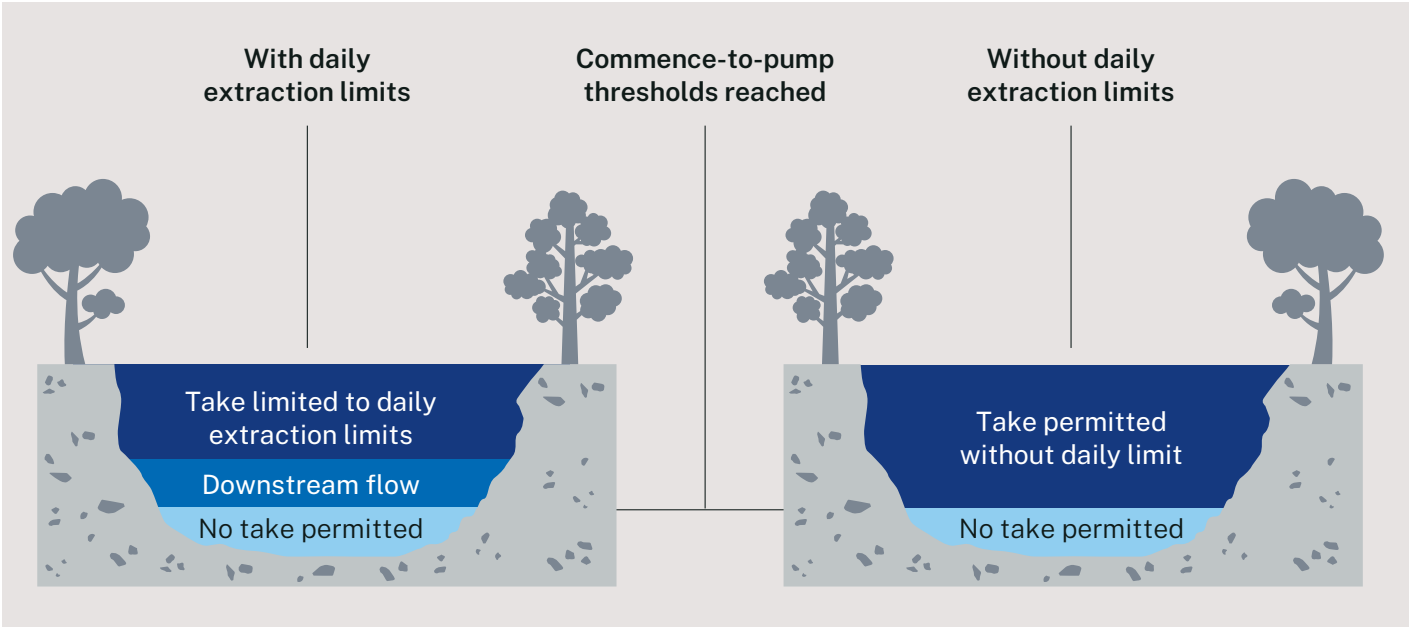


Image courtesy of Department of Planning and Environment. Biamanga National Park, NSW.

Action 2.4: Reduce the take of low flows

This action will investigate and assess options for reducing water extraction during low flows. The assessments will focus on:

- the effectiveness of high-flow conversions
- adopting low-flow bypasses across catchments
- options for landholders to store water extracted from the region's streams under basic landholder rights.

Reducing the take of low flows will improve river connectivity and natural flow variability in the region's rivers and complement other actions in the South Coast Regional Water Strategy aimed at improving river health.

High-flow conversions

For some water sources in the South Coast region, water users can apply to have their existing water access licence converted to allow the extraction of a greater volume of water under high-flow conditions. The high-flow conversion rule applies in catchments that are gauged and experiencing hydrologic stress in low flows, but not in high flows.

