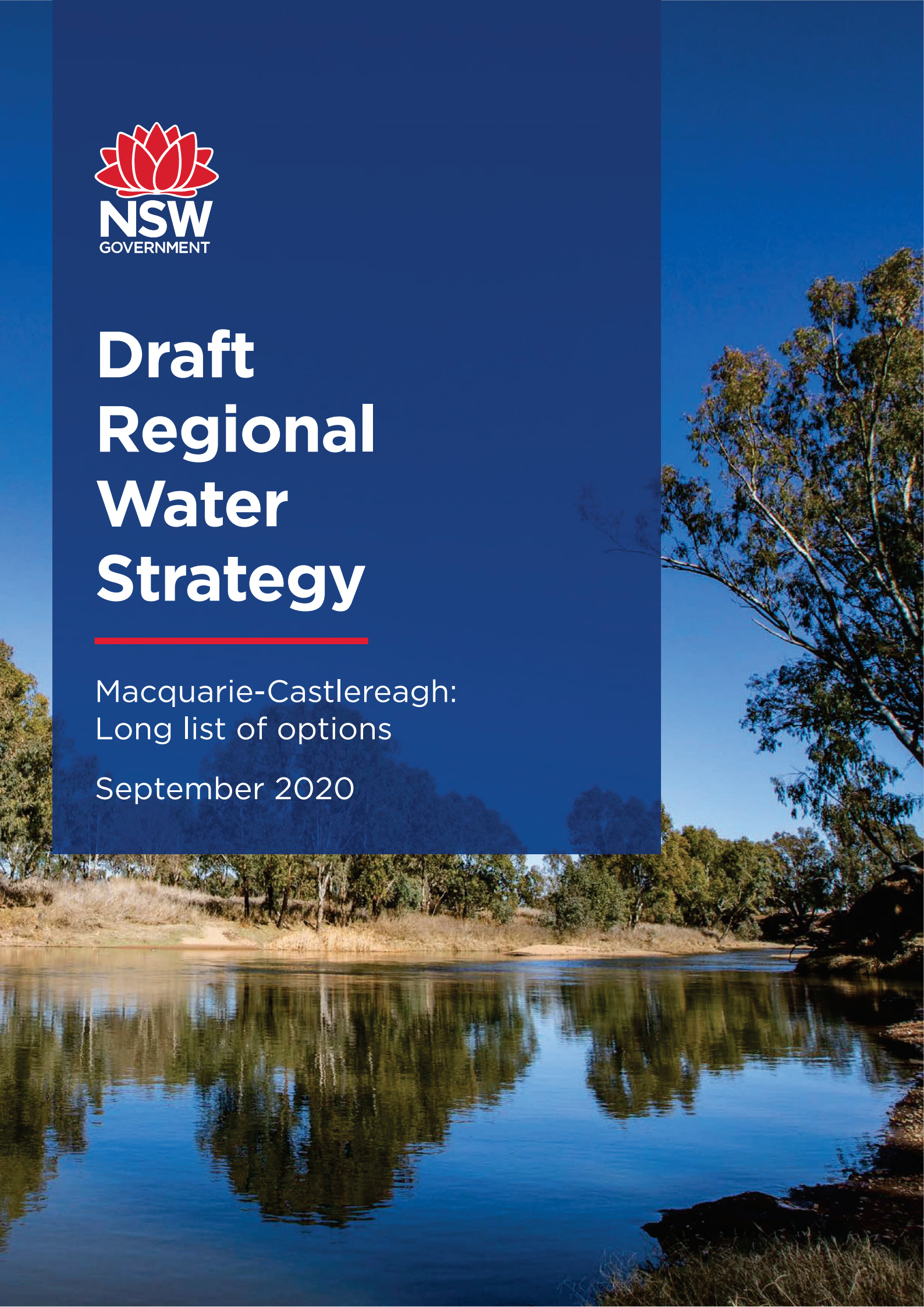
NSW GOVERNMENT

Draft Regional Water Strategy

Macquarie-Castlereagh: Long list of options

September 2020



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

We acknowledge that the people of the Gomeroi/Kamilaroi/Gamilaroiay/Gamilaroi, Ngemba, Ngiyampaa, Wailwan and Wiradjuri Nations hold a significant connection to the lands in which the Macquarie-Castlereagh Regional Water Strategy falls upon.

