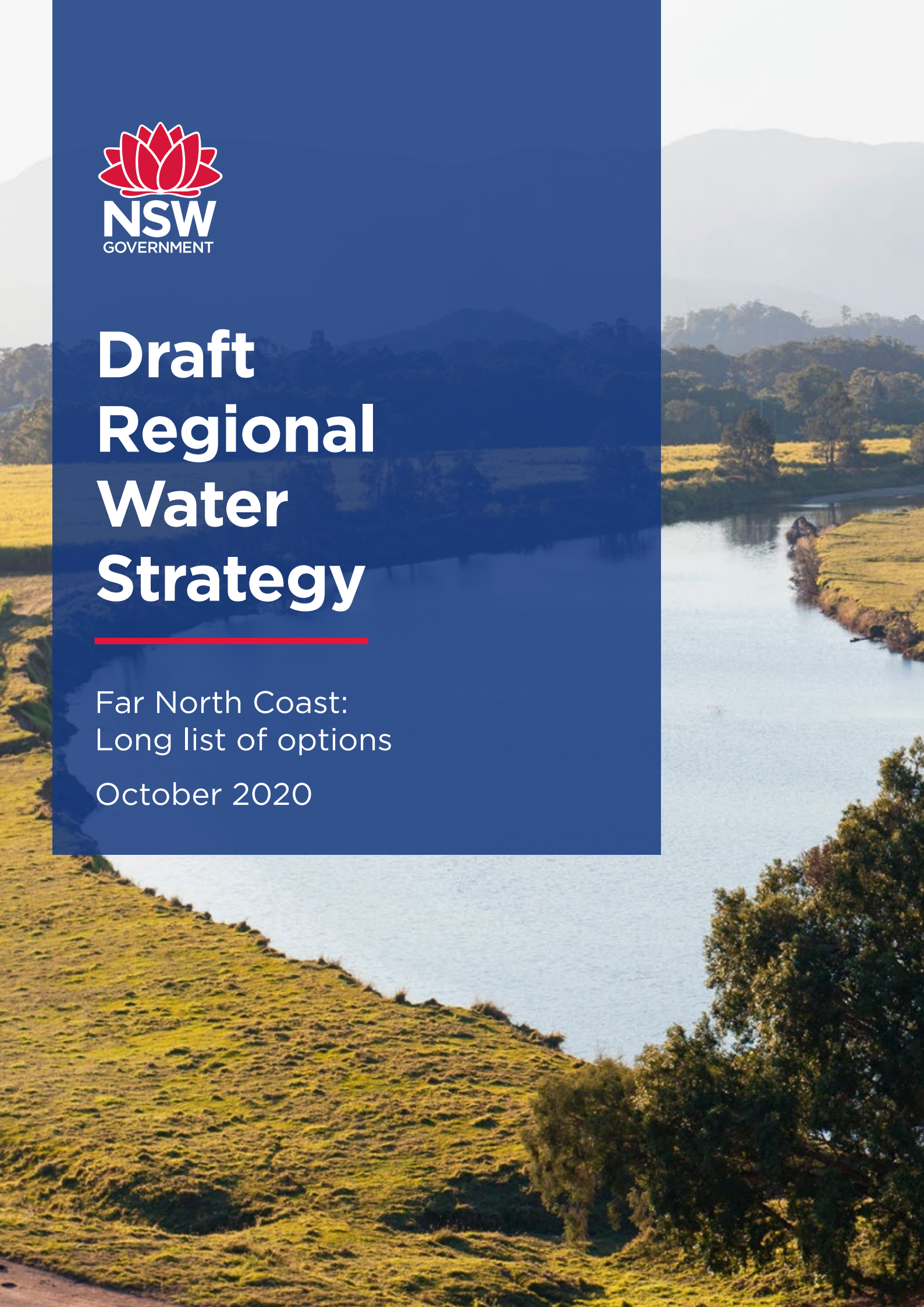

NSW GOVERNMENT

Draft Regional Water Strategy

Far North Coast: Long list of options

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

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

We acknowledge that the people of the Bundjalung and Githabul Nations hold a significant connection to the lands in which the Far North Coast Regional Water Strategy falls upon.

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

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

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

NSW Department of Planning, Industry and Environment is committed to continuing future relationships and building strong partnerships with Aboriginal people. We thank the Elders, representatives of the Bundjalung and Githabul Nations and Aboriginal community members who provided their knowledge throughout the regional water strategy development process.

Options for the Draft Far North Coast Regional Water Strategy

As outlined in the Draft Far North Coast Regional Water Strategy, we have developed a long list of options that could be included in the final strategy.

It is important to note that the options have not been prioritised and not all options have been costed.

In preparing this list, we recognise that a great deal of work has been done over the last few years to identify initiatives that could improve water management, water security and water reliability in the Far North Coast region. We have collated options from previous studies and supplemented them with further options derived from recent experience, community engagement and current NSW Government initiatives and programs. Bringing all of these options together will also help to align and better sequence the various water reform processes underway to deliver the best outcomes for the Far North Coast region.

These options aim to address the challenges the region may face in the future, while maximising opportunities arising from growing regional centres, emerging and expanding industries, and new investments in transport and community infrastructure.

The draft long list of options and government commitments focus on:

- maintaining and diversifying water supplies
- protecting and enhancing natural systems
- supporting water use and delivery efficiency and conservation
- strengthening community preparedness for climate extremes.

Face-to-face engagement with Aboriginal communities on the Far North Coast region was delayed due to the COVID-19 pandemic. However, we are committed to ensuring that options with a primary focus on **recognising Aboriginal people's water rights, interests and access to water** are also included in the strategy following further consultation with Aboriginal communities. This will also ensure we preserve our important natural systems and include the extensive knowledge of our Traditional Owners in water management decisions.

A number of options included in the current long list will contribute to recognising Aboriginal people's water rights, interests and access to water, as well as addressing one or more of the four focus areas listed above.

Table 1 shows a snapshot of how we have matched the draft options with these four categories and the challenges and opportunities we identified in the Draft Far North Coast Regional Water Strategy. Overall, all options that are progressed will need to contribute to the NSW Government's strategic planning vision for the region.

Table 1. Draft long list of options matrix

Category	Maintaining and diversifying water supplies	Protecting and enhancing natural systems
Region-specific challenges and opportunities	**Risks/Challenges:** • region is unprepared for extended dry periods • water demands are shifting • town water demand is expected to exceed supply in the short-to-medium term • underutilisation of Toonumbar Dam • major rivers in the region are under hydrologic stress during periods of low river flow • susceptibility to sea level rise due to climate change. **Opportunities:** • improve industry access to water • improve drought resilience of industry through provision of increased storage capacity • increase drought security for existing regulated water users • improve resilience of town water supplies in the Far North Coast region • supply augmentation and drought security for the northeast NSW area • increase resilience of the regional water supply, through the recovery and reuse of wastewater • support implementation of water reuse projects by local water utilities and industry • reduce demand on potable water supplies by supplying fit-for-purpose reuse water • prepare the water system for any future major supply augmentations • more efficient use (by minimising evaporation) of stored water in areas where demand is high • maximise available water for productive use • improve capacity of industries to grow • increase utilisation of Toonumbar Dam water • reduce extractive pressures on low streamflows • increase the capacity of the region to manage the impacts of sea level rise • increase water security for industry.	**Risks/Challenges:** • poor water quality is affecting the environmental health of water sources • major rivers in the region are under hydrologic stress during periods of low river flow • protecting native and threatened aquatic species • water demands are shifting • lack of data to inform both decision-making and other assessments • ensuring the NSW Government and the community have the required information to inform groundwater management frameworks and decisions • mitigating the impacts of urban and rural land management activities on water quality and waterway stability. **Opportunities:** • restore near-natural river water temperature to provide native and threatened fish species in the Far North Coast systems with the necessary environmental cues to spawn, recruit, move and grow • improve ecological health • improve flood management throughout the region • improve the health of waterways across the region • improve resilience of ecosystems • improve social amenity through access to recreational activities • maximise secure yields while maintaining environmental flows • improve our understanding of coastal river systems and their sustainable extraction limits • set extractions for productive use across the region at a level that maintains natural ecosystems • facilitate access to water for productive use where available • reduce the loss of native fish from the in the Far North Coast region while improving water delivery and extraction efficiency • improve fish movement through fishways and encourage breeding and spawning activities, especially for threatened species • improve recreational fishing and regional tourism opportunities • support groundwater dependent ecological processes that support soils, fauna and flora and establish and maintain environments that are valuable to coastal NSW • flooding is a major issue for towns, businesses and communities • improve knowledge sharing and education • mitigate the risks of water extractions during low flow periods.

Supporting water use and delivery efficiency and conservation

Risks/Challenges:

- lack of data to inform decision-making
- region is vulnerable to extended dry periods
- underutilisation of Toonumbar Dam
- water demands are shifting.

Opportunities:

- inform future water management decisions in the Far North Coast region
- provide transparency and confidence to water users in the Far North Coast
- educate water users about the operation of and rules governing the water trade in the Far North Coast
- improve and broaden the market to create opportunities to move water more efficiently
- improve consistency in approach to demand management across the region
- improve efficiency of monitoring and implementation.

Strengthening community preparedness for climate extremes

Risks/Challenges:

- susceptibility to sea level rise due to climate change
- region is vulnerable to extended dry periods
- flooding is a major issue for towns, businesses and communities
- major rivers in the region are under hydrologic stress during periods of low river flow
- poor water quality is affecting the environmental health of water sources
- providing reliable and safe town water supplies
- maintaining domestic water availability during extended dry periods
- mitigating the impacts of urban and rural land management activities on water quality.

Opportunities:

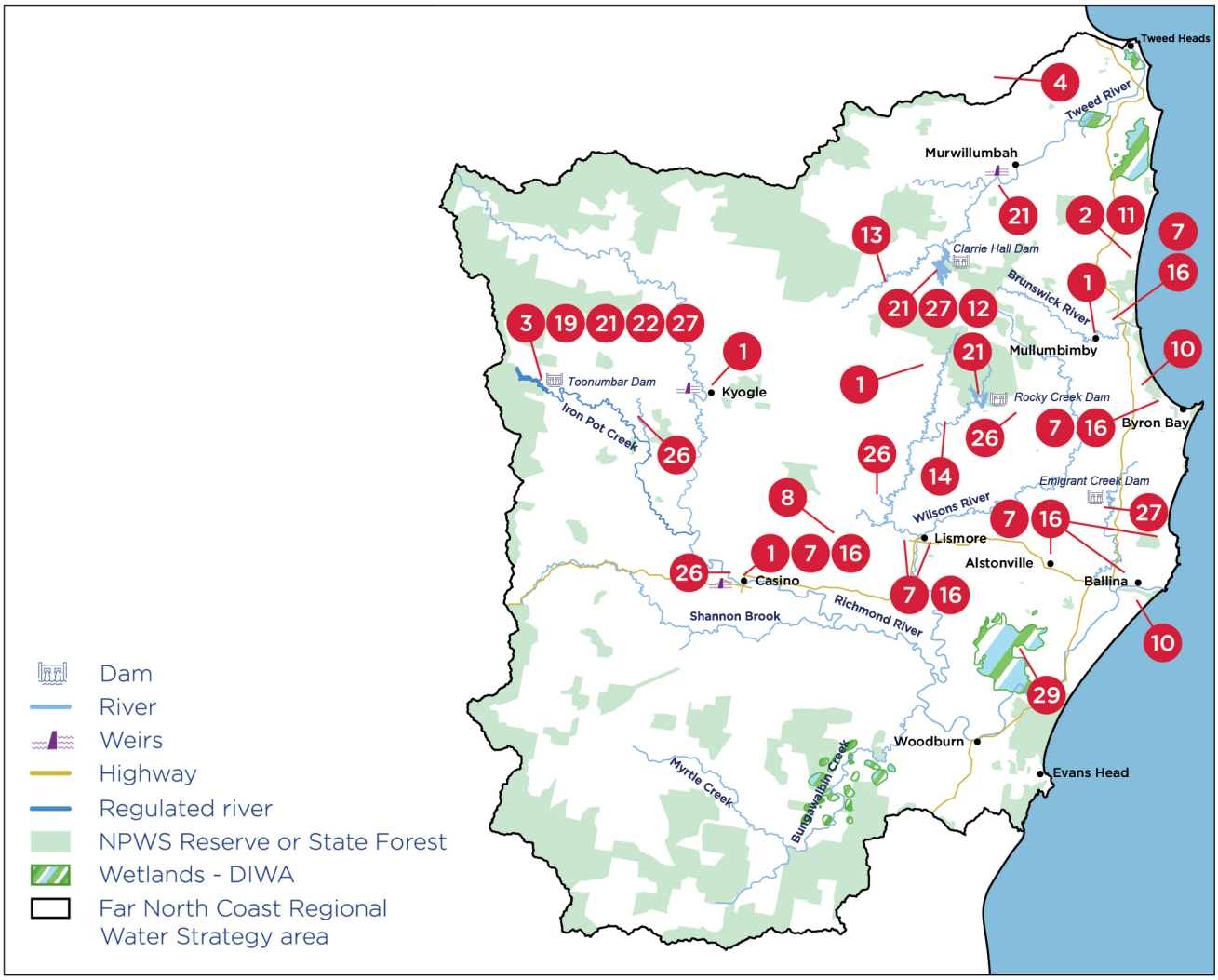
- improve industry water efficiency and reduce water demands
- improve drought resilience of agricultural industry
- improve water quality in watercourses
- mitigate flood impacts
- provide clarity in decision-making during periods of drought
- ensure towns and rural groundwater users are prepared for drought
- prepare for the impacts of climate change and sea level rise on groundwater sources in coastal regions
- provide for development while protecting groundwater resources.