To date, no licence holders in the South Coast region have taken up the opportunity to convert their entitlement, mainly because the proposed conversion rates do not provide enough water security benefits to offset the additional costs of irrigating from on-farm storages. Widespread adoption of high-flow licence conversion 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. Any modification to the current conversion rate would also need to consider the impact on all parts of the flow regime, particularly high flows, and subsequent changes to river health, the reliability of downstream licences, and social or cultural values.

Overcoming constraints in constructing and operating on-farm storages (Action 3.3), and an improved understanding of climate risks to surface water availability in the region, may make high-flow licence conversions more viable in the future.

Low-flow bypasses

Farm dams offer increased water security for landholders but reduce the volume of runoff that makes its way into downstream waterways. The impacts of reduced downstream runoff are greater during extended dry periods, when the volumes of water stored in farm dams is typically low, and the dams are configured in a way that prevents runoff from passing downstream. Farm dams fitted with devices that allow some runoff to bypass or flow through dams reduce their impact on low flows, while still offering water security benefits for landholders.

The department 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 their design efficacy 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.

Low-flow bypasses may also be necessary to mitigate the environmental impacts of infrastructure options being proposed through the South Coast Regional Water Strategy, such as investigating increased on-farm water storage (Action 3.3).

Storage of water extracted under basic landholder rights

Landholders with river frontage are allowed to extract water under very low-flow conditions under their basic landholder rights, regardless of 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 dams⁷¹ can reduce the volume of water extracted from stressed rivers and delay the need to cart water from town water supply networks.

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

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

Action 2.5: Address catchment-based impacts of increased harvestable rights limits

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 where necessary, in future water sharing plan arrangements.

The NSW Government's decision in October 2021 to increase the current harvestable rights limit from 10% to 30% in coastal-draining areas includes a range of mitigation measures to manage the impact of these changes on downstream users.⁷²

This action will implement these mitigation measures through the following initiatives:

- **Undertake further assessment to confirm the appropriateness of the 30% limit in each water-source scale, taking account of the specific characteristics of the water source.** This assessment may result in recommendations to adjust the limit over time. The assessments of water sources or groups of water sources across the South Coast region will be prioritised based on considerations such as the sensitivity of the downstream environment.
- **Introduce levers to manage future impacts from an increase in the uptake of harvestable rights on existing water sharing plan arrangements.** An amendment provision is progressively being included in coastal water sharing plans as they are being remade that requires a review of the uptake of harvestable rights by either year 3 or year 5 of the plan. The amendment will require a review of access, trade and water supply work approval rules if the harvestable rights uptake has increased above the previous 10% dam capacity limit.

- **Revised coastal water sharing plans will also include an estimate of annual extractions under the 10% of rainfall runoff harvestable rights limit to establish the long-term average annual extraction limits.** This estimate is important for ensuring harvestable rights take is included when establishing sustainable long-term average annual extraction limits in the future (see Action 2.3). If extraction (including harvestable rights take) increases above the long-term average annual extraction limit then a reduced available water determination may be announced to reduce extraction of licenced water take, in order to bring extractions back down to the extraction limit.

Action 2.6: Support Aboriginal business opportunities

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.

Department of Planning and Environment will lead Aboriginal business development opportunities in the South Coast region and will be supported by the Department of Regional NSW. Through the Aboriginal Partnership Program, a dedicated Aboriginal Partnership Manager will work with Aboriginal organisations, businesses and individuals to identify and develop new business opportunities or better manage existing ones, and 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.



Image courtesy of Department of Environment and Planning. Lilly pilly/riberry, Aboriginal bush tucker food.

⁷². More information is available at: dpie.nsw.gov.au/water/licensing-and-trade/basic-landholder-rights/harvestable-rights/coastal-draining-catchments

Priority 3

Prepare for future climatic extremes

Being prepared for future climate variability, particularly extended dry periods, will help build a stronger and more resilient 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.