The Macquarie-Castlereagh 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 Macquarie-Castlereagh Regional Water Strategy area landscape and natural resources.

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

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

Options and government commitments for the Macquarie-Castlereagh Regional Water Strategy

As outlined in the Draft Macquarie-Castlereagh Regional Water Strategy, we have developed a long list of options and government commitments 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 and water security in the Macquarie-Castlereagh 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 sequence the various water reform processes underway to deliver the best outcomes for the Macquarie-Castlereagh region.

These options aim to address the challenges the region may face in the future, while maximising opportunities arising from the growing agricultural sector, other 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 efficiency and conservation
- strengthening community preparedness for climate extremes
- improving the recognition of Aboriginal people's water rights, interests and access to water.

Table 1 shows a snapshot of how we have matched the draft options and government commitments with these five categories and the challenges and opportunities we identified in the Draft Macquarie-Castlereagh Regional Water Strategy.

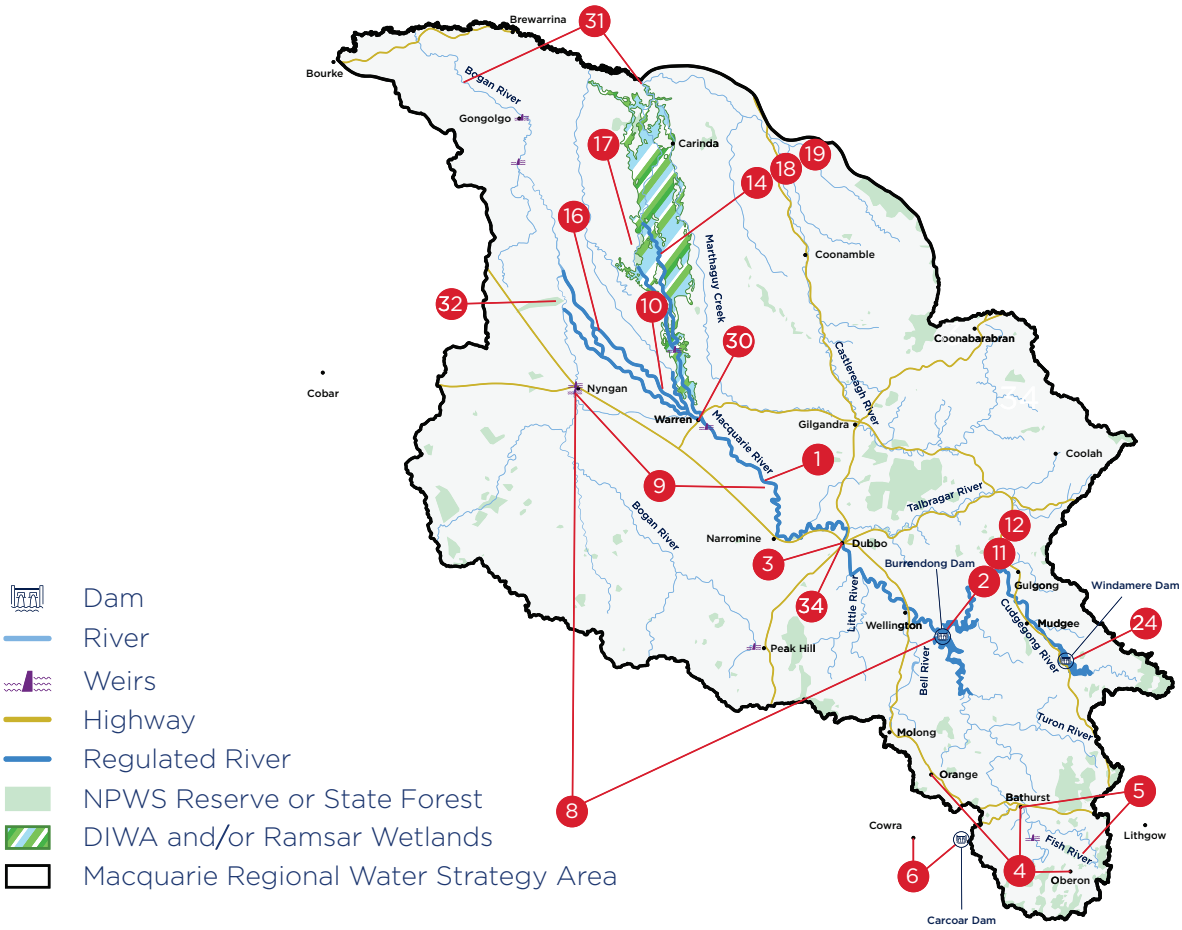
Overall, all options that are progressed will need to contribute to the liveability of the region.