Table 1. Draft long list of options matrix (continued)

Category	Maintaining and diversifying water supplies	Protecting and enhancing natural systems
Options and government commitments	• Interconnection of independent water supplies in the region to the Rous County Council network • Interconnection of Rous County Council and Tweed Shire Council bulk water supplies • Use Toonumbar Dam to augment town water supplies • Connect the regional water system to the South East Queensland water grid • Vulnerability of surface water supplies to sea level rise • Remove impediments to water reuse projects • Indirect potable reuse of purified recycled water • Direct potable reuse of purified recycled water • Managed aquifer recharge investigations and policy • Decentralised desalination • Regional desalination • Raise Clarrie Hall Dam level • New dam on Byrrill Creek • New Dunoon Dam on Rocky Creek • Increased harvestable rights • Provide recycled wastewater for industry and rural users • Increased on-farm water storage • A grid of off-stream storages in the Far North Coast region • Raise Toonumbar Dam level	• Establish sustainable extraction limits for Far North Coast surface water and groundwater sources • Establish and/or increase environmental water releases from major storages in the Far North Coast • Convert low flow water access licences to high flow water access licences • Improve stormwater management • Bringing back riverine and estuarine habitats and threatened species • Fish-friendly water extraction • Improve fish passage in the Far North Coast region • Addressing cold water pollution • Characterising coastal groundwater resources • Protecting ecosystems that depend on coastal groundwater resources • Northern Rivers Watershed Initiative • River Recovery Program for the Far North Coast: a region-wide program of instream works, riparian vegetation and sediment control

Supporting water use and delivery efficiency and conservation	Strengthening community preparedness for climate extremes
• Improved data collection and information sharing • Active and effective water markets • Regional Demand Management Program • Regional network efficiency audit	• Apply the NSW Extreme Events Policy to the Far North Coast region • Protecting coastal groundwater resources for town water supplies and rural water users • Planning for climate change impacts on coastal groundwater resources • Planning for land use pressures on coastal groundwater resources

Figure 1. Far North Coast long list of options and government commitments map



Options not shown on the map are not location specific.

Long list of options

Maintaining and diversifying water supplies

1. Interconnection of independent water supplies in the region to the Rous County Council network
2. Interconnection of Rous County Council and Tweed Shire Council bulk water supplies
3. Use Toonumbar Dam to augment town water supplies
4. Connect the regional water system to the South East Queensland water grid
5. Vulnerability of surface water supplies to sea level rise
6. Remove impediments to water reuse projects
7. Indirect potable reuse of purified recycled water
8. Direct potable reuse of purified recycled water
9. Managed aquifer recharge investigations and policy
10. Decentralised desalination
11. Regional desalination
12. Raise Clarrie Hall Dam level
13. New dam on Byrrill Creek
14. New Dunoon Dam on Rocky Creek
15. Increased harvestable rights
16. Provide recycled wastewater for industry and rural users
17. Increased on-farm water storage
18. A grid of off-stream storages in the Far North Coast region
19. Raise Toonumbar Dam level

Protecting and enhancing natural systems

20. Establish sustainable extraction limits for Far North Coast surface water and groundwater sources
21. Establish and/or increase environmental water releases from major storages in the Far North Coast
22. Convert low flow water access licences to high flow water access licences
23. Improve stormwater management
24. Bringing back riverine and estuarine habitats and threatened species
25. Fish-friendly water extraction
26. Improve fish passage in the Far North Coast region
27. Addressing cold water pollution
28. Characterising coastal groundwater resources
29. Protecting ecosystems that depend on coastal groundwater resources
30. Northern Rivers Watershed Initiative
31. River Recovery Program for the Far North Coast: a region-wide program of instream works, riparian vegetation and sediment control

Supporting water use and delivery efficiency and conservation

32. Improved data collection and information sharing
33. Active and effective water markets
34. Regional Demand Management Program
35. Regional network efficiency audit

Strengthening community preparedness for climate extremes

36. Apply the NSW Extreme Events Policy to the Far North Coast region
37. Protecting coastal groundwater resources for town water supplies and rural water users
38. Planning for climate change impacts on coastal groundwater resources
39. Planning for land use pressures on coastal groundwater resources

Not all options in this long list will be progressed. Only feasible options will be progressed, following the evidence-based assessment process described in the *Regional Water Strategies Guide*. The final package of options will also consider how the implementation of the preferred options should be staged.

This document describes each option, its intent and the challenges it seeks to address. Each option is aligned with one or more of the overarching objectives set for the NSW regional water strategies (Figure 2). Additional considerations and further work required to progress the option are identified.

This will need to be supplemented by further analysis and your feedback. Where possible, links and references are provided for further information on the option.

The list also identifies potential combinations of options. These combinations recognise that most options require associated works, further assessments and/or legislative and policy and planning changes to ensure they address the risks and challenges identified in the Far North Coast region and do not have unintended impacts. Our aim is to develop a final strategy with a balanced package of options that delivers on all of these objectives and the NSW Government's focused planning goals for the region.

Figure 2. NSW regional water strategies: objectives

Deliver and manage water for local communities

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

Enable economic prosperity

Improve water access reliability for regional industries.

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

Including Aboriginal heritage assets.

Protect and enhance the environment

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

Affordability

Identify least cost policy and infrastructure options.

Far North Coast: Long list of options and government commitments

Image courtesy of Destination NSW.

Maintaining and diversifying water supplies

Opportunities to improve water security, maintain suitable water quality, and support growth and jobs in the region.

Option 1. Interconnection of independent water supplies in the region to the Rous County Council network	
Source: Northern Rivers Regional Bulk Water Supply Strategy	
Description	Byron Shire, Ballina Shire, Lismore City, and Richmond Valley councils all operate at least one town water supply that is not connected to the Rous County Council bulk water supply network. These independent supplies generally suffer from water security issues. Connection of these towns into the regional Rous County Council network would increase their water security and resilience. Towns identified as suitable for connection to the Rous County Council network are Casino, Kyogle, Mullumbimby and Nimbin/Channon.
Intent	Improve resilience of town water supplies in the Far North Coast region.
Challenges addressed	• Region is unprepared for extended dry periods. • Town water demand is expected to exceed supply in the short-to-medium term. • Water demands are shifting.
Potential combinations	This option could be potentially combined with any of the other listed options aiming to augment the regional water supply, including: • Option 3. Use Toonumbar Dam to augment town water supplies • Option 4. Connect the regional water system to the South East Queensland water grid • Option 8. Direct potable reuse of purified recycled water • Option 10. Decentralised desalination • Option 11. Regional desalination • Option 14. New Dunoon Dam on Rocky Creek • Option 19. Raise Toonumbar Dam level • Option 34. Regional Demand Management Program.
Considerations	Increases in water security are generally only one-way; that is, they do not necessarily provide additional benefit to the Rous County Council network. However, connection of the Marom Creek water treatment plant to the Rous County Council network will provide a security benefit to Rous County Council and may allow deferral of investment in larger scale augmentation. Interconnection options would also require consideration of funding arrangements and potential identification of new funding streams to facilitate these works.
Objectives	

Option 2. Interconnection of Rous County Council and Tweed Shire Council bulk water supplies

Source: Northern Rivers Regional Bulk Water Supply Strategy

Description	Connect the two major regional water supply systems. This improves system resilience by increasing and diversifying the water supplies available in both the Tweed and Rous regions. It can also improve the feasibility of a regional desalination scheme by making the desalinated water available to both systems. The most likely location for the connection is between Pottsville (Tweed) and Ocean Shores (Rous).
Intent	• Improve resilience of town water supplies in the Far North Coast region. • Prepare the water system for any future major supply augmentations.
Challenges addressed	• Region is unprepared for extended dry periods. • Town water demand is expected to exceed supply in the short-to-medium term. • Water demands are shifting.
Potential combinations	This option could be combined with: • Option 1. Interconnection of independent water supplies in the region to the Rous County Council network • Option 4. Connect the regional water system to the South East Queensland water grid • Option 10. Decentralised desalination • Option 11. Regional desalination • Option 12. Raise Clarrie Hall Dam level • Option 13. New dam on Byrrill Creek • Option 34. Regional Demand Management Program.
Considerations	Connecting the two systems is complicated by the different infrastructure and operating rules in place in each system. Due to the large investments in planning, infrastructure and water sharing arrangements that need to be in place, this is likely a long-term option. This option requires investigation into: • pipeline route • transfer system • potential administrative and governance arrangements, including responsibility for operation. We have heard from councils that engagement with the community for any interconnection option would be important to communicate that it would not be losing a water source.
Objectives	

Option 3. Use Toonumbar Dam to augment town water supplies

Source: Rous County Council, WaterNSW and Department of Planning, Industry and Environment—Water

Description	Connect Toonumbar Dam to a town water supply to provide additional town water security for the region. A number of connection opportunities exist: • pipe from the dam wall to Casino water treatment plant • pipe from the dam wall to Rocky Creek Dam • pipe from the end of Eden Creek to Casino water treatment plant • pipe from the end of Eden Creek to Rocky Creek Dam • deliver along existing river to Jabour Weir at Casino (non-build option).
Intent	• Increase utilisation of Toonumbar Dam water. • Improve resilience of town water supplies in the Far North Coast region.
Challenges addressed	• Region is unprepared for extended dry periods. • Town water demand is expected to exceed supply in the short-to-medium term. • Underutilisation of Toonumbar Dam.
Potential combinations	This option could be combined with: • Option 1. Interconnection of independent water supplies in the region to the Rous County Council network • Option 19. Raise Toonumbar Dam level.
Considerations	The current water sharing plan does not allow for extraction from the Richmond regulated system for town water supply. This option would require modification of the water sharing plan to allow such extractions. Introducing regular extraction for town water supply may impact on water reliability for existing rural regulated system users. This option would need to assess the impact of increased extraction on the water security of existing regulated licence holders.
Objectives	

Option 4. Connect the regional water system to the South East Queensland water grid

Source: Tweed Shire Council and Department of Planning, Industry and Environment—Water

Description	This option proposes construction of infrastructure and development of governance arrangements to facilitate two-way transfer of water between the Far North Coast region and South East Queensland. This could provide mutual water security benefits.
Intent	Improve resilience of town water supplies in the Far North Coast region.
Challenges addressed	• Region is unprepared for extended dry periods. • Town water demand is expected to exceed supply in the short-to-medium term.
Potential combinations	This option could be potentially combined with any of the other listed options aiming to augment the regional water supply, including: • Option 1. Interconnection of independent water supplies in the region to the Rous County Council network • Option 2. Interconnection of Rous County Council and Tweed Shire Council bulk water supplies • Option 12. Raise Clarrie Hall Dam level • Option 34. Regional Demand Management Program.
Considerations	Tweed Shire Council already has an emergency connection to the Gold Coast that can supply 3 ML/day and is pursuing opportunities to upgrade this link. The primary purpose of the connection is as a contingency supply in the event of gross system failure. This would ensure water supply for the Tweed Shire area in the event of saltwater intrusion to the Bray Park Weir water source, contamination of the water supply, fire or other disaster at key points, or extended drought. The link upgrade is proposed in two stages: the first would upgrade the existing link to operate at 10 ML/day. The second phase would upgrade the link to supply 70% of Tweed Shire Council's projected demand in 2065 (roughly 36 ML/day). The link would be capable of operating both ways, allowing excess water to be supplied from Tweed Shire Council to Seqwater until Clarrie Hall Dam falls below 95% capacity. The link could supply water from the Seqwater system until the cut-in level for desalination is reached (currently 60% of storage in South East Queensland). As currently planned, water would not be supplied to Tweed Shire Council once the Seqwater system is fed with desalinated water due to pricing issues. The link is mutually beneficial as it would: • provide greater security to Tweed Shire Council • defer starting the Tugun desalination plant as it allows Tweed Shire Council to supply excess water to Seqwater • defer capital works for Queensland. The link is currently not viable as a water supply augmentation option. A pipeline to the South East Queensland water grid has previously been found to have high risks associated with cross-border issues and the lack of assurance as to whether supply from the South East Queensland water grid would be maintained. Additionally, an augmentation link would incur costs associate with buy-in to the Tugun desalination plant, ongoing plant maintenance costs, and very high usage charges. The viability of connection for the purposes of augmentation may increase in the future if this option is combined with a connection of the Tweed and Rous water systems. The ability to augment the entire Far North Coast region may change the economics of the proposal. This should be reassessed over the lifetime of the regional water strategy implementation.
Objectives	

Option 5. Vulnerability of surface water supplies to sea level rise

Source: Department of Planning, Industry and Environment—Water

Description	This option would investigate the potential impacts of sea level rise on surface water supplies and local water utility infrastructure in tidal pools and estuaries. The project involves: • identifying key estuaries/tidal pools for investigation based on the volume of water extraction and location of water infrastructure • reviewing the availability and suitability of existing hydrodynamic and salinity numerical models at priority locations • updating and/or developing the numerical models necessary to determine how salinity dynamics and tidal inundation may change at key locations in the future due to sea level rise and future changes in hydrology • assessing risks to water users and local water utility infrastructure posed by sea level rise and future changes in hydrology • identifying options to address these risks for inclusion in future reviews of the Far North Coast Regional Water Strategy.
Intent	• Understand the vulnerability of surface water supplies to sea level rise. • Improve resilience of town water supplies in the Far North Coast region.
Challenges addressed	Susceptibility to sea level rise due to climate change.
Potential combinations	This project could link in with work being carried out under Initiative 3 of the *Marine Estate Management Strategy* to understand the vulnerability of tidal wetlands to sea level rise. It will also complement: • Option 28. Characterising coastal groundwater resources • Option 32. Improved data collection and information sharing.
Considerations	The development of fit for purpose hydrodynamic and salinity models is resource intensive and expensive so model development will be prioritised based on a coastal-wide needs assessment. Several models already exist or are being developed to inform various coastal management initiatives and this project will look to build on this work to avoid duplication. The Far North Coast Regional Water Strategy may propose options that alter the hydrology of estuary and tidal pool inflows. Developing new or updated models will enable the salinity and inundation impacts of these options to be assessed.
Objectives	

Option 6. Remove impediments to water reuse projects

Source: Department of Planning, Industry and Environment—Water

Description	Reuse of wastewater and stormwater can play an important role for reducing demands on potable water supplies. Reuse projects are much more accepted now by the community than they have been in the past and have been successfully implemented at different scales and with various end uses across Australia and internationally. The Far North Coast region has not maximised use of recycled water, despite the amenability of the community and the enthusiasm of local water utilities to implement water reuse projects. There is a major opportunity in the region to use recycled water as a valuable water resource. Although a few water reuse projects have been constructed across the region, local water utilities have reported that there are cost and regulatory barriers that are impeding their ability to implement reuse projects. This option may include: • a review to fully characterise the barriers impeding implementation of water reuse projects. These may be cost, pricing, regulatory or engineering constraints, or may be associated with community acceptance • development of options for reconfiguring cost or regulatory requirements • plans to support implementation of on-site reuse projects by industry.
Intent	• Support implementation of water reuse projects by local water utilities and industry. • Reduce demand on potable water supplies by supplying fit-for-purpose reuse water.
Challenges addressed	• Town water demand is expected to exceed supply in the short-to-medium term. • Major rivers in the region are under hydrologic stress during periods of low river flow.
Potential combinations	This option could be combined with: • Option 7: Indirect potable reuse of purified recycled water • Option 8. Direct potable reuse of purified recycled water • Option 9. Managed aquifer recharge investigations and policy • Option 16. Provide recycled wastewater for industry and rural users • Option 34. Regional Demand Management Program.
Considerations	The review will need to consider the diverse demographics of the region and that concerns and impediments may vary at the local scale.
Objectives	

Image courtesy of Lori Cameron,
Department of Planning, Industry and Environment.