Our starting point

The **NSW Water Strategy**⁷³ has committed 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 Program**⁷⁴ 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**⁷⁵ is currently underway. Its aim is to work with councils to develop a new framework to better support local councils manage safe, secure and sustainable water supply and sewerage services to regional communities across NSW.

The NSW Government will support water utilities to **diversify sources of water** including groundwater, stormwater harvesting and recycling. This support 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 Strategy**⁷⁶ 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 Strategy**⁷⁷ 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.

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

74. More information is available at: industry.nsw.gov.au/water/plans-programs/infrastructure-programs/safe-and-secure-water-program

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

76. More information is available at: nsw.gov.au/regional-nsw/future-ready-regions

77. More information is available at: dpi.nsw.gov.au/dpi/climate/about-dpi-climate/climate-change-research-strategy

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 South Coast towns and industries

Figure 22. Actions to address Priority 3: Prepare for future climatic extremes

Action number	Action name	Challenges addressed
Support water users to manage risks		
Action 3.1	Provide better information about water access, availability and climate risks	 
Optimise use of existing water supplies		
Action 3.2	Enhance coastal water markets	 
Action 3.3	Investigate increased on-farm water storage	 
Action 3.4	Investigate delivery efficiency improvements for the Bega–Brogo regulated river system	  
Action 3.5	Identify the best option to improve water security for the Bermagui town water supply system	 
Action 3.6	Improve water security for lower Tuross water users	  



Image courtesy of Lachlan Edwards, Department of Planning and Environment. On-farm water storage, Morans Crossing.

Support water users to manage risks

Action 3.1: Provide better information about water access, availability and climate risks

Reliable and timely information helps both the community and government make informed decisions. This is particularly true when preparing for droughts and floods. Unfortunately, this information can often be difficult to access or use.

The community also told us this during recent consultation on several NSW Government water initiatives. This affects landholders' abilities to make business decisions and for all residents' capacities to plan for natural disasters, including drought.

The NSW Government has improved how it provides climate and water availability information recently. However, we can improve how we provide information to ensure it meets the needs of South Coast communities and industries.

What this action will do

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

- WaterNSW's WaterInsights portal⁷⁸
- NSW Government's Water Usage Dashboard⁷⁹
- Bureau of Meteorology's Water Information Dashboard.⁸⁰

We will consult widely with stakeholders in the South Coast. This will ensure that we can provide the training and information products that the South Coast region needs.

As part of this action, we will also:

- develop a website that brings together information on coastal areas, estuaries and climate change and provides access to associated data and reports
- review the ways water information is made available so we can improve usability and accessibility
- educate industry and local government on water access options including about 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.

We 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.

Recent progress

The NSW Government has already started to make progress on this action by:

- Publishing 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 South Coast region and a number of other NSW regions are available on the Sharing and Enabling Environmental Data (SEED)⁸¹ portal.
- Developing an open data framework: The NSW Government is working towards a policy of more open and easily accessible data. The open data framework outlines how we will manage and drive open data to improve transparency and data sharing.⁸²

Benefits of improved data and forecasts

Improving forecasts and data about short-term and long-term water availability can offer several benefits:

- 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.

78. More information is available at: waternsw.com.au/waterinsights/water-insights

79. More information is available at: industry.nsw.gov.au/water/allocations-availability/water-accounting/usage-dashboard

80. More information is available at: bom.gov.au/water/dashboards/#/water-storages/summary/state

81. More information is available at: datasets.seed.nsw.gov.au/dataset/water-modelling-stochastic-climate-data

82. More information is available at: water.dpie.nsw.gov.au/science-data-and-modelling/data

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 regulation 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 3.2: Enhance coastal water markets

Our climate modelling shows the South 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 by enabling industries, especially those reliant on unregulated water, to prepare for drier conditions. Trade could also be used as 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.