Table 1. Draft long list of options and government commitments matrix

Category	Maintaining and diversifying water supplies	Protecting and enhancing natural systems
Region-specific challenges and opportunities	**Risks/Challenges:** • increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh • changing water needs, both within the agriculture industry and through strategic growth of regional centres • provide regional towns with multiple sources of supply. **Opportunities:** • improve town water security • maintain or improve water quality • support growth and industries in the region, and new development.	**Risks/Challenges:** • delivering water along a long river system • protecting critical environmental assets including the Ramsar Macquarie Marshes Wetlands and ecological values (especially during extreme dry times) • presently, the fish community of the Macquarie valley is in poor health • increased climate variability, particularly during dry times, will place increased pressure on surface and groundwater resources and the ecosystems they support • sustainable access to groundwater resources by all water users. **Opportunities:** • recognise wider community benefits that the natural environment provides.
Options and government commitments	• A new mid-system re-regulating weir on the Macquarie River • Access water from Burrendong Dam's deep storage • Managed aquifer recharge investigations and policy • Improving town water security in the upper Macquarie unregulated river system • Drought protocols for Bathurst and Oberon town water supply • Inter-regional connections project investigation • Reuse, recycling and stormwater projects • Burrendong Dam to Nyngan pipeline • Pipeline from the proposed new mid-system weir near Gin Gin to Nyngan • Gunningbar Creek pipeline • Increase Burrendong Dam's Full Supply Level • Increase outlet valve capacity at Burrendong Dam • Reliable access to groundwater by towns	• Address channel constraints to delivering environmental flows to the Macquarie Marshes • *NSW Fish Passage Strategy* • Introduce flow variability in the distributary (effluent) creeks • Determine the feasibility of delivering water to the Talga Wetland/Overflow of the Lower Crooked Creek • Undertake channel works to reinstate natural channel profiles in selected streams in the southern Macquarie Marshes • Formalise channel sharing arrangements • Implement the Native Fish Restoration program • Diversion screens to prevent fish extraction at pump offtakes • Cold water pollution mitigation measures • Modification and/or removal of existing floodwork structures causing adverse impacts • Relive flow constraints on the Cudgegong River at Rocky Waterhole Bridge • Improved understanding of groundwater processes • Sustainable access to groundwater • Improved clarity in managing groundwater resources sustainably • Investigation of water quality mitigation measures • River Ranger Program • Secure flows for Beemunnel Aboriginal Place • Connectivity with downstream systems