Option 7. Indirect potable reuse of purified recycled water

Source: Department of Planning, Industry and Environment—Water

Description	Highly treated wastewater from sewage treatment plants has the potential to be a reliable, safe and mostly climate-independent water source. The level of treatment required depends on whether it will be stored or conveyed by rivers or groundwater, and what the end uses are. Water for drinking requires higher levels of treatment and purification that water used by agriculture and industry. Indirect potable reuse involves augmenting drinking water supplies through: • managed aquifer recharge, whereby purified recycled water is used to recharge groundwater aquifers before it is extracted, treated again to *Australian Drinking Water Guidelines* and added to the water supply network • discharging purified recycled water directly into or upstream of an existing dam or other major water store, where it mixes with surface water before being treated again to *Australian Drinking Water Guidelines* and supplied to customers. This option would investigate potential locations for new or expanded reuse schemes from sewage treatment plants, including at East and South Lismore, Alstonville, Ballina, Lennox Head, Casino, Byron Bay and Brunswick Heads.
Intent	Increase resilience of the regional water supply, through the recovery and reuse of wastewater.
Challenges addressed	• Region is unprepared for extended dry periods. • Town water demand is expected to exceed supply in the short-to-medium term.
Potential combinations	This option could be combined with: • Option 1. Interconnection of independent water supplies in the region to the Rous County Council network • Option 6. Remove impediments to water reuse projects • Option 8. Direct potable reuse of purified recycled water • Option 9. Managed aquifer recharge investigations and policy • Option 34. Regional Demand Management Program.
Considerations	Experience in developing recycled water solutions for drinking water supply in Australia and overseas has demonstrated that community trust and acceptance needs to be built carefully and may take around 10 years. The community's willingness to consider purified recycled water for drinking purposes needs to be carefully consulted on and tested. Any risk of system failure resulting in inadequately treated water entering the potable network would need to be overcome. Purified recycled water for drinking involves high levels of treatment, including reverse osmosis. Any treatment process involving reverse osmosis will produce a brine which can be discharged safely to ocean, but in most cases not to inland waterways. Recycling wastewater and stormwater avoids discharge to rivers and the ocean of water likely to contain sediment or nutrients, reducing pollutants released to waterways. Instead nutrients can be recovered and used beneficially. Due to advanced treatment requirements and associated infrastructure recycled water options generally have higher energy requirements than surface water options, although less than desalination options. The advanced treatment requirements may also make it challenging for regional local water utilities to implement due to a lack of qualified reuse system operators in the industry.
Objectives	

Option 8. Direct potable reuse of purified recycled water

Source: Northern Rivers Regional Bulk Water Supply Strategy

Description	Investigate the injection of purified recycled water from sewage treatment plants into the drinking water supply network. This option can leverage the existing water supply network (which covers many of the sewage treatment plants in the region) to distribute potable recycled water across the region. Councils in the Far North Coast have told us that communities in the region broadly support the reuse of wastewater. This option could include a pilot project to test and promote the adoption of wastewater reuse options more broadly across the Far North Coast region. This could build confidence and trust in the ability of local water utilities to provide safe and reliable purified recycled water for drinking purposes. Rous County Council are currently developing plans for a pilot water reclamation plant at the Perradenya Estate in Caniaba (roughly 12 km from Lismore). Using the estate as a test case, Rous County Council intends to demonstrate ecologically sustainable water management by producing recycled water for all purposes, including for drinking water. Rous County Council hopes to partner with the NSW Government and Southern Cross University to deliver the project.
Intent	Increase resilience of the regional water supply, through the recovery and reuse of wastewater.
Challenges addressed	• Region is unprepared for extended dry periods. • Town water demand is expected to exceed supply in the short-to-medium term.
Potential combinations	This option could be combined with: • Option 1. Interconnection of independent water supplies in the region to the Rous County Council network • Option 6. Remove impediments to water reuse projects • Option 34. Regional Demand Management Program.
Considerations	Experience in developing recycled water solutions for drinking water supply in Australia and overseas has demonstrated that community trust and acceptance needs to be built carefully and may take around 10 years. The community's willingness to consider purified recycled water for drinking purposes needs to be carefully consulted on and tested. Any risk of system failure resulting in inadequately treated water entering the potable network would need to be overcome. Any treatment train involving reverse osmosis will produce a brine which can be discharged safely to ocean, but in most cases not to inland waterways. Due to advanced treatment requirements and associated infrastructure recycled water options generally have higher energy requirements than surface water options, although less than desalination options. The advanced treatment requirements may also make it challenging for regional local water utilities to implement due to a lack of qualified reuse system operators in the industry.
Objectives	

Image courtesy of John Spencer,
Department of Planning, Industry and Environment.

Option 9. Managed aquifer recharge investigations and policy

Source: Department of Planning, Industry and Environment—Water and Northern Rivers Regional Bulk Water Supply Strategy

Description	Investigation of possible sites for temporary storage of treated wastewater, stormwater and river flows in aquifers to improve storage efficiencies. This is normally referred to as managed aquifer recharge. This option would develop a policy and regulatory framework to enable the storage and recovery of this water. Stored water could be reused by towns, water users or groundwater-dependent ecosystems.
Intent	More efficient use (by minimising evaporation) of stored water in areas where demand is high.
Challenges addressed	• Region is vulnerable to extended dry periods. • Major rivers in the region are under hydrologic stress during periods of low river flow. • Town water demand is expected to exceed supply in the short-to-medium term.
Potential combinations	This option builds on Option 20. Establish sustainable extraction limits for Far North Coast surface water and groundwater sources. This option could also be combined with: • Option 6. Remove impediments to water reuse projects • Option 7. Indirect potable reuse of purified recycled water • Option 23. Improved stormwater management • Option 28. Characterising coastal groundwater resources • Option 37. Protecting coastal groundwater resources for town water supplies and rural water users.
Considerations	Managed aquifer recharge requires careful control of injected water quality and quantity. Injection of water to an aquifer can result in dry land salinity, caused by a rising water table which brings with it dissolved salts from the soil profile. This can have severe impacts on soil and vegetation health and can affect the salinity profile of rivers and creeks. Acid sulfate soils in the region may oxidise as a result of managed aquifer recharge projects, leaching toxic levels of acid, iron and aluminium into the groundwater store. The coastal sands aquifers of the Far North Coast region are particularly susceptible to contamination, which may limit managed aquifer recharge suitability. The assessment of this option in this type of groundwater sources would have to be site-specific. The need for additional treatment before injection will limit managed aquifer recharge possibilities as it would increase its cost (such as in the case of Evans Head). Volcanic groundwater sources (North Coast Volcanics and Alstonville Basalt) present better prospects due to higher permeability and storage capacity and also better groundwater quality. In the Alstonville Basalt, demand from industry also exists. The capacity of the North Coast Volcanic Sources is not well known. This option requires: • consideration of the distribution of benefits (such as additional water because of reduced evaporation) amongst consumptive water users and the environment • consideration of equity issues between industries and cross-subsidies in implementing a managed aquifer recharge policy • an assessment of the engineering and economic challenges of managed aquifer recharge • an assessment of the licensing and accounting framework for surface water temporarily stored as groundwater • an assessment of public acceptance of this option (including specific pilot schemes) • an assessment of required policy and legislative changes • an assessment of potential risks: an assessment of water quality, contamination and biosecurity risks associated with transferring water from surface water to groundwater.
Objective	

Option 10. Decentralised desalination

Source: Rous Future Water Strategy 2014

Description	Desalination can be an attractive option for coastal regions as it offers a virtually unlimited, climate-independent source of water. Decentralised, small-scale, often modular, desalination plants can be sited close to a water demand. It is possible to site several of these water plants across the region to supply local demands or to feed into the Rous County Council bulk water supply network. Decentralised desalination plants can be scaled up as the water demand of a town or region grows or to respond to prolonged droughts or extreme events. Several sites have been identified as suitable for local-scale desalination, including Tyagarah and South Ballina.
Intent	Improve resilience of town water supplies in the Far North Coast region.
Challenges addressed	• Region is unprepared for extended dry periods. • Town water demand is expected to exceed supply in the short-to-medium term. • Water demands are shifting.
Potential combinations	This option could be combined with: • Option 1. Interconnection of independent water supplies in the region to the Rous County Council network • Option 2. Interconnection of Rous County Council and Tweed Shire Council bulk water supplies.
Considerations	The siting of such plants in the Far North Coast region may be an impediment. Many suitable locations are prized for their aesthetic value and so may not gain community support. The success of this option would depend largely on finding suitable sites and suitable technologies with small footprints. Brine disposal can be problematic. However, methods and technologies for brine disposal are advancing and it is possible to mitigate possible aesthetic and environmental impacts. Some disposal methods can have economic benefits (e.g. salt production). We have heard from councils that the energy requirements for desalination facilities may make it less attractive to community stakeholders. Environmental issues resulting from greenhouse gas emissions may be associated with operation of a desalination plant. As such, this option may require consideration of green energy options to offset community concern or requirements relating to zero carbon and climate change implications. It would be important to engage stakeholders on how desalination options may improve resilience in water supplies over the long term. Desalination would be used to supplement regional water supplies and provides a climate-independent supply that can become beneficial during drought.
Objectives	

Option 11. Regional desalination

Source: Rous Future Water Strategy 2014 and Northern Rivers Regional Bulk Water Supply Strategy

Description	Desalination offers a virtually unlimited, climate-independent source of water. A regional desalination facility would be able to supplement supply for the entire region, connected to the bulk water supply network. A site south of Pottsville has been identified as a potential location as it could service both the Rous and Tweed systems.
Intent	Improve resilience of town water supplies in the Far North Coast region.
Challenges addressed	• Region is unprepared for extended dry periods. • Town water demand is expected to exceed supply in the short-to-medium term.
Potential combinations	This option could be combined with: • Option 1. Interconnection of independent water supplies in the region to the Rous County Council network • Option 2. Interconnection of Rous County Council and Tweed Shire Council bulk water supplies.
Considerations	A regional desalination facility would provide the greatest benefit if the Rous County Council and Tweed networks were connected. Due to the large infrastructure requirements of such interconnections and the desalination facility, it would likely be a long-term option that would be developed after the immediate supply augmentation needs are met across the region. Environmental issues resulting from greenhouse gas emissions may be associated with operation of a desalination plant. As such, this option may require consideration of green energy options to offset community concern or requirements relating to zero carbon and climate change implications. Brine disposal can be problematic. However, methods and technologies for brine disposal are advancing and it is possible to mitigate possible aesthetic and environmental impacts. Some disposal methods can have economic benefits (e.g. salt production). Such a desalination facility could be located near the border of systems to collect water and distribute to those systems, such as the border of the Tweed and Rous systems. Desalination is energy and treatment intensive and may be a more costly source than many others.
Objectives	

Option 12. Raise Clarrie Hall Dam level

Source: Tweed Shire Council

Description	Raise Clarrie Hall Dam by 8.5 m to achieve an increase in dam storage capacity from 16 GL to 42.3 GL. Tweed Shire Council has identified the raising of Clarie Hall Dam as the best option for the augmentation of its water supply.
Intent	Improve supply security for town water in the Tweed Shire area.
Challenges addressed	• Region is unprepared for extended dry periods. • Town water demand is expected to exceed supply in the short-to-medium term.
Potential combinations	This option could be combined with: • Option 2. Interconnection of Rous County Council and Tweed Shire Council bulk water supplies • Option 4. Connect the regional water system to the South East Queensland water grid • Option 34. Regional Demand Management Program.
Considerations	This option requires: • assessment of potential impacts on cultural heritage sites • assessment of inundation impacts on landholders in the vicinity of the storage • assessment of changes to existing river flow patterns and planned environmental water • assessment of cold water pollution impacts • consideration of the distribution of benefits amongst consumptive water users and the environment • assessment of flow modifications or changed operational regime on connectivity including fish passage, native fish (including threatened species), ecological communities and ecosystems • assessment of flow modifications on riparian vegetation, Endangered Ecological Communities and stream geomorphology, including recovery of vegetation from bank full/channel forming events • review and amendments to the *Water Sharing Plan for the Tweed River Area Unregulated and Alluvial Water Sources 2010*. This option would require assessment under the *Fisheries Management Act 1994*. Environmental assessment processes require sufficient scope to consider the cumulative impact of combined infrastructure options. Tweed Shire Council is currently preparing an Environmental Impact Statement for the project and is due for public exhibition by March 2021.
Objectives	
Further information	**www.yoursaytweed.com.au/RaisingClarrieHall**