Active and effective water markets could play an important role in increasing water usage and licence holder security in the Bega–Brogo regulated river system and improving the operations of Brogo Dam. Hydrologic and economic modelling carried out as part of the South Coast Regional Water Strategy explored the benefits of increasing usage of the Bega–Brogo regulated river system by activating sleeper entitlements, which are up

to 50% of entitlements in some reaches. This modelling showed that there could be an 8% increase in the median annual general security usage, based on an increase in the median area perennial pasture planted in the regulated river areas of 10%. Net economic benefits were also modelled when trade-activated use in the regulated system was combined with increasing on-farm storages in the unregulated systems, consistent with Action 3.3.

This action will investigate the barriers and underlying demand why so little trade has occurred in the region's unregulated, regulated and groundwater sources, and identify what improvements can be made to its water markets.

The Australian Consumer and Competition Commission identified common elements of effective water markets in its Murray–Darling Basin Water Markets Inquiry.⁸³ This action would assess how well South Coast region's water markets are set up to deliver these key elements, by identifying and exploring barriers for participation in the markets. This action would also consider the extent to which the issues and barriers identified in the Murray–Darling Basin Water Markets Inquiry would apply to a more developed water market in the South Coast region.

Recommendations arising from this investigation would be informed by forecast behaviour change and more detailed hydrologic and economic analysis of benefits and costs. They would also be informed by recommendations from the department's review of trade rules in unregulated catchments, the Australian Consumer and Competition Commission's water markets inquiry, and the establishment of sustainable extraction limits for surface water sources (Action 2.3).



Image courtesy of Destination NSW. Cupitt's Winery, Ulladulla.

83. More information is available at: accc.gov.au/focus-areas/inquiries-finalised/murray-darling-basin-water-markets-inquiry-0

Action 3.3: Investigate increased on-farm water storage

River catchments along the South Coast are relative short and steep. Consequently, stream flows are flashy – that is, they peak dramatically within hours of heavy rain, usually returning to low to medium flows within a few days.

Increasing the volume of water stored on farms will help landholders in unregulated catchments to manage the impacts of climate change on water security. Furthermore, capturing runoff high in the catchment and applying it for irrigation in drier times will assist in retaining water in the catchment for longer periods. Water in farm dams also provides vital supplies to help fight bushfires.

Preliminary modelling of this action across the Bega River catchment, based on 21 on-farm storages ranging from 100 to 600 ML with a total storage volume of 6,300 ML, illustrated the potential water security benefits of increased on-farm storage. The modelling showed the greatest benefits of on-farm storages are realised in the drier years. The modelling indicated that increasing on-farm storage could support more irrigation for pasture (e.g. almost 50% more in 1983 and more than 70% in 2020). In the 15 driest years over the historic record, the same level of on-farm storage without low-flow bypasses could have increased water provided to pasture, on average.

This action considers water harvested and stored in farm dams under a water access licence, and will investigate:

- current levels of on-farm storage and usage, and barriers to constructing them
- options to mitigate downstream environmental and water security impacts of on-farm storages, such as the provision of low-flow bypasses
- impacts on catchment hydrology, in particular potential to reduce take of low flows
- the value of on-farm storages to various South Coast region industries and as a local water supply to fight bushfires
- options for incentivising the uptake of on-farm storage.

As on-farm dams 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 the least impact on river ecology if considered in conjunction with actions that shift water extraction away from low flows, where the greatest pressure on extraction occurs (Action 2.5), or through increased trade (Action 3.2).

Any proposal to increase on-farm storage will be considered and implemented alongside the investigations to address catchment-based impacts of increased harvestable rights limits (Action 2.6) and establish sustainable extraction limits for surface water and groundwater sources (Action 2.3).



Image courtesy of Jaime Plaza Van Roon, Department of Planning and Environment. Farmland west of Bega, NSW.

Action 3.4: Investigate delivery efficiency improvements for the Bega–Brogo regulated river system

For much of the time, releases from Brogo Dam are made on top of unregulated flows in the Bega River to supply water to regulated water users downstream of the confluence of the Bega and Brogo rivers. However, larger releases of 50 ML/day from Brogo Dam are required to deliver the same volume of water to the end of system during periods of very low flow in the Bega River.