Supporting water use efficiency and conservation	Strengthening community preparedness for climate extremes	Improving the recognition of Aboriginal people's water rights, interests and access to water
Risks/Challenges: • delivering water along a long river system • increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh. **Opportunities:** • improve water use • maintain, improve productivity and efficiency in delivery • demand management (via price, signals, policy and trade).	**Risks/Challenges:** • healthy water sources support the region's environment, which—in turn—supports liveable communities and thriving industries • increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh. **Opportunities:** • fit-for-purpose policies and regulation to protect town water security • strengthen community health and wellbeing • to better manage risks.	**Risks/Challenges:** • Aboriginal people's rights and obligations are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions • Aboriginal people have limited access to water allocations to use for cultural and economic purposes • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways • lack of culturally appropriate information about how governments manage water. **Opportunities:** • protect and strengthen cultural landscapes, practices, knowledge and traditions • support the empowerment, self-determination and economic advancement of Aboriginal people • strengthen the community wellbeing of Aboriginal people.
• End of system efficient stock and domestic water delivery options • Enterprise water use efficiency programs • Market measures to support Dubbo's town water supply • Review of water pricing framework • Improve access to supplementary events	• Investigation of licence conversions • New drought operational rules (Macquarie River) • Review of regulated river water accounting and allocation process • Improved data collection and storage • Training and information sharing programs: – new climate data/modelling – managing groundwater resources sustainably • Investigation to maintain amenity for regional towns during drought • Land use change impact on water resources	• Culturally appropriate water knowledge program • Water-dependent cultural practices and site identification project • Shared benefit project (environmental and cultural outcomes) • Regional Aboriginal Water Advisory Committee • Water portfolio project for Aboriginal communities • Aboriginal cultural water access licence review • Co-management investigation of Travelling Stock Reserves • Regional Cultural Water Officer employment program

Macquarie-Castlereagh long list of options and government commitments map



Legend:

Maintaining and diversifying water supplies

1. A new mid-system re-regulating weir on the Macquarie River—Existing Government Commitment
2. Access water from Burrendong Dam's deep storage—Existing Government Commitment
3. Managed aquifer recharge investigations and policy
4. Improving town water security in the upper Macquarie unregulated river system
5. Drought protocols for Bathurst and Oberon town water supply
6. Inter-regional connections project investigation
7. Reuse, recycling and stormwater projects
8. Burrendong Dam to Nyngan pipeline
9. Pipeline from the proposed new mid-system weir near Gin Gin to Nyngan
10. Gunningbar Creek pipeline
11. Increase Burrendong Dam's Full Supply Level
12. Increase outlet valve capacity at Burrendong Dam
13. Reliable access to groundwater by towns

Protecting and enhancing natural systems

14. Address channel constraints to delivering environmental flows to the Macquarie Marshes
15. NSW Fish Passage Strategy
16. Introduce flow variability in the distributary (effluent) creeks
17. Determine the feasibility of delivering water to the Talga Wetland/Overflow of the Lower Crooked Creek
18. Undertake channel works to reinstate natural channel profiles in selected streams in the southern Macquarie Marshes
19. Formalise channel sharing arrangements
20. Implement the Native Fish Restoration program
21. Diversion screens to prevent fish extraction at pump offtakes
22. Cold water pollution mitigation measures
23. Modification and/or removal of existing floodwork structures causing adverse impacts
24. Relieve flow constraints on the Cudgegong River at Rocky Waterhole Bridge
25. Improved understanding of groundwater processes
26. Sustainable access to groundwater
27. Improved clarity in managing groundwater resources sustainably
28. Investigation of water quality mitigation measures
29. River Ranger Program
30. Secure flows for Beemunnel Aboriginal Place
31. Connectivity with downstream systems

Supporting water use efficiency and conservation

32. End of system efficient stock and domestic water delivery option
33. Enterprise water use efficiency programs
34. Market measures to support Dubbo's town water supply

Strengthening community preparedness for climate extremes

35. Investigation of licence conversions
36. New drought operational rules (Macquarie River)
37. Review of regulated river water accounting and allocation process
38. Improved data collection and storage
39. Training and information sharing programs:
    - new climate data/modelling
    - managing groundwater resources sustainably
40. Investigation to maintain amenity for regional towns during drought
41. Land use change impact on water resources