Option 13. New dam on Byrrill Creek

Source: Tweed Shire Council Integrated Water Cycle Management

Description	A dam on Byrrill Creek has been proposed in the past as an option for water supply augmentation. The proposed dam design would provide an additional 36 GL storage.
Intent	Improve supply security for town water in the Tweed Shire area.
Challenges addressed	• Town water demand is expected to exceed supply in the short-to-medium term. • Region is unprepared for extended dry periods.
Potential combination of options	This option could be combined with: • Option 2. Interconnection of Rous County Council and Tweed Shire Council bulk water supplies • Option 4. Connect the regional water system to the South East Queensland water grid • Option 27. Addressing cold water pollution.
Considerations	Byrrill Creek has been identified as having high instream values. The proposed inundation area is an area of high biodiversity and is home to a number of threatened flora and fauna species. This option requires: • assessment of potential impacts on cultural heritage sites • assessment of inundation impacts on landholders in the vicinity of the storage • assessment of changes to existing river flow patterns and planned environmental water • assessment of cold water pollution impacts • consideration of the distribution of benefits amongst consumptive water users and the environment • assessment of flow modifications or changed operational regime on connectivity including fish passage, native fish (including threatened species), ecological communities and ecosystems • assessment of flow modifications on water quality • assessment of flow modifications on riparian vegetation, Endangered Ecological Communities and stream geomorphology, including recovery of vegetation from bank full/channel forming events • review and amendments to the *Water Sharing Plan for the Tweed River Area Unregulated and Alluvial Water Sources 2010*. This option would require assessment under the *Fisheries Management Act 1994*. Environmental assessment processes require sufficient scope to consider the cumulative impact of combined infrastructure options. It is noted that Tweed Shire Council have placed a moratorium on not pursuing any new Byrill Creek Dam for 20 years, from 2012. The environment of the catchment also includes significant Aboriginal sites. Byrill Creek Dam would be located within the same catchment as Clarrie Hall Dam. Any investigation may include understanding impacts on secure yield during periods of drought if flows ceased into Byrill Creek and Doon Doon Creek. Tweed Shire Council's strategy is currently focused on raising Clarrie Hall Dam rather than constructing a new dam on Byrrill Creek.
Objectives	

Option 14. New Dunoon Dam on Rocky Creek

Source: Rous Future Water Strategy and Northern Rivers Regional Bulk Water Supply Strategy

Description	A new dam at Dunoon was first proposed in 1995. The proposed site is on Rocky Creek, downstream of the existing Rocky Creek Dam. Three different full-storage capacity options have been proposed: 20 GL, 50 GL and 85 GL. Rous County Council is currently proposing the 50 GL option.
Intent	Improve supply security of town water supply in the Rous County Council network.
Challenges addressed	• Region is unprepared for extended dry periods. • Town water demand is expected to exceed supply in the short-to-medium term.
Potential combinations	This option could be combined with: • Option 1. Interconnection of independent water supplies in the region to the Rous County Council network • Option 27. Addressing cold water pollution.
Considerations	Ecological and cultural heritage constraints have been identified in studies to date. Aboriginal communities have flagged heritage concerns. This option requires: • assessment of potential impacts on cultural heritage sites • assessment of inundation impacts on landholders in the vicinity of the storage • assessment of changes to existing river flow patterns and planned environmental water • assessment of cold water pollution impacts • consideration of the distribution of benefits amongst consumptive water users and the environment • assessment of flow modifications or changed operational regime on connectivity including fish passage, native fish (including threatened species), ecological communities and ecosystems • assessment of flow modifications on water quality • assessment of flow modifications on riparian vegetation, Endangered Ecological Communities and stream geomorphology, including recovery of vegetation from bank full/channel forming events • review and amendments to the *Water Sharing Plan for the Tweed River Area Unregulated and Alluvial Water Sources 2010*. This option would require assessment under the *Fisheries Management Act 1994.* Environmental assessment processes require sufficient scope to consider the cumulative impact of combined infrastructure options. Nightcap water treatment plant may require augmenting in the future to manage the expanded supply. Parts of the community in the Far North Coast region are opposed to the construction of Dunoon Dam due to the impacts on ecology and Aboriginal heritage sites.
Objectives	
Further information	**Rous County Council Future Water Project 2060:** rous.nsw.gov.au/cp_themes/default/page.asp?p=DOC-KZG-22-16-87

Option 15. Increased harvestable rights

Source: Landholders and Department of Planning, Industry and Environment—Water

Description	This option considers increasing the proportion of rainfall that can be captured in farm dams as a harvestable right, which is a form of basic landholder right. In recent years, some coastal landholders have requested that the NSW Government review its policy for harvestable water rights in coastal catchments. The argument put forward by these landholders is that because coastal catchments are shorter and experience higher rainfall than inland catchments, they should be able to sustain a higher proportion of water being taken under harvestable rights. A review of harvestable rights is currently underway and is considering the benefits and impacts of increased harvestable rights and of allowing dams to be built on larger tributaries within NSW catchments that drain to the coast. It aims to determine if greater access to water for agricultural ventures could be allowed while ensuring enough water is available for downstream water users and the environment. **Undertaking this review is an existing NSW Government commitment.**
Intent	• Improve industry access to water. • Improve drought resilience of industry through provision of increased storage capacity.
Challenges addressed	• Region is unprepared for extended dry periods. • Water demands are shifting.
Potential combinations	This option could be combined with other water efficiency and policy options, such as: • Option 22. Convert low flow water access licences to high flow water access licences • Option 33. Active and effective water markets. It could also be combined with Option 17. Increased on-farm water storage.
Considerations	The review is considering the benefits of increasing harvestable rights for agricultural productivity as well as ancillary benefits such as additional water storage for firefighting. It is also considering potential impacts on river flows, water pricing, the environment and downstream water users such as water access licence holders and town water supplies. The review will identify other options for improving water access that could be considered in conjunction with, or instead of, changing harvestable rights limits.
Objectives	
Further information	www.industry.nsw.gov.au/water/licensing-trade/landholder-rights/harvestable-rights-dams

Option 16. Provide purified recycled wastewater for industry and rural users

Source: Department of Planning, Industry and Environment—Water

Description	Highly purified recycled wastewater from sewage treatment plants has the potential to be a reliable, safe and climate-independent water source. The use of treated wastewater for industry and rural users presents an opportunity to both support industry growth and reduce pressure on town water supplies and other water sources. This option could include: • identifying industrial or rural water users within or in close proximity to towns who would benefit from a reliable supply of treated wastewater • constructing third-pipe reticulation systems to supply treated wastewater to industrial water users within towns or in close proximity to towns • supporting industrial water users to develop closed-loop systems to recycle their own water where possible • developing localised wastewater reuse networks in industrial estates to supply industrial water users • constructing distribution pipes to rural areas to supply recycled wastewater to rural water users. This water could be supplied to individual properties from large header tanks and could be used for irrigation or for non-potable domestic uses • ensuring rural households can access recycled wastewater supplies for non-potable uses. This could either be through the rural distribution network described above, or by supporting rural households to install onsite water recycling systems. Ensuring rural households can access recycled water may also act as a drought security measure. During dry periods, this may reduce pressure on rural rainwater tanks and may delay the need for tankers to access town water supplies. This would provide benefits to both rural and town users by increasing the overall security of supply. Potential locations for new or expanded reuse schemes include East and South Lismore sewage treatment plant, Alstonville sewage treatment plant, Ballina and Lennox Head sewage treatment plants, Casino sewage treatment plant and Byron Bay and Brunswick Heads sewage treatment plants.
Intent	• Improve resilience of town water supplies in the Far North Coast region. • Improve capacity of industries to grow.
Challenges addressed	• Region is unprepared for extended dry periods. • Town water demand is expected to exceed supply in the short-to-medium term.
Potential combinations	This option could be combined with: • Option 6. Remove impediments to water reuse projects • Option 34. Regional Demand Management Program.

Option 16. Provide purified recycled wastewater for industry and rural users (continued)

Considerations	There is some precedent to parts of this option in the northern coastal regions of NSW. Coffs Harbour City Council supplies recycled wastewater to irrigators at no cost. The treated wastewater is delivered to large header tanks (approximately 5 ML capacity) and from there fed to a number of properties adjacent to each tank. There are a number of important issues that need to be considered in detail for this option: • there can be large distances between existing wastewater treatment plants and the operations that would need access to treated wastewater. It is more cost effective and practical to develop opportunities for wastewater reuse relatively close to treatment plants • sewage treatment plant releases in the region may provide important flows to waterways and to some extent can help offset impacts caused by extractions. This option will need to consider the impacts on waterways of removing these relatively consistent flows, particularly during low-flow or dry periods • in many regions, recycled wastewater is used for irrigation. However, due to the highly variable irrigation demands associated with the climate of the Far North Coast region, irrigation may not be an appropriate end use for recycled wastewater. However, it may be possible to supply recycled irrigation supplies if adequate storage is also provided. Alternatively, the reuse water may be supplied for uses with a relatively consistent demand such as washdowns, glasshouse agriculture, meatworks, quarries or other industrial processes • it may be more beneficial for some industrial users to recycle their own water. This would reduce treated wastewater demands from local water utility supplies, but may still offer benefits to the system as a whole. Investigations would be required to understand how best to balance these different kinds of reuse scenarios and develop supporting policies • consideration will need to be given to equity of supply and the distribution of benefits between those who are able to access recycled water schemes and those who do not have access • opportunities for integrating wastewater reuse into coastal management programs being developed across the region may prove beneficial as a water quality improvement measure • the cost of recycled water often compares poorly to the cost of extracting water from river and groundwater sources • avoided costs, if any, from the requirements that would apply to the treatment and management of wastewater disposal may be factored into assessment of the costs and benefits.
Objectives	

Option 17. Increased on-farm water storage

Source: Department of Planning, Industry and Environment—Water

Description	Lack of water storage is a major constraint to balancing water supply and demands in Far North Coast catchments. Water storage options that facilitate water extraction during medium and high flows can reduce pressures on low flows, while meeting water demands during dry periods. This option would assess: • the current levels of farm dam implementation and usage • the hurdles to constructing on-farm storages • the value of on-farm storages to various industries in the Far North Coast region • regional consequences of low on-farm water security • risks to downstream water users and the environment from an increase in on-farm dams across the region. On-farm water storage may assist in developing industry responses to emerging markets as they provide greater flexibility in access to water.
Intent	• Increase water security for industry. • Improve drought resilience of industry through provision of increased storage capacity. • Reduce extractive pressures on low streamflows.
Challenges addressed	• Region is vulnerable to extended dry periods. • Major rivers in the region are under hydrologic stress during period of low river flow. • Water demands are shifting.
Potential combinations	This option could be combined with: • Option 15. Increased harvestable rights • Option 18. A grid of off-stream storages in the Far North Coast region • Option 20. Establish sustainable extraction limits for Far North Coast surface water and groundwater sources • Option 22. Convert low flow water access licences to high flow water access licences • Option 25. Fish-friendly water extraction • Option 31. River Recovery Program for the Far North Coast: a region-wide program of instream works, riparian vegetation and sediment control.
Considerations	As farm dams can increase how much water is taken under water access licences, this option may risk placing further pressure on rivers and streams already under hydrologic stress. Increasing on-farm storage is most attractive when considered in conjunction with options looking to shift extractive pressures from low streamflows to high streamflows, as it offers benefits to both extractive water users and river ecology. Increases in on-farm storage may also have impacts on water availability for extractive use, depending on current and future capacity and regulatory settings. They can also reduce runoff to waterways, impacting water quality and ecosystem health. Dam safety requirements (*Dams Safety Act, 2015*) will need to be assessed with consideration to potential impacts on downstream flood risk associated with dam failure.
Objectives	

Image courtesy of Destination NSW.

Option 18. A grid of off-stream storages in the Far North Coast region

Source: Department of Planning, Industry and Environment—Water

Description	The Far North Coast does not have the large storages necessary to provide drought security for industry. However, there are many small farm dams scattered across the region. These dams are typically used for stock watering purposes and minor irrigation. Due to the small size of these dams they generally do not offer much water security for farmers. This option proposes a network of farm dams is developed that can help move water between users. A network of farm dams could use watercourses or pipes as the distribution medium. Dams could be filled by licenced extraction or harvestable rights. Once an order is placed, it may be filled by an upstream dam holder and released to the stream or pipe system for extraction downstream. This option can provide several benefits: • effectively increase the storage capacity of the region without construction of large-scale instream structures • improve the effectiveness of the water market in the region • improve engagement of landholders in water management • provide access to excess water stored on non-productive properties or hobby farms.
Intent	• Improve industry access to water. • Improve drought resilience of industry through provision of increased storage capacity.
Challenges addressed	• Region is unprepared for extended dry periods. • Water demands are shifting.
Potential combinations	This option could be combined with: • Option 20. Establish sustainable extraction limits for Far North Coast surface water and groundwater sources • Option 33. Active and effective water markets.
Considerations	This option requires: • consideration of how to monitor transactions and delivery of water. Microgrids in the energy sector could provide a useful implementation model • detailed consideration of how to integrate this system into the broader water market system currently in place • development of a policy to support the physical movement of water between users. This policy would need to consider the acceptable timing, volume and rate of flows to ensure integrity of the environment • possible modification of water sharing plans. It would also need to consider how changes in land ownership would impact the ownership and rights for storages and network infrastructure.
Objectives	

Option 19. Raise Toonumbar Dam level

Source: Northern Rivers Regional Bulk Water Supply Strategy

Description	Raise Toonumbar Dam to increase storage capacity and encourage additional usage uptake. By increasing the size of the dam and associated water security, dam usage becomes more attractive to business and facilitates the introduction of new users to the regulated system (e.g. town water suppliers). WaterNSW investigations indicate the optimum level increase to be 6 m. Several other dam levels have been considered, including a 10 m and 20 m lift.
Intent	• Increase drought security for existing regulated water users. • Improve resilience of town water supplies in the Far North Coast region.
Challenges addressed	• Region is unprepared for extended dry periods. • Town water demand is expected to exceed supply in the short-to-medium term. • Underutilisation of Toonumbar Dam.
Potential combinations	This option could be combined with: • Option 1. Interconnection of independent water supplies in the region to the Rous County Council network • Option 3. Use Toonumbar Dam to augment town water supplies • Option 20. Establish sustainable extraction limits for Far North Coast surface water and groundwater sources • Option 21. Establish and/or increase environmental water releases from major storages in the Far North Coast • Option 22. Convert low flow water access licences to high flow water access licences • Option 27. Addressing cold water pollution • Option 33. Active and effective water markets • Option 34. Regional Demand Management Program.
Considerations	This option requires: • consideration of sustainable extraction limits and assessment of potential impacts on the reliability of water access licences in the Richmond River Extraction Management Unit • assessment of potential impacts on cultural heritage sites • assessment of inundation impacts on landholders • assessment of changes to existing river flow patterns and planned environmental water • assessment of cold water pollution impacts • assessment of potential impacts on floodplain industries • consideration of the distribution of benefits amongst consumptive water users and the environment • assessment of flow modifications or changed operational regime on connectivity including fish passage, native fish (including threatened species), ecological communities and ecosystems • review and amendments to the *Water Sharing Plan for the Richmond River Area Unregulated, Regulated, and Alluvial Water Sources 2010.* This option would require assessment under the *Fisheries Management Act 1994*. Environmental assessment processes require sufficient scope to consider the cumulative impact of combined infrastructure options.
Objectives	

Protecting and enhancing natural systems

Opportunities to protect and enhance environmental outcomes and realise broader community benefits through a healthy environment.