Our modelling shows that very low flows in the unregulated Bega River are expected to occur more often in the future and will lead to an increased reliance of releases from Brogo Dam. For example, flows below 33 ML/day in the Bega River at Kanoona were modelled to occur 5% of the time under historic conditions. Under climate change, this is expected to occur 10% of the time. Our new modelling also shows that, as a consequence of climate change, demand for irrigation water is likely to increase.

Rising sea levels are expected to require greater volumes of water to be released from Brogo Dam to maintain low salinity levels in the Bega tidal pool. A temporary sand barrage located on the Bega River near Jellat Jellat Creek currently helps minimise the volume of water released to manage salinity levels in the tidal pool. This barrage is subject to a Department of Primary Industries Fisheries requirement to be breached every 6 weeks to allow fish passage. Being of a temporary nature, the sand barrage washes out following moderate rainfall.

This action will:

- develop a drought management plan for the Bega–Brogo regulated river system will be prepared. Although not intended to improve the delivery efficiency of the overall regulated system, the drought management plan will include operational response measures that will be used when the system is in drought
- investigate improvements to the efficiency of water deliveries to the tidal pool in the Bega–Brogo regulated river system.

The new climate data and hydrological model of the Bega–Brogo regulated river system will provide improved data about the performance of the system under increased climate variability. Hydrodynamic modelling carried out in Action 1.6 to understand the vulnerability of the Bega tidal pool to sea level rise, will improve our understanding of the freshwater flows needed to mitigate rising salinity levels in the future.

Further, identifying the best way to improve water security for the Bermagui town water supply system (Action 3.5) and enhancing coastal water markets (Action 3.2) will complement efforts to improve the efficiency and utilisation of the Bega–Brogo regulated river system.



Image courtesy of WaterNSW. Brogo Dam, NSW.

Action 3.5: Identify the best option to improve water security for the Bermagui town water supply system

The Bermagui town water supply system has been identified as having the greatest unaddressed water security risk in the South Coast region.

Bermagui draws its town water supply directly from the Brogo River, with releases supplied by the regulated Brogo Dam. At the start of each water year, a set amount of water is set aside in Brogo Dam before it is allocated to other water licences. This reserve is calculated by modelling to determine a volume of water to be held to satisfy essential needs, which includes town water supply, basic landholder rights, and available water determinations based on a repeat of the worst period of low inflows on the observed historical record.

During extended dry periods when the capacity of Brogo Dam is low, water releases are reduced to help maintain the supply in the dam and prolong water for towns and other essential needs. Brogo Dam is operated by WaterNSW, while Bega Valley Shire Council is responsible for the water supply system to Bermagui. A combination of how the dam is managed and town water infrastructure meant that Bermagui's town water supply faced additional stress during the last drought.

In January 2020, Brogo Dam dropped rapidly to 14% capacity (falling to approximately 1.2 GL). The NSW Government issued a temporary restriction order to limit releases from the dam for essential downstream needs. Essential needs such as town water supplies were exempt; however, restrictions were applied to general and high security licences. Water releases from Brogo Dam were reduced to

approximately 5 ML/day while trying to satisfy Bega Valley Shire Council's 1 ML/day requirement for the Bermagui town water supply system. At one stage, the release volume was insufficient to maintain a sufficient pool depth for the town water supply pumps to operate properly. WaterNSW was required to increase water releases to above 10 ML/day to increase the pool depth and support town water supplies.

A drier future climate could result in times when the river and dam fall to levels where there may not be enough water to support town water supplies under the current operating regime. We need to understand the best options available to ensure the security of the Bermagui town water supply in this scenario, recognising that some options will have system-wide impacts given the system sources water from a regulated dam that supplies water to a range of users.