Improving recognition of Aboriginal people's water rights, interests and access to water

42. Culturally appropriate water knowledge program
43. Water-dependent cultural practices and site identification project
44. Shared benefit project (environment and cultural outcomes)
45. Regional Aboriginal Water Advisory Committee
46. Water portfolio project for Aboriginal communities
47. Aboriginal cultural water access licence review
48. Co-management investigation of Travelling Stock Reserves
49. Regional Cultural Water Officer employment program

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

This document describes each option and government commitments, 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 1). 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.

The list also identifies potential combinations of options information. These combinations recognise that most options require associated works, further assessments and/or legislative, policy and planning changes to ensure they address the risks and challenges identified in the Macquarie-Castlereagh 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.

Figure 1. 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.

Macquarie-Castlereagh: Long list of options and government commitments

Image courtesy of Destination NSW.

Maintaining and diversifying water supplies

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

Government commitment 1: A new mid-system re-regulating weir on the Macquarie River	
Existing government commitment—WaterNSW is preparing a detailed business case for this project (funding from Snowy Hydro Legacy Fund)	
Description	Preparation of a detailed business case for the construction of a new 6,000 ML re-regulating weir in close proximity to the existing weir at Gin Gin to assist with delivery efficiency to the lower reaches of the Macquarie River.
Intent	• Improve delivery efficiency and supply reliability for industry, towns and basic landholder rights under all climate conditions by capturing regulated water order rejections. • Reduce annual transmission losses during transfer and delivery of water through the system.
Challenges addressed	• Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh. • Changing water needs, both within the agriculture industry and through strategic growth of regional centres.
Potential combinations	This government commitment could be combined with Option 37 (Review of regulated river water accounting and allocation process)—including, for example, a 'cut off trigger' reserve for town water supply—and Option 9 (Pipeline from the proposed new mid-system weir near Gin Gin to Nyngan).
Considerations	The assessment of cost implications on water licence holders needs to be considered in the whole-of-life cost of the asset. The business case will: • set out a range of management options or configurations and the associated costs and benefits to the water environment and communities for the whole-of-life cost of the asset • set out potential impacts on the environment and stakeholders and other water users, including impacts on tributary flows to downstream water sources • examine non-build alternatives, such as water order debiting or a punitive rainfall-rejection ordering policy in order to determine the optimised infrastructure and policy option that will have the least impact on the environment • assess impacts due to flow modifications or changed operational regime on connectivity including fish passage, native fish including threatened species, ecological communities and ecosystems • assess impacts on planned environmental water • assess impacts on cultural values and heritage. Note: • in line with the requirements of the *Fisheries Management Act 1994*, a range of mitigation measures including biodiversity offsets, environmental flows and fish passage will be required • changes may be needed to the water sharing plan to regulate changed operational conditions • the option would be subject to community consultation.
Objective	
Further information	**www.waternsw.com.au/projects/regional-nsw/macquarie-river-re-regulating-storage**

Government commitment 2: Access water from Burrendong Dam's deep storage

Existing government commitment—works are undertaken as an emergency drought measure

Description	Accessing 21,000 ML deep storage volume normally not accessible in Burrendong Dam for critical town water supply during times of extreme water scarcity, using temporary infrastructure (including pumps).
Intent	• Access Burrendong Dam's deep storage water to provide additional supply for town water needs. • Improve water security in towns and for other basic landholder rights users downstream of the dam, when water resource availability is at a minimum.
Challenges addressed	Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh.
Considerations	This is a temporary government commitment for the duration of drought. Access would commence when Burrendong Dam storage falls below the current accessible storage level. Potential risks to be managed include: • impacts on a multi-million-dollar recreational fishery that could take a long time to recover • impacts on regional economy and tourism • potential mass fish deaths may adversely impact water quality, resulting in the modelled water gains not being available • water quality from the deep storage may not be suitable for some users (including the environment and town water users) and may require treatment • support for key refugia and river reaches below Burrendong Dam in line with Environmental Needs Policy.
Objective	