Option 20. Establish sustainable extraction limits for Far North Coast surface water and groundwater sources

Source: Department of Planning, Industry and Environment—Water

Description	Water sharing plans set the long-term average annual extraction limit (LTAAEL) for surface water and groundwater sources. In most cases, surface water LTAAELs for coastal valleys were set at the sum of existing entitlement, and groundwater LTAAELs were calculated based on an assumed percentage of groundwater recharge. With the imminent remake of water sharing plans and improved information, there is scope to redefine LTAAELs based on ecological, economic, social and cultural water needs. This option would: • investigate methods for defining sustainable levels of extraction based on ecological, economic, social and cultural water needs • quantify the sustainable extraction volumes for surface water and groundwater sources in the Far North Coast at different temporal and hydrological scales based on best available science and understanding of surface water and groundwater processes and knowledge of social and economic impacts • consider amending water sharing plans to legally establish new limits on surface water extraction that reflect sustainable levels • develop a strategy for the controlled allocation of surface water for the Far North Coast if the study identifies available unassigned water • review, and if necessary update, the strategy for the controlled allocation of groundwater if the study identifies changes to existing LTAAELs.
Intent	• Improve our understanding of coastal river systems and their sustainable extraction limits. • Set extractions for productive use across the region at a level that maintains natural ecosystems. • Facilitate access to water for productive use where available.
Challenges addressed	• Water demands are shifting. • Major rivers in the region are under hydrologic stress during periods of low river flow.
Potential combinations	This option would underpin or inform all options relating to increasing access to water for productive use or for the environment.
Considerations	Stating sustainable, volumetric extraction limits in water sharing plans is a recurring recommendation of the Natural Resources Commission in its reviews of coastal water sharing plans. The National Water Initiative also suggests that governments have a responsibility to ensure water is allocated and used to achieve socially and economically beneficial outcomes in a manner that is environmentally sustainable. Extraction limits will need to account for climate change because as the climate changes, the volumes of water that can be extracted sustainably may also change. Other consequences of climate change, such as saltwater ingress to coastal aquifers, will also need to be considered. Further investigations may be required to gain a better understanding of these risks. There are challenges in administering daily extraction limits (such as total daily extraction limits and individual daily extraction limits) due to the lack of metering infrastructure. Extraction limits will need to consider differentiating between types of unregulated water access entitlements. For example, licences to extract low flows are currently treated the same as licences linked to harvesting farm dams that have low-flow bypasses. These farm dams are likely to have a lesser impact on low flows than a licence to extract from the river during these periods. Establishing a sustainable LTAAEL will also need to occur in parallel with a review of trade rules. This is because the trade-in volume will need to align with the defined LTAAELs.
Objectives	
Further information	**Controlled allocations:** **www.industry.nsw.gov.au/water/allocations-availability/controlled**

Option 21. Establish and/or increase environmental water releases from major storages in the Far North Coast

Source: Rous County Council and Department of Planning, Industry and Environment—Water

Description	Establish and/or increase environmental release requirements or environmental contingency allowances from major storages in the Far North Coast region. Release requirements would be informed by an assessment of risks to the riverine ecosystems located downstream of the storages and the ability to mitigate these risks by changing operating rules.
Intent	Maximise secure yields while maintaining environmental flows.
Challenges addressed	Major rivers in the region are under hydrologic stress during periods of low river flow.
Potential combinations	This option could be combined with: • Option 20. Establish sustainable extraction limits for Far North Coast surface water and groundwater sources • Option 32. Improved data collection and information sharing. It could also combine with options that seek to augment water supplies. For example, new environmental flows could be used to offset the ecological impacts of new infrastructure, such as the Dunoon Dam or augmented Toonumbar or Clarrie Hall dams.
Considerations	This option requires a number of important considerations, including: • mechanisms to protect environmental flows • issues associated with cold water pollution • impacts on the reliability of existing water access licences • operational constraints and costs (e.g. Rocky Creek Dam cannot currently make environmental releases as it does not have an outlet structure) • the management of the water, including the need to establish environmental water advisory groups • impacts of climate change and climate variability. An environmental contingency allowance was in place for Toonumbar Dam for the first five years of the current water sharing plan and has now lapsed. The environmental contingency allowance was never used at Toonumbar Dam. Some storages in the region have environmental release requirements set out in the relevant water sharing plans. A key requirement would be to evaluate if the rules in the water sharing plans have allowed for any environmental benefits. Increasing environmental release requirements can have an impact on water security for towns and, as a result, a direct capital cost. Any impacts on town water security and costs will need to be assessed and carefully managed. This option may also impact on the reliability of water access licence and could trigger compensation claims from current licence holders. These impacts would also need to be assessed.
Objectives	

Option 22. Convert low-flow water access licences to high-flow water access licences

Source: Department of Planning, Industry and Environment—Water

Description	Many of the region's rivers and creeks are under hydrologic stress during low flow periods. High flow conversion is when an existing licence is converted to allow extraction of a greater volume of water, but only under high flow conditions. This is an existing policy, but it currently applies only to limited areas and excludes the Far North Coast region. This option would: • review the barriers to, and opportunities for, the conversion of low flow to high flow class access licences in Far North Coast surface water sources • apply the policy to the water sharing plans of the Far North Coast if appropriate • amend existing policy settings to provide incentives for the conversion of licences within sustainable extraction limits.
Intent	• Mitigate the risks of water extractions during low flow periods. • Maximise available water for productive use.
Challenges addressed	• Major rivers in the region are under hydrologic stress during periods of low river flow. • Water demands are shifting.
Potential combinations	This option could be combined with: • Option 15. Increased harvestable rights • Option 17. Increased on-farm water storage • Option 19. Raise Toonumbar Dam level • Option 20. Establish sustainable extraction limits for Far North Coast surface water and groundwater sources • Option 32. Improved data collection and information sharing • Option 33. Active and effective water markets • Option 34. Regional Demand Management Program.
Considerations	This option would proceed from the action to establish sustainable extraction limits for Far North Coast surface water and groundwater sources (Option 20). It could also combine with options to establish and/or increase environmental water releases from major water utility works, protect environmental water and develop a strategy for the controlled allocation of surface water for the Far North Coast.
Objectives	

Option 23. Improve stormwater management

Source: Department of Planning, Industry and Environment—Water

Description	Stormwater is runoff generated from rain falling on impervious surfaces. This option will consider the possibility of precinct-scale schemes to harvest and reuse stormwater in new urban developments. This involves harvesting, storing, treating and delivering stormwater for non-potable use such as the irrigation of local parks or fields. In addition to providing an alternative water source, stormwater schemes can also provide environmental benefits by improving the quality of stormwater discharges to waterways, reducing localised flooding and improving public amenity. This option will identify and investigate potential locations across the region to develop new stormwater harvesting and reuse schemes and adopt water sensitive urban design principles for managing stormwater from urban areas.
Intent	Increase resilience of the regional water supply and improve water quality and local flood risk management, through improved stormwater management.
Challenges addressed	• Town water demand is expected to exceed supply in the short-to-medium term. • Mitigating the impacts of urban and rural land management activities on water quality and waterway stability. • Flooding is a major issue for towns, businesses and communities.
Potential combinations	This option could be combined with: • Option 6. Remove impediments to water reuse projects • Option 9. Managed aquifer recharge investigations and policy.
Considerations	Stormwater is a climate-dependent supply and is unreliable in dry times. Consequently, stormwater storages need to be large enough to capture large rainfall events during the wet season and supply it throughout the dry season. In addition, stormwater is associated with pollutants and requires adequate treatment prior to use. As such, the cost of stormwater harvesting and reuse schemes can be high, making large scale projects more attractive. Urban development modifies and increases runoff to waterways, adversely affecting waterway health and stability. This is often managed by in piping and channelisation of waterways. Stormwater interception, storage and reuse within urban areas can avoid or reduce these impacts and provide opportunities to improve urban amenity—this is often referred to as water sensitive urban design. Water sensitive urban design opportunities are best identified at planning, subdivision and development stage. However, opportunities also arise when street drainage, guttering and footpath renewal are undertaken by local government.
Objectives	

Image courtesy of Destination NSW.

Option 24. Bringing back riverine and estuarine habitats and threatened species

Source: Department of Primary Industries—Fisheries

Description	The riparian and aquatic habitat of NSW has suffered a serious decline in quality and quantity since European settlement. Impacts associated with urban, industrial and agricultural development have placed significant pressure on the natural environment. The 'Bringing Back Threatened Species' program would restore riparian and wetland habitats by protecting and enhancing priority areas using best practice management. This would improve the condition, connectivity, and resilience of habitat and landscape. It would also improve water quality, which provides benefits for the cultural, social and economic wellbeing of river-reliant communities. The program can also build skills and share the knowledge of local landholders, community groups and Aboriginal people. The project would use a catchment management framework and be structured as a five-year partnership with a scoping-study in the first phase to identify high priority targeted works, project partners and detailed costs. On-ground works and evaluation would proceed in Stage 2 of the project.
Intent	• Improve ecological health. • Improve resilience of ecosystems. • Improve social amenity through access to recreational activities. • Improve knowledge sharing and education.
Challenges addressed	• Poor water quality is affecting the environmental health of water sources. • Major rivers in the region are under hydrologic stress during periods of low river flow. • Protecting native and threatened aquatic species.
Potential combinations	This option could combine with several options aimed at protecting and enhancing the environment and Aboriginal heritage, including: • Option 20. Establish sustainable extraction limits for Far North Coast surface water and groundwater sources • Option 21. Establish and/or increase environmental water releases from major storages in the Far North Coast • Option 26. Improve fish passage in the Far North Coast region • Option 29. Protecting ecosystems that depend on coastal groundwater resources.
Considerations	On-ground restoration projects require multi-stakeholder partnerships including with Aboriginal and wider community groups and government agencies. Fostering a strong sense of engagement from communities is critical to meeting regional water strategy objectives, and this is especially so when it comes to protecting and enhancing the environment. Engagement with the community will support efficient delivery of river and marine estate health outcomes, build a greater understanding of issues facing native fish populations, create ownership of local and regional projects, and provide the government with a significant return on its investment. This option would have links to the statewide 'Saving our Species' program, which is led by Department of Planning, Industry and Environment—Environment, Energy and Science. Knowledge gleaned from the 'Saving our Species' program could add significant value to this option. This option is consistent with a number of *Marine Estate Management Strategy* initiatives, in particular *Initiative 5: Reducing impacts on threatened and protected species*.
Objectives	

Option 25. Fish-friendly water extraction

Source: Department of Primary Industries—Fisheries

Description	This option would require the installation of screens on pumps channels to reduce the amount of fish being extracted at pump sites. Native fish can be inadvertently extracted by pumps. From there, the fish are unable to return to the river system. Addressing fish extraction with diversion screening has benefits both for the environment and for pump owners/operators by mitigating blockages caused by debris. This improves water delivery and extraction efficiency and results in on-farm cost savings. The 'Screens for Streams' program will partner extractive water users with scientists and engineers to collaboratively reduce native fish mortality. This option for diversion screening will target high priority reaches or installations in the Far North Coast region.
Intent	Reduce the loss of native fish from the in the Far North Coast region while improving water delivery and extraction efficiency.
Challenges addressed	Protecting native and threatened aquatic species.
Potential combinations	This option could be combined with other environmental options to support a healthy regional environment, including: • Option 17. Increased on-farm water storage • Option 21. Establish and/or increase environmental water releases from major storages in the Far North Coast • Option 24. Bringing back riverine and estuarine habitats and threatened species • Option 26. Improve fish passage in the Far North Coast region.
Considerations	Diversion screening has the following benefits for the community, pump owners and the environment: • it prevents entrainment of adults, larvae and eggs. thereby reducing fish mortalities and supporting population growth. Research by Department of Primary Industries—Fisheries in 2013 found that well designed and installed screens can reduce fish deaths by up to 90%, as well as mortalities for other biota • pump owners save money as a result of reduced costs for fuel and electricity, filters and maintenance. These funds are then available to reinvest in other areas of their business • screens improve water delivery and extraction efficiency through reduced debris blockages • demand for screens provides a boost for manufacturing and retail sectors • screening will deliver ecological outcomes to support regional water strategy objectives without requiring additional water allocations. The program would require: • assessment of the cost-benefits of screening, including environment outputs, water delivery efficiency and long-term social and financial implications to water licence holders • assessment of incentive schemes for landholders to install screens. If the screens are a legislative requirement, a mandatory condition for applicable works approvals may need to be included in the relevant water sharing plans. This would enable enforcement and monitoring of presence/absence of the devices. Note: Diversion screens have been used successfully for decades overseas (for example, in western USA, Europe and New Zealand).
Objectives	

Option 26. Improve fish passage in the Far North Coast region

Source: Department of Primary Industries—Fisheries and Department of Planning, Industry and Environment—Water