This action will investigate a range of options, including changes to policy or Brogo Dam operational regimes, as well as possible infrastructure options to identify the best solution to improve water security for the Bermagui town water supply system. A town water security assessment may include:

- investigating if changing the reserve set aside in Brogo Dam could improve the ability of Brogo Dam to deliver water to the Bermagui town water supply during extreme events
- investigating weir pool volumes and whether a redesign of the existing inlet arrangement to the town water supply offtake and/or changing the location of the offtake, is sufficient
- investigating whether constructing a weir at the offtake site that will enable a sufficient depth of water during low-flow periods for the town water supply pumps to operate and assist WaterNSW to manage releases from Brogo Dam.



Image courtesy of Destination NSW. Bermagui Point, Bermagui.

Action 3.6: Improve water security for lower Tuross water users

The floodplain of the lower Tuross River supports about 600 ha of irrigated pasture for dairying, generating an estimated average annual income of around \$10 million and directly employing 40 to 50 people. In addition to irrigation, local dairy farms rely on the Tuross River for stock drinking water and dairy wash-down water. Every few years, during periods of low flow and higher than average tides, saltwater moves upstream from the Tuross River estuary into the lower reaches of the Tuross River, threatening essential water supplies for local landholders. With projected sea level rise, the severity and frequency of saltwater intrusion into the lower Tuross River is expected to increase.

Historically, a temporary sand barrage has been used to restrict the upstream movement of saltwater to prolong landholders' access to fresh stream flows. The Department of Primary Industries Fisheries has expressed concerns that the barrage creates a barrier to the passage of native fish.

In recognition of the water security challenge for lower Tuross River water users, Eurobodalla Shire Council revised its design and operation of the proposed Eurobodalla Southern Water Supply Storage to reduce town water supply demands on low flows.

Affected landholders will work with the department and other NSW Government agencies to assess options to maintain water supply for their business operations. These options may include:

- using a sand barrage, including provision for fish passage and adherence to operating rules
- developing groundwater sources to provide stock and dairy washdown water
- increasing on-farm storage.

Our new climate data and hydrological model of the Tuross River will provide improved data about the river flows and water availability under increased climate variability. Hydrodynamic modelling carried out in Action 1.6, will help us to better understand the vulnerability of the Tuross tidal pool to sea level rise and will improve our understanding of the future risks to water quality in the area.



Image courtesy of Destination NSW. Tuross River, Tuross Head.

Implementing the strategy

6

Image courtesy of Destination NSW. Bar Beach, Merimbula.

Getting our timing right

A critical feature of developing the South 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 various actions is aimed to meet existing challenges, identify and prepare for foreseeable coming challenges, and lay the groundwork for adapting to future uncertainties and changed circumstances.

The water security actions in this strategy have a strong focus on drought security following the experience of the 2018–2020 drought. However, this drought has been closely followed by major flood events across NSW from 2020–2022.

Some of the actions may have the capability to mitigate low to moderate flooding events. Analysing the flood benefits of many of the actions in this strategy will require enhanced investment by governments in flood modelling and mitigation works.

Progressing the shortlisted actions from the strategy to on-ground implementation can be supported by more detailed assessment of the flood mitigation benefits of some of the water security actions presented in this strategy and whole-of-government input. The *Floodplain Development Manual*⁸⁴ and the Flood Prone Land Policy guide local governments in managing flood risk in their communities. The Office of Local Government and the Department of Planning and Environment – Environment and Heritage also take the specific lead role in flood risk management for towns and regional centres across the state.

Not all actions will be commenced at once, and funding will be a key consideration in planning when and how the actions will be implemented. The regional water strategies will be a key tool in seeking funding as future opportunities arise. The South Coast Regional Water Strategy has a separate implementation plan⁸⁵ that prioritises the delivery of actions over the life of the strategy. The implementation plan also outlines responsibilities and timeframes for delivery, so that we can monitor the progress of the actions, assess the effectiveness of the strategy and identify areas where we need to adapt.