Option 3: Managed aquifer recharge investigations and policy

Source: Water NSW Macquarie Priority Catchment Study and consultation with joint organisations and councils

Description	Investigation of possible sites for temporary storage of stormwater and river flows in aquifers to improve storage efficiencies. This is normally referred to as managed aquifer recharge. This option would develop a supporting policy to regulate the storage and recovery of this water. The potential for managed aquifer recharge is proposed to be investigated in several areas within the region. Initial assessments show that a pilot in Dubbo region would be feasible. Dubbo Regional Council has indicated that a desirable capacity for the managed aquifer recharge scheme would be 1,500–2,000 ML per year. During the final quarter of each water year (April to June), the council could assess its likely surplus urban water entitlement and pump to an aquifer.
Intent	• More efficient use (by minimising evaporation) of water in areas where demand is high. • Providing additional recharge to groundwater sources may reduce Dubbo's high reliance on Burrendong Dam for water supply in normal years and during years of water shortage.
Challenges addressed	• Changing water needs, both within the agriculture industry and through strategic growth of regional centres. • Provide regional towns with multiple sources of supply.
Potential combinations	This option builds on Option 25 (Improved understanding of groundwater processes) and Option 39 (Training and information sharing programs). It would be combined with Option 13 (Reliable access to groundwater by towns).
Considerations	The 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 irrigation and mining 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 biosecurity risks associated with transferring water from surface water to groundwater.
Objective	

Option 4: Improving town water security in the upper Macquarie unregulated river system

Source: CENTROC 2009, WaterNSW, councils in the Macquarie-Castlereagh region

Description	Conduct a feasibility study to identify options to improve water security for towns that rely on water from the upper Macquarie (unregulated) system, which include Bathurst (Campbells River and Fish River), Orange (Summerhill Creek, unregulated Macquarie River) and Oberon (Fish River), Lithgow (Farmers Creek, Fish River, Clarence Colliery transfer) and Sydney Water between Katoomba and Mt Victoria (Fish River). The study would establish the current and future needs of water users in the system and holistically examine the range of options available to improve water security for these towns. It would build on previous work already completed by Councils, CENTROC and WaterNSW.
Intent	• Improve town water security through various water sources and delivery mechanisms in the upper Macquarie. • Identify water security deficiencies, potential water sources, scheme linkages and preferred options for further development. • Address water quality issues in some parts of the system.
Challenges addressed	• Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh. • Provide regional towns with multiple sources of supply.
Potential combinations	This option could be combined with Option 7 (Reuse, recycling and stormwater projects), Option 3 (Managed aquifer recharge investigations and policy) and Option 6 (Inter-regional connections project investigation).
Considerations	• The water needs of communities and industries in the upper Macquarie (unregulated) system are undergoing significant change with the growth of cities like Orange and Bathurst, changed water management from mine operations and the closure of the Wallerawang power station, which is associated with a large water entitlement. • The system is challenged by significant variability in stream flows and supplies water for diverse uses including power generation, town water supply and other customers. • The Fish River system is a key component of the upper Macquarie catchment supplying water for customers in the Greater Sydney Metropolitan area, power generation, minor consumers and the townships of Oberon, Lithgow and surrounding villages. • A number of options have previously been identified including pipe networks, recycled water use, groundwater, treated mine water and temporary purchase of water for these towns in the upper catchment. • Bathurst Council is investigating a pipeline from Chiefly Dam to Bathurst to improve security of supply, a pipeline from the Winburndale Dam to Bathurst water treatment plant to supplement the Chiefly Dam supply and a stormwater harvesting scheme to capture and use urban stormwater run-off. • Orange Council has increased its take from the Macquarie River in times of drought. Orange is also investigating options to improve the water security of its town water supply headworks through increased urban stormwater harvesting and augmentation and upgrade of other local water sources. • Lithgow is looking at the viability of alternative supply options to increase its water security and to provide water to new industry. • Downstream impacts in the Macquarie River from extractions in the upper Macquarie River catchment also need to be understood and quantified. • Impacts on cultural heritage/employment opportunities for Aboriginal people need to be assessed.
Objective	
Further information	www.centroc.com.au/centrocs-advocacy-priorities/water-infrastructure/water-security-study/