Description	Barriers to fish passage are a major contributor to the decline of native fish species. Reflecting this, they are listed as a key threatening process in State and Commonwealth threatened species legislation. The NSW Fish Passage Strategy aims to address the highest priority fish barriers remaining in NSW, including the replacement or remediation of five high priority fish barriers in the Far North Coast region: Jabour Weir (Casino), Eden Creek, Goolmangar, Pioneer Crossing (Coopers Creek) and Eureka Road (Coopers Creek). Remediating these structures will: • improve the ability of native and threatened fish species to move along waterways to access important habitat and food sources • improve the ability of fish to access reproductive and spawning grounds in the system • improve growth and survivorship of native and threatened fish species. The NSW Fish Strategy is scheduled to be carried out over multiple phases.
Intent	• Maintain and improve native fish access to core habitat in the Far North Coast region. • Improve fish movement through fishways and encourage breeding and spawning activities, especially for threatened species. • Improve recreational fishing and regional tourism opportunities.
Challenges addressed	Protecting native and threatened aquatic species.
Potential combinations	This option could be combined with: • Option 20. Establish sustainable extraction limits for Far North Coast surface water and groundwater sources • Option 21. Establish and/or increase environmental water releases from major storages in the Far North Coast • Option 24. Bringing back riverine and estuarine habitats and threatened species • Option 25. Fish-friendly water extraction • Option 27. Addressing cold water pollution.
Considerations	Many native fish species in the Far North Coast region require unimpeded access through waterways to carry out natural reproductive and migratory processes. Physical waterway barriers such as weirs and dams can limit these processes leading to a decline in the health and viability of native fish populations. Suitable environmental water management settings need to be in place to secure hydrological connectivity between connected river reaches. Fish passage remediation can only assist in mitigating the impact of barriers to fish passage in hydrologically connected systems. Local water utility and water user access requirements will need to be considered in the design of new fishway structures to ensure reliability of supplies are not negatively impacted or are offset. Bray Park Weir in the Tweed Shire local government area and Cookes Weir (on the Richmond River near Casino) have been previously identified as requiring fish passage remediation. An existing regulatory requirement exists to provide fish passage at Bray Park Weir. Contracts are in place to undertake fish passage remediation works at Cookes Weir by the end of the 2020.
Objectives	
Further information	www.dpi.nsw.gov.au/fishing/habitat/threats/barriers www.marine.nsw.gov.au/strategy-implementation/delivering-healthy-coastal-habitats-with-sustainable-use-and-development/re-connecting-fish-habitats

Option 27. Addressing cold water pollution

Source: Department of Planning, Industry and Environment—Water

Description	Cold water pollution—an artificial decrease in the temperature of water in a natural river—is caused by cold water being released into rivers from large dams during warmer months. This can be detrimental to ecological health. Between spring and autumn, the water stored in large dams can form two layers; a warm surface layer overlying a cold bottom layer. This option aims to evaluate the degree of cold water pollution impacts from existing storages in the Far North Coast and to work with asset owners to implement appropriate capital and operational responses to mitigate those impacts. This option is structured as a five-year partnership with a scoping-study in the first phase to assess the issue and identify suitable works and project partners.
Intent	• Restore near-natural river water temperature to provide native and threatened fish species in the Far North Coast systems with the necessary environmental cues to spawn, recruit, move and grow. • Improve social amenity through access to recreational activities.
Challenges addressed	Poor water quality is affecting environmental health of water sources.
Potential combinations	This could be combined with any of the dam augmentation options, including: • Option 12. Raise Clarrie Hall Dam level • Option 13. New dam on Byrrill Creek • Option 14. New Dunoon Dam on Rocky Creek • Option 19. Raise Toonumbar Dam level.
Considerations	The major storages in the Far North Coast region vary in their likelihood of releasing cold water to the environment. While Toonumbar Dam has a destratification system, the dam was identified in the *NSW Cold Water Pollution Strategy* as having the potential to cause moderate cold water pollution effects. Clarrie Hall Dam does not have a destratification system and is likely to intermittently cause cold water pollution effects. Emigrant Creek Dam does have a destratification system and, due to its location just upstream of Killen Falls, cold water pollution effects are likely to be minimal. Rocky Creek Dam does not have an outlet structure so it does not provide releases for downstream flows. There is a lack of monitoring sites both upstream and downstream of storages in the region. This can make it difficult to determine the extent of cold water pollution. This option would include: • alignment with *NSW Cold Water Pollution Strategy* • assessment of existing temperature metrics against best-practice frameworks for managing impacts on aquatic fauna • examination of the extent and magnitude of cold water pollution effects from storages in the region • an exploration of the potential for, and feasibility of, technologies (such as augmentation of dam outlets, improvements to mixing regimes, and modifications to water delivery mechanisms) to mitigate cold-water pollution effects.
Objectives	
Further information	www.dpi.nsw.gov.au/fishing/habitat/threats/cold-water-pollution www.industry.nsw.gov.au/water/science/surface-water/quality/temperature

Option 28. Characterising coastal groundwater resources

Source: Department of Planning, Industry and Environment—Water

Description

Over the next 30 years, there will likely be increasing use of and competition for groundwater resources between landholders, towns, irrigation and other industries. Climate change and rising sea levels will also impact the recharge rates and storage volumes of coastal groundwater resources. These resources will be under increasing pressure in the coming decades. There is an opportunity to ensure that groundwater supports a prosperous and liveable Far North Coast region.

To be well placed to respond effectively to the groundwater management challenges of 2020-2050 we need to further invest in the characterisation of:

- coastal sands
- floodplain and upriver alluvials
- volcanic rock aquifers (e.g. Alstonville Plateau)
- Clarence Moreton Basin
- underlying basement rocks.

In this option, the groundwater resources for these areas would be characterised in six steps:

1. Geological, geophysical, geochemical, ecological and hydrogeological field investigations combined with compilation of all available information via a comprehensive literature review. Such field investigation would be done by Department of Planning, Industry and Environment—Water in collaboration with the NSW Geological Survey. This will provide us with baseline information on the availability and vulnerability of the resources (e.g. levels of fracturing, likely water quality, etc).
2. Expansion of the monitoring network and programs. Currently, the NSW Government has a network of monitoring bores and monitors water levels and quality parameters. This was fit-for-purpose for the prior level of development in the region. This option will determine whether a new injection of funds to upgrade the network/programs is now required, given increasing population pressure and potential climate change impacts.
3. Metering of spearpoints, bores, wells, and all other forms of groundwater take. This is being addressed by the NSW Government's metering reforms. Consideration should be given to whether there is a need for smaller bores not currently captured by theses reforms to be metered.
4. Development of conceptual groundwater models. By combining the data collected in the first three steps we will have a better idea of how much groundwater is available, how it recharges, where it discharges, and how the extraction impacts on the resource. Such analysis and synthesis of the data into useful information and insights would be done by Department of Planning, Industry and Environment—Water in collaboration with universities and other research institutions such as ANSTO and CSIRO.
5. Development of numerical groundwater flow and transport model(s). Historically, the NSW Government has modelled the six large inland alluvial aquifers—where most of the state's groundwater abstraction occurs (predominately for irrigation). Numerical models are also needed for the coastal groundwater resources. This would involve consideration of the impacts of climate change on the availability of groundwater resources given changes to recharge and the salinisation of coastal sands due to sea level rise. The priority for this work across the state will need be determined through a risk assessment process.
6. Publishing of annual resource updates. These would be web-based and include a plain english version of the applicable regulations, explain who and what is impacting the resource, and identify any emerging risks.

Intent

Ensure the NSW Government and the community have the required data and knowledge to inform groundwater management frameworks and decisions.

Challenges addressed

- Lack of data to inform decision-making and other assessments.
- Ensuring the NSW Government and the community have the required information to inform groundwater management frameworks and decisions.

Option 28. Characterising coastal groundwater resources (continued)

Potential combinations	This option would provide the data for subsequent options, including: • Option 29. Protecting ecosystems that depend on coastal groundwater resources • Option 37. Protecting coastal groundwater resources for town water supplies and rural water users • Option 38. Planning for climate change impacts on coastal groundwater resources • Option 39. Planning for land use pressures on coastal groundwater resources.
Considerations	Development of groundwater sources is an opportunity in coastal regions to increase reliability of water supply in drought times. This must only be done with an improved understanding of the resources and their dependent ecosystems. Good groundwater management is underpinned by area-specific knowledge of the groundwater resources. Our knowledge of a groundwater resource can always be improved. Consequently, there will always be a need to invest in characterising the resources. The level of investment required at a given time should be guided by the level of current and predicted risk to the resource and opportunities for its development. This option is consistent with the recommendations of the NSW Chief Scientist and Engineer's *Independent Review of the Impacts of the Bottled Water Industry on Groundwater Resources in the Northern Rivers Region of NSW*.
Objective	
Further Information	www.chiefscientist.nsw.gov.au/independent-reports/bottled-water-in-the-northern-rivers

Option 29. Protecting ecosystems that depend on coastal groundwater resources

Source: Department of Planning, Industry and Environment—Water

Description	A critical but often overlooked element of the water cycle is groundwater and groundwater dependent ecosystems (GDEs). GDEs support a range of species and provide important ecosystem services such as habitats. They also have inherent environmental value. GDEs are classified broadly as terrestrial (vegetation communities), aquatic (wetlands and springs) or subterranean (aquifers and caves). These ecosystems support a variety of fauna and flora communities. It is critical that groundwater dependent vegetation is also maintained during droughts when groundwater is also needed to support communities. In this option, a series of projects would be initiated to advance our knowledge and management of GDEs. These projects would: • review and develop new methods to monitor the vegetation condition of GDEs (including root depth and response to drought) • develop policy that supports recognition and protection of all GDE types including those that are only partially reliant on groundwater • formalise water quality guidelines for groundwater ecosystems • create guidelines on how to characterise a GDE and what an impact assessment should consider • develop a state-level sampling method and assessment guidelines for all GDE types • identify groundwater bioregions to provide a basis for management and setting baseline conditions for future monitoring and create an information source for offsetting • determine groundwater regimes for GDEs and include climate change in determining threshold changes to GDEs • implement a groundwater health index monitoring program and establish baseline conditions for the groundwater health index on the coast • ground truth the GDE schedule in the water sharing plans and 'High Probability High Ecological Value Aquatic Ecosystems GDEs' identified from the geographic information system analysis • standardise sample collection, data and reporting by third parties to feed into a centralised database • create a NSW 'single point of truth' portal for GDEs that includes government and industry data, and high-quality metadata • collaborate with universities and other research organisations (for example, via future projects included in the water science research prospectus) • revise the high ecological value aquatic ecosystems (HEVAE) geographic information system layer used for risk assessments • review and amend water sharing plans to list high-priority GDEs.
Intent	Support groundwater dependent ecological processes that support soils, fauna and flora and establish and maintain environments that are valuable to coastal NSW.
Challenges addressed	• Poor water quality is affecting the environmental health of water sources. • Lack of data to inform decision-making. • Protecting native and threatened aquatic species.
Potential combinations	This option could be combined with: • Option 28. Characterising coastal groundwater resources • Option 32. Improved data collection and information sharing.

Option 29. Protecting ecosystems that depend on coastal groundwater resources (continued)

Considerations	Development of groundwater sources is an opportunity in coastal regions, in particular to increase reliability of water supply in drought times. This must only be done while protecting the resources and their dependent ecosystems. This option requires: • increased bore network to target groundwater dependent ecosystem locations for monitoring and evaluation • better quantification of the relationships between groundwater GDEs, availability and extraction volumes • understanding the role of natural recharge and flooding on GDEs • groundwater salinity monitoring and management • educational and communication material to promote awareness of GDEs including the relationships between above and underground processes and benefit to the local environment • inclusion of Aboriginal cultural connections to GDEs • consideration of changes to water sharing plans to include additional high priority groundwater dependent ecosystems.
Objectives	

Option 30. Northern Rivers Watershed Initiative

Source: Rous County Council and Northern Rivers Joint Organisation

Description	The Northern Rivers Watershed Initiative (NRWI) is a catchment and estuary restoration program that has been specifically devised for the 'footprint' of the Northern Rivers Joint Organisation to address ecosystem health, water security and flood risk issues across the Tweed, Brunswick, Richmond and Evans River systems in an integrated way. The NRWI is based on a holistic approach to the management of water within the catchments that will use modern, best practice approaches in catchment modelling and natural flood mitigation to target improvements in stream bank condition and river health that also contribute to reduced flood risk within the catchments. The NRWI is premised on the concept of natural flood management, consisting of a range of measures that aim to restore the natural functioning of river catchments, floodplains and rivers to retain water in the landscape in order to reduce downstream flood risks. The NRWI would involve large-scale investment in catchment works in upper catchment areas. These works would restore natural hydrologic functions that deliver improvements in stream bank condition and river health, and that also contribute to reduced flood risk within the catchment. In addition, it would involve implementation of coastal zone management plan actions to address high priority estuarine health issues. These measures would deliver a range of environmental, social and economic benefits. Preliminary scoping of the scale of work needed to address this initiative indicates that a budget in the order of $150 million over 10 to 15 years would be required to effect the necessary changes across the landscape.
Intent	• Improve flood management throughout the region. • Improve the health of waterways across the region.
Challenges addressed	• Flooding is a major issue for towns, businesses and communities. • Major rivers in the region are under hydrologic stress during periods of low river flow. • Poor water quality is affecting the environmental health of water sources.
Potential combinations	This option could be combined with: • Option 24. Bringing back riverine and estuarine habitats and threatened species • Option 31. River Recovery Program for the Far North Coast: a region-wide program of instream works, riparian vegetation and sediment control.
Considerations	It is important that the NRWI integrates with existing initiatives in each river system. This includes coordination with the rollout of the *NSW Marine Estate Management Strategy 2018–2028* and the Richmond River Governance and Funding Framework. The NRWI operates at a whole-of-catchment scale, while the *Marine Estate Management Strategy* focuses on estuary and coastal areas. This allows the NRWI to address issues in the upper parts of the Far North Coast catchments more so than the Marine Estate Management Strategy. An integrated catchment-scale approach is important to ensure that other substantial investments (such as the targeted works being undertaken under the Marine Estate Management Strategy) are contributing in an integrated manner to an agreed catchment vision and to associated catchment-wide adaptive management and monitoring frameworks. The NRWI would also integrate natural flood management measures and implementation of high priority Coastal Zone Management Plan actions throughout the Tweed, Brunswick, Richmond and Evans River catchments and estuaries. The Coastal Zone Management Plans are currently transitioning to a new framework consistent with the *Coastal Management Act 2016*. This will mean that any actions in a Coastal Management Plan need to be implemented through a council's Integrated Planning and Reporting framework and land-use planning systems. The injection of external resources will be needed, otherwise high priority actions within future coastal management plans will be truncated to align with a council's existing budgetary process.
Objectives	