The implementation plan sets our priorities over the next 3 years.

The implementation plan also 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 will lead 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.

84. More information is available at: environment.nsw.gov.au/research-and-publications/publications-search/floodplain-development-manual

85. Available at: dpie.nsw.gov.au/south-coast-regional-water-strategy

Figure 23. South Coast Regional Water Strategy implementation timeline

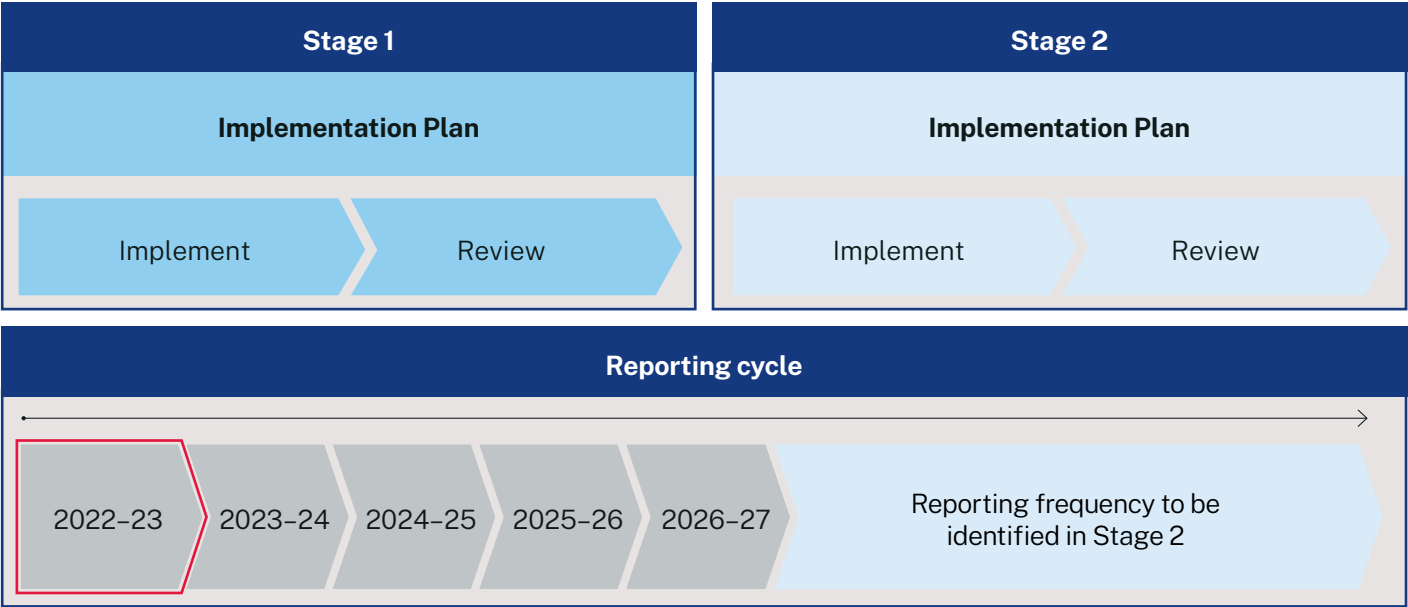


Image courtesy of Destination NSW. Pigeon House Mountain (Didthul), Moreton National Park.

Ongoing monitoring, adaptation and reporting

The South Coast Regional Water Strategy is designed to respond to changing circumstances (Figure 24). We will undertake a formal review of the strategy at least every 5 years or in response to significant changing conditions and government priorities. The formal review will ensure that the key assumptions, such as population and demographics, have not significantly changed.

Amendments may be made 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.

We will report every year against actions in the implementation plan, so that the community can track our progress and we can demonstrate which actions have been delivered, or continue to be delivered, in that year.

Figure 24. Regional water strategies process