Option 5: Drought protocols for Bathurst and Oberon town water supply

Source: NSW Government Temporary water restriction (Macquarie Bogan Unregulated and Alluvial Water Source) Order 2019

Description	Review the water sharing plan for the Macquarie Bogan Unregulated and Alluvial Water Source to identify appropriate drought triggers and responses to protect water supply for critical water needs in extreme drought conditions. Bathurst Council has advised that because of dry conditions, high losses and regular irrigation extractions, council has to release four to five times the water required for Council's needs from Chifley Dam over summer to ensure sufficient volume reaches their offtake. To protect Bathurst's town water supply during the recent drought, temporary pumping restrictions were in place (upto July 2020) to restrict access for unregulated licence holders between Bathurst and major upsteam dams. A review of the water sharing plan rules would determine whether permanent changes to these rules, including drought triggers and responses, could be needed in the future.
Intent	Extend the available water supply for Bathurst and Oberon town use and critical needs by reducing the demand on water releases from the Oberon and Chifley Dams in extreme conditions.
Challenges addressed	Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh.
Considerations	This option would need to consider whether there are likely to be any impacts on other uses along the river. The new non-urban metering framework announced by the NSW Government as part of its 2017 Water Reform Action Plan will support this option.
Objective	

Option 6: Inter-regional connections project investigation

Source: Central NSW Joint Organisation

Description	Investigation of potential additional inter-regional pipeline connections between Macquarie and neighbouring regions (such as the Lachlan region). Examples include the recently announced pipeline Cowra to Central Tablelands Water Emergency connection or connections between Oberon, Carcoar, Wyangala and Burrendong Dams.
Intent	Increase the connections between town water supply within the Macquarie-Castlereagh region and provide towns with access to more than one water source.
Challenges addressed	• Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh (and neighbouring regions). • Provide regional towns with multiple sources of supply.
Potential combinations	This option could be combined with other urban water options.
Considerations	The option requires: • an assessment of whether amendments to the water sharing plans/water resource plans are required • an assessment of possible triggers for when options would be initiated (for example: would these options be emergency or permanent solutions?) • an assessment of the impact of the proposal on downstream regulated and unregulated water sources • analysis of public acceptance of the option • consideration of connections within the Macquarie catchment first • assessment of the impacts on cultural values and heritage • possible employment/economic opportunities for Aboriginal people • Basin plan requirements. Note: • this type of option will be most feasible and have the largest impact when the seasonal rainfall patterns of the neighbouring regions/catchments are different • the likely benefits of this option would need to be informed by hydrologic modelling.
Objective	

Option 7: Reuse, recycle and stormwater projects

Source: Central NSW Joint Organisation, local councils in the Macquarie region

Description	Investigation of opportunities to maximise the use of surface water and groundwater for potable and non-potable uses through reuse/recycle initiatives or stormwater harvesting. Suitable options would need to be scoped; however, options could focus on improving water security for individual towns and providing options to maintain 'green' spaces during extended drought.
Intent	Increase water security for individual towns in the Macquarie region and maintain local parks, town water lakes and green spaces during droughts.
Challenges addressed	• Increased climate variability poses new risks to towns, communities and industries and communities in the region. • Changing water needs, both within the agriculture industry and through strategic growth of regional centres. • Provide regional towns with multiple sources of supply.
Potential combinations	This option could be combined with other options such as Option 3 (Managed aquifer recharge investigations and policy