Option 31. River Recovery Program for the Far North Coast: a region-wide program of instream works, riparian vegetation and sediment control

Source: Department of Planning, Industry and Environment—Water

Description	Land clearing associated with European settlement has had detrimental impacts on river catchments in the Far North Coast region. Due to the removal of vegetation and straightening of rivers, water now moves more quickly through the catchment, leading to less water being stored in the landscape and consequently longer dry periods. Furthermore, water now moves through the landscape with more energy, eroding land and degrading water quality by increasing sediment loads. Recent bushfires in the region have considerably exacerbated these challenges. Instream works such as log jams, rock chutes and log weirs, along with riparian vegetation, can help reverse this degradation by slowing the movement of water through the landscape, reducing erosion and decreasing sediment loads in streams. This option will consider the costs and benefits of a region-wide program to better manage catchment hydrology and erosion by providing landholders with financial assistance and technical expertise. Such a program would build on previous work, as well as current programs such as the Coastal Management Programs that are being developed by local councils.
Intent	• Slow the movement of water through the catchment. • Reduce stream-bed and bank erosion. • Improve water quality in watercourses. • Attenuate minor flood flows. • Increase in-channel water storage and groundwater recharge.
Challenges addressed	• Susceptibility to sea level rise due to climate change. • Region is vulnerable to extended dry periods. • Flooding is a major issue for towns, businesses and communities. • Major rivers in the region are under hydrologic stress during periods of low river flow. • Poor water quality is affecting the environmental health of water sources.
Potential combinations	This option could be combined with: • Option 17. Increased on-farm water storage • Option 30. Northern Rivers Watershed Initiative.

Option 31. River Recovery Program for the Far North Coast: a region-wide program of instream works, riparian vegetation and sediment control (continued)

Considerations	A River Recovery Program that is properly resourced to address policy, technical and financial resources could be designed and delivered through a regional delivery model involving collaboration between the Department of Planning, Industry and Environment—Water, Department of Planning, Industry and Environment—Environment, Energy and Science, Department of Primary Industries—Fisheries and the North Coast Local Land Services. It would also require collaboration with Rous County Council, local councils and Native Title holders. Although there are considerable benefits to be gained there is also scope for instream works to have detrimental effects on the environment and water users if not properly implemented or if implemented in the wrong places. A program such as this needs significant scientific/technical support to ensure the options being considered are suitable for their proposed locations. Strategic planning to identify suitable locations will be required. Instream works are also expensive, often require the most productive land to be taken out of production and their benefits may take years to be fully realised. Instream works must also be designed and constructed by experts in the fields of river engineering and fluvial geomorphology. There are numerous examples across the state where poorly designed and poorly constructed works have exacerbated rather than reduced soil erosion. The NSW Government has previously provided financial incentives and technical expertise to construct instream works. However, there have been varying degrees of uptake of these types of programs in NSW in the past. This option supports a number of actions proposed by the *NSW Marine Estate Management Strategy 2018-2028*, including: Action 1.3.2: Riparian vegetation improvements by planting native trees, shrubs and ground covers and fencing out stock from waterways. Action 1.3.4: Bank protection works to reduce sediment input into estuaries from eroding river banks. Action 1.2.11: Conducting social research into behaviour around what drives different agricultural industry groups and communities to adopt change and how to influence the adoption of agricultural best management practice for priority industries. Action 1.3.6: Road and track improvements, such as road surface sealing or stormwater runoff controls, to reduce sediment input into waterways from unsealed roads.
Objectives	
Further Information	***NSW Marine Estate Management Strategy 2018-2028*:** **www.marine.nsw.gov.au/marine-estate-programs/marine-estate-management-strategy**

Supporting water use and delivery efficiency and conservation

Opportunities to improve the efficiency of existing water delivery systems, increase productivity and address water security challenges through demand management options.

Option 32. Improved data collection and information sharing

Source: Department of Planning, Industry and Environment—Water, Department of Primary Industries—Fisheries and NSW Marine Estate Management Strategy 2018–2028

Description	The Far North Coast region suffers from a paucity of water data, particularly regarding water quality in surface and groundwater systems, and groundwater levels. There is also a lack of data on fish communities as well as an understanding of the relationship between flow and native fish and ecological health in the region. This option proposes that the NSW Government improves data collection on the environment (particularly water quality and groundwater levels), industrial water use (by industry sector) and town water in the Far North Coast region. This would improve information and knowledge to inform future water planning and management decisions in the region. This could include: • investigating ways to efficiently harness water data collected through local water utilities and water providers, including metered water use data collected through the implementation of the non-urban metering framework from 1 December 2023 onwards • investigating ways to harness water data collected by industries • providing incentives for voluntary uptake of metering and telemetry, or review current policy thresholds on pump sizes requiring metering • coordinating with WaterNSW to undertake an audit of monitoring bore integrity and a hydrometric review of existing gauges • investigating opportunities to refurbish existing infrastructure (such as groundwater monitoring bores) and installing new infrastructure and technology to enable better collection of water flows, levels and quality parameters • a review of the water monitoring programs that use the monitoring infrastructure and preparing a unified state-wide monitoring program strategy • gathering more information on factors affecting water quality (e.g. flows required to maintain ecological processes, latitudinal and longitudinal connectivities, drainage of wetlands/ backswamps, impacts of bushfires on water quality and impacts of migration of saltwater due to extractions) • consideration of how best to share data (both publicly and within government), and the information products that are needed for different types of water users and water managers • developing an open and comprehensive data-sharing platform to enable government, councils, natural resource management organisations and citizen scientists to both submit and access important water data • developing 3D geological, numerical flow, and reactive transport models for groundwater systems to inform future management practices. In relation to fish communities, this option could include: • structural assessment of fish communities • development of ecological monitoring, evaluation and reporting frameworks • development of environmental watering requirements to understand flow related biological needs for aquatic biota (e.g. native fish, frogs and birds) including threatened species.
Intent	Inform future water management decisions in the Far North Coast region.

Option 32. Improved data collection and information sharing (continued)

Challenges addressed	Lack of data to inform decision-making.
Potential combinations	This option would support the design, development and implementation of future options for the Far North Coast region.
Considerations	A lack of necessary fish data is preventing the development of the objectives and indicators required to manage commercial, recreational and threatened fish species. It is also hampering identification of environmental flow requirements and development of aquatic habitat strategies. Given the complexity of data needs and the number of agencies required, a strong governance and coordination framework is needed to coordinate and plan improvements. This option would need to consider: • provision of guidance/guidelines on data provision • performance reporting requirements for local water utilities • setting requirements for standardising data loggers and data formats • how to improve data quality and increase sampling compliance by implementing a quality management program • how best to apportion clear roles and responsibilities • funding arrangements for ongoing monitoring • links with the NSW non-urban water metering framework • incentives to encourage monitoring, data provision and use of the resulting data sets (e.g. through pricing structures) • integration with existing NSW Government data platforms such as Sharing and Enabling Environmental Data (SEED). This option may also require: • a review of legislation around point versus diffuse pollution sources and defining the roles and responsibilities for both types of pollution across government agencies • a review the legislative mechanisms for managing groundwater quality • integration with a state-wide strategy for monitoring groundwater quality.
Objectives	
Further Information	**NSW Non-urban metering framework:** **www.industry.nsw.gov.au/water/metering** **SEED (portal for Sharing and Enabling Environmental Data):** **www.seed.nsw.gov.au/**

Image courtesy of Destination NSW.

Option 33. Active and effective water markets

Source: Department of Planning, Industry and Environment—Water

Description	Water markets should allow water access licence holders to trade water in connected systems to where it is most needed. However, barriers often prevent effective trade. This option proposes to review of the effectiveness of water markets (unregulated, regulated and groundwater) in the Far North Coast, including their ability to contribute to improved water security outcomes in the region. The review could examine the regulatory (water rights, use and pricing) and hydrological and operational (delivery and metering) challenges and opportunities associated with developing an effective water market for the region and propose ways to overcome existing barriers.
Intent	• Provide transparency and confidence to water users in the Far North Coast. • Educate water users about the operation of and rules governing water trade in the Far North Coast. • Improve and broaden the market to create opportunities to move water more effectively.
Challenges addressed	• Region is vulnerable to extended dry periods. • Underutilisation of Toonumbar Dam. • Water demands are shifting.
Potential combinations	This option could be combined with several options aimed at improving water efficiency and sustainable water use, including: • Option 15. Increased harvestable rights • Option 18. A grid of off-stream storages in the Far North Coast region • Option 20. Establish sustainable extraction limits for Far North Coast surface water and groundwater sources • Option 22. Convert low flow water access licences to high flow water access licences.
Considerations	The water market in the Far North Coast has been almost completely inactive since the dealing rules were established in water sharing plans. There are no established water brokers in the region, information about the water market is limited, and some water users have expressed frustration about administrative barriers to trade. A large proportion of entitlement in the Richmond River regulated system is inactive, which not only represents a wasted resource, but also restricts annual water determinations for all general security users. Since the preparation of the existing water sharing plans, we have developed a better understanding about the ecological value of specific reaches of streams. This knowledge provides an opportunity to review and introduce more sophisticated trade zones and rules. There is also an opportunity to learn from the more developed water markets that exist in the southern Murray-Darling Basin.
Objectives	

Option 34. Regional Demand Management Program

Source: Rous Future Water Strategy 2014 and Northern Rivers Regional Bulk Water Supply Strategy

Description	Demand management is fundamental to good water management. Rous County Council currently coordinate demand management planning for constituent councils that use the Rous County Council bulk water supply, while Kyogle Council and Tweed Shire Council manage their own demand management programs. This option will consider the coordination of a region-wide demand management program that would include all local water utilities in the Far North Coast. The program could also include rural water users within the council areas of the region. This could bring consistency in approach and efficiencies in monitoring and implementation across the Far North Coast region and may delay and downsize future water sources required for the region. Other opportunities for regional demand management include: • education and awareness and development of consistent messages to the community through public education resources, regional advertising and recognition programs • purchasing and improving economies of scale • improved training for local water utility staff • common guideline development (e.g. for rainwater tanks and irrigation) • centralised monitoring and data intelligence services that could be used to detect leakage that might otherwise go undetected.
Intent	• Improve consistency in approach to demand management across the region. • Improve efficiency of monitoring and implementation.
Challenges addressed	Region is vulnerable to extended dry periods.
Potential combinations	This option could be combined with any supply augmentation options to improve the secure yield of those options.

Option 34. Regional Demand Management Program (continued)

Considerations	A regional demand management plan was developed in 2015 by the Northern Rivers Water Group. The group comprised representatives from the Far North Coast councils, Clarence Valley Council and Coffs Harbour Water who worked collaboratively on regional water issues. The plan did not set a detailed demand management plan, but rather identified priorities and implementation actions, and laid the groundwork for understanding the constraints and opportunities for demand management at the regional scale. Barriers to regional demand management identified by the plan include: • there is currently no legislative or planning driver that exists to bring together demand management planning or initiatives across the region • there are differing demand management priorities between councils and within each council • regional demand management activities must be compatible with existing plans and achieve balance between regional cooperation and remaining locally relevant • each council is at a different stage of implementation of demand management • differing demographics across councils meaning that a 'one size fits all' approach to engagement and education programs may not be suitable • generic water efficiency messages are no longer effective. People will respond to specific offers/actions relevant to their circumstances and this may be dependent on particular target audiences within each council area • some councils have limited human and budget resources. This option requires: • investigation into the current demand management arrangements to understand if there are flaws to be addressed • careful consideration of governance arrangements for administration of the program • collective agreement on investment and rebate programs. This option could include development of a monitoring and evaluation program to ensure that demand management initiatives continue to perform well over the long term.
Objectives	
Further information	**Rous County Council Demand Management:** www.rous.nsw.gov.au/cp_themes/default/page.asp?p=DOC-IMY-52-35-17 **Tweed Shire Council Demand Management Strategy:** www.yoursaytweed.com.au/42403/widgets/232002/documents/95457

Option 35. Regional network efficiency audit

Source: Department of Planning, Industry and Environment—Water

Description	Leakage is the component of water that is lost in the system and does not make it to the customer. The type of leakage, or non-revenue water, can be categorised into one of three categories: • Reported bursts—visible at the surface and reported by the public or utility staff. • Unreported bursts—not visible at the surface, and usually picked up through investigation or leak detection surveys. • Background leakage—small leaks that cannot be detected by, which over time may gradually worsen until they can be detected. The proportion of non-revenue water is higher across the Far North Coast than the NSW median. This option would establish a region-wide audit of major water supply network infrastructure leakage to assess the volumes and locations of leakage against agreed performance indicators. The audit would also identify opportunities and region-wide strategies to reduce leakage, for example through improved leak detection and hydraulic control.
Intent	• Improve resilience of town water supplies in the Far North Coast. • Improve the efficiency of monitoring and implementation.
Challenges addressed	Town water demand is expected to exceed supply in the short-to-medium term.
Potential combinations	This option could combine with: • Option 32. Improved data collection and information sharing • Option 34. Regional Demand Management Program.
Considerations	Managing water loss is a core function of local water utilities. Research suggests that water supply customers expect utilities to do their best to minimise leaks and breaks and reduce water waste, especially when they are asked to save water during drought conditions. However, leakage reduction measures are sometimes less cost-effective than other options to improve water supply efficiency. We have heard from local councils that staffing and funding shortages are major impediments to improving water supply efficiency. According to the Water Services Association of Australia, water utilities across Australia use different strategies to reduce leakage including: • pressure management—reduction of excess average and maximum pressures • active leakage control—monitoring of flows in metered areas to identify leaks and repair before they become a greater issue • pipeline and assets management—material selection, installation, maintenance, rehabilitation and replacement, and is commonly associated with renewals • speed and quality of repairs—repairs done quickly and to a suitable standard. This option would assess the effectiveness of leakage strategies adopted by Far North Coast region local water utilities and identify opportunities for these strategies to combine to positively influence each other.
Objectives	
Further information	**Water Services Association of Australia Ltd 2019, Reducing Leakage in Australia, www.wsaa.asn.au/publication/reducing-leakage-australia**

Image courtesy of Destination NSW.

Strengthening community preparedness for climate extremes

Opportunities to develop fit-for-purpose policies and regulation to protect town water security, strengthen community health and wellbeing and better manage risks.

Image courtesy of Destination NSW.

Option 36. Apply the NSW Extreme Events Policy to the Far North Coast region

Source: Department of Planning, Industry and Environment—Water

Description	The NSW Extreme Events Policy provides a transparent framework for making decisions during extreme events, including what those decisions are, when they are made and who makes them. This information allows water users to make plans during extreme events with more confidence and provides more certainty for the water market. The policy is designed to facilitate early intervention and delay the need to suspend certain water sharing arrangements so that suspension will only occur during more severe water stress and water quality events. The policy establishes the principles for managing extreme events for major water sources. It provides a transparent decision-making framework based on an assessment of risk and need in the face of competing priorities and demands. This option would: • amend the Extreme Events Policy to apply to all of NSW • establish a Critical Water Advisory Panel for the Far North Coast region • develop an incident response guide for the Far North Coast region.
Intent	Provide clarity in decision-making during periods of severe water stress drought and severe water quality events.
Challenges addressed	Region is vulnerable to extended dry periods.
Potential combinations	This option could combine with: • Option 32. Improved data collection and information sharing • Option 34. Regional Demand Management Program • Option 37. Protecting coastal groundwater resources for town water supplies and rural water users.
Considerations	Development of environmental water requirements could inform extreme event thresholds. Currently, the policy only applies to the Murray-Darling Basin. This option would extend the policy to coastal regions as well to provide local water utilities and other water users clarity and direction during periods of drought. The extreme events covered could also include the impact of rainfall and flooding associated with former tropical cyclones, and water infrastructure recovery. A review of the policy following the most recent drought has highlighted possible improvements to the framework that should be considered before applying the existing policy to coastal areas. Consideration should be given to the role of Toonumbar Dam during extreme droughts. This could include identifying whether a minimum reserve is required for emergency town supply, or whether to designate it as a source for water carting.
Objectives	
Further information	**Extreme Events Policy:** www.industry.nsw.gov.au/water/what-we-do/legislation-policies/eep

Option 37. Protecting coastal groundwater resources for town water supplies and rural water users

Source: Department of Planning, Industry and Environment—Water

Description	Coastal sands are shallow, unconfined, highly porous and permeable. As such, they can be a ready source of groundwater during droughts for both town water supplies and rural water users. A proactive approach requires appropriate policy and infrastructure to ensure adequate groundwater access and sustainable use during times of low surface water availability. Protecting coastal groundwater resources that provide an emergency drought reserve has two elements: • assessing and securing groundwater availability • assessing and protecting groundwater quality. In this option, Department of Planning, Industry and Environment—Water, in consultation will councils, would build on the information collated in Option 28. Characterising coastal groundwater resources to collect further information on: • current and future water demands including critical human needs • surface water reliability • current borefield capacity • aquifer capacity (around the borefield, as distinct from the water-source scale) • quality of groundwater in aquifer surrounding borefield. Up-to-date maps of aquifer availability and vulnerability would be created. For those towns at high risk, monitoring bores would be installed in the aquifer around the borefields and a process established to collate information from the bores into a state-owned database. This information will allow the NSW Government to plan where to best target resources, while allowing local councils to prepare for future droughts. This option would also: • clarify roles and responsibilities between the NSW Government and local councils for securing groundwater access for critical human and high priority needs • address policy gaps with respect to local water utility access to groundwater. • improve communication campaigns to rural water users leading up to and during drought • consider the viability of a groundwater supply network that feeds into local water utility infrastructure during drought • assess the need for a raw water supply network for rural water users to access during drought. This option does not replace or pre-empt any current or future reviews of integrated water cycle management guidelines, section 60 approval processes, local government reforms and the like.
Intent	Ensure towns and rural groundwater users are prepared for drought.
Challenges addressed	• Providing reliable and safe town water supplies. • Region is vulnerable to extended dry periods. • Lack of data to inform decision-making. • Ensuring the NSW Government and the community have the required information to inform groundwater management frameworks and decisions.
Potential combinations	This option would build on Option 28. Characterising coastal groundwater resources. It also links with: • Option 36. Apply the NSW Extreme Events Policy to the Far North Coast region • Option 39. Planning for land use pressures on coastal groundwater resources.
Considerations	Development of groundwater sources is an opportunity in coastal regions, in particular to increase reliability of water supply in drought times. The definition of critical human needs in the *Water Management Act 2000* may need to be revised.
Objectives	

Option 38. Planning for climate change impacts on coastal groundwater resources

Source: Department of Planning, Industry and Environment—Water

Description	Coastal groundwater resources provide fresh and easy-to-access water for communities and industries. They support baseflows to creeks and rivers and provide water for ecosystems. The shallow nature of coastal groundwater resources provides advantages but also means they are vulnerable to the impacts from climate change and sea level rise. Possible impacts include: • reduced water availability for consumptive use and the environment due to reduced groundwater recharge from changes in rainfall and increased evapotranspiration • salination of aquifers by seawater intrusion and inundation, impacting both water supplies and ecosystems that rely on groundwater • waterlogging, contamination (from septic tanks or inadequately designed or maintained bores) and flooding due to high groundwater tables. The expected magnitude of these impacts varies greatly depending on local conditions. In this option, Department of Planning, Industry and Environment—Water would collaborate with Local Land Services, councils and universities to co-design and implement local-scale projects to: • identify areas which are at risk to one or more of the above impacts • undertake numerical modelling to predict the impacts • conduct a quantitative risk assessment of salinity induced by land management and pumping in all groundwater sources • create monitoring networks and programs to measure the impacts • establish a cross-agency governance group to annually review the above three steps, and publish its findings online for transparency and accountability. The projects would lead to better: • recharge estimates under various climate change scenarios • informed long-term annual extraction limits (reviewed every 5-10 years) for coastal groundwater sources • science to review assessment criteria for coastal groundwater applications.
Intent	Prepare for the impacts of climate change and sea level rise on groundwater sources in coastal regions.
Challenges addressed	• Maintaining domestic water availability during extended dry periods. • Lack of data to inform management frameworks and decision-making.
Potential combinations	This option would build on Option 28. Characterising coastal groundwater resources.
Considerations	Development of groundwater sources is an opportunity in coastal regions, in particular, to increase reliability of water supply in drought times. This must only be done with an improved understanding of the resources and the impacts of climate change. The expected magnitude of the impacts varies greatly depending on local conditions.
Objectives	

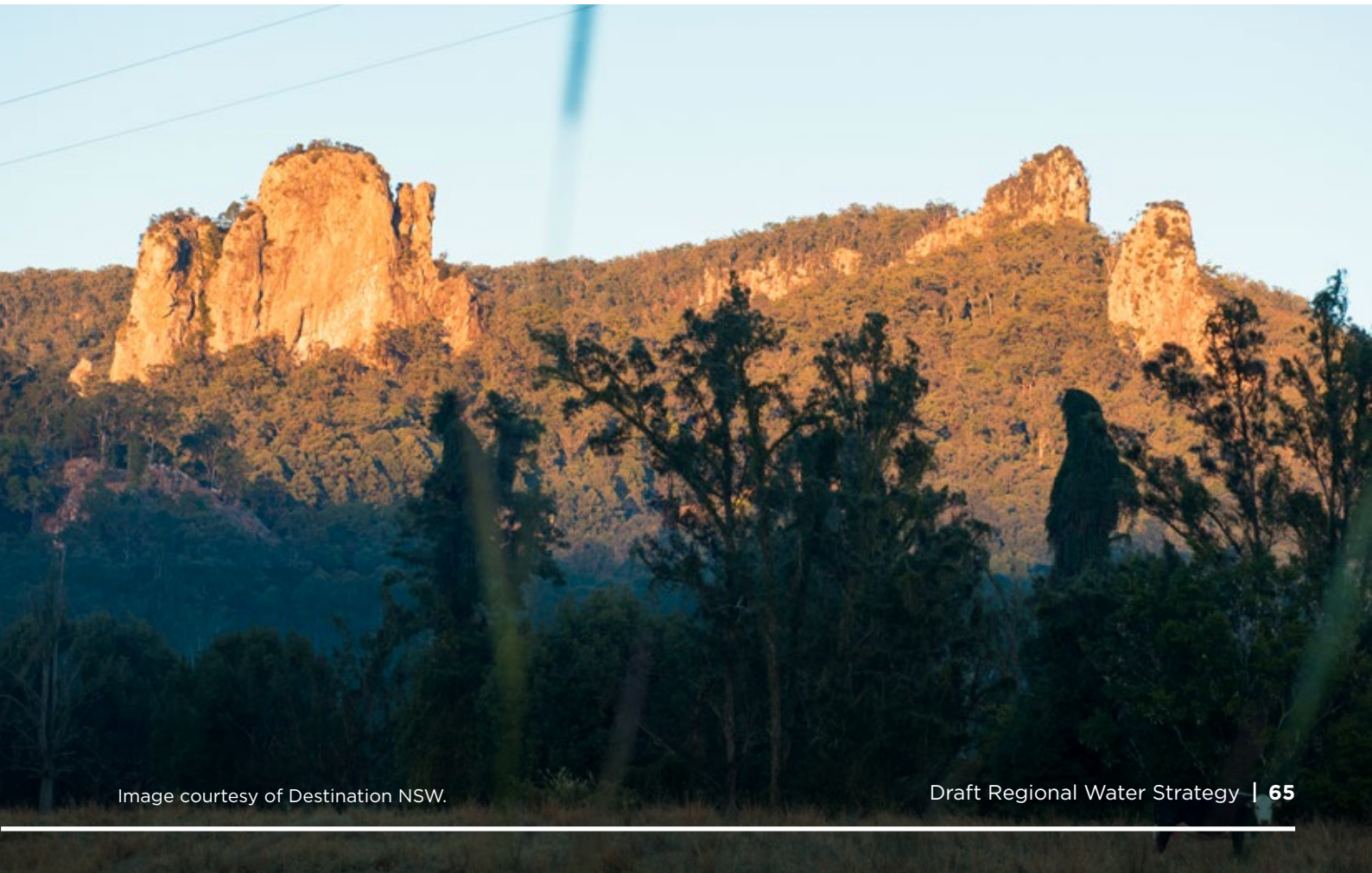
Option 39. Planning for land use pressures on coastal groundwater resources

Source: Department of Planning, Industry and Environment—Water

Description	Coastal aquifers provide reliable water sources during droughts and produce good quality, high yielding groundwater. However, these aquifers require careful management because they are vulnerable to contamination and are increasingly under pressure from growing coastal populations. Landuse planning needs to consider the impact of changes to landuse on aquifer recharge and storage areas, particularly where coastal aquifers are identified as being key to the future water security of population growth and development in these areas. Key challenges affecting coastal groundwater sources are: • changes to recharge—urban populations increase impermeable surfaces • changes to storage—sand mining reduces the aquifer storage capacity and sustainable yield • acid pollution—dewatering aquifers (e.g. sand mining) can expose acid sulfate soils and mobilises toxic metals • saltwater intrusion—excessive pumping coastal bores allows saline water to flow into the fresh aquifer, with climate change potentially exacerbating these impacts • groundwater pollution—waste products from agriculture, industry, on-site wastewater systems and urban environments. How activities are managed on the land surface directly impacts the underlying aquifers. Land and groundwater management need to be carefully integrated. This option would undertake a review to: • identify the key challenges facing coastal groundwater resources in NSW • assess the risk to coastal sands from diffuse pollution sources (pesticides and fertilisers) using groundwater quality sampling • assess whether the current legislation is fit-for-purpose in addressing the key challenges, including groundwater quality • identify gaps in current policy and regulation, and make recommendations for regulatory reform • develop partnerships with Local Land Services to coordinate activities and work towards changing land practices • engage with councils in relation to the level of protection of key aquifer systems within Local Environmental Plans • clarify roles and responsibilities for each government department in managing coastal groundwater sources • set out a strategic framework for the long-term management of coastal aquifers.
Intent	Provide for development while protecting groundwater resources.
Challenges addressed	• Mitigating the impacts of urban and rural land management activities on water quality. • Ensuring the NSW Government and the community have the required information to inform groundwater management frameworks and decisions.
Potential combinations	This option would build on Option 28. Characterising coastal groundwater resources.

Option 39. Planning for land use pressures on coastal groundwater resources (continued)

Considerations	Development of groundwater sources is an opportunity in coastal regions, in particular, to increase reliability of water supply in drought times. This must only be done with an improved understanding of the resources and the impacts of land use. Consideration needs to be given to the roles and responsibilities of different agencies, as groundwater protection functions are spread across levels of government and different government agencies. Currently there are three main pieces of legislation relevant to the management of coastal aquifers: • *Water Management Act 2000* provides guidance for the licensing or approval activities that intersect the groundwater as well as the development of water sharing plans for water sharing water use, drainage, and floodplains • *Environmental Planning and Assessment Act 1979* provides a framework for consideration of the impacts of a development on coastal sands systems. Local governments on the Far North Coast are required to prepare local environment plans under this act, and some have also included special provisions relating to protection of aquifer systems in their local environment plans • *Protection of the Environment Operations Act 1997* can also be used to manage groundwater contamination. The North Coast Regional Plan and the Aquifer Interference Policy 2012 are also relevant. The *Contaminated Land Management Act 1997* includes powers for the Environmental Protection Authority to regulate and rehabilitate contamination sources and to manage and prevent water pollution.
Objectives	



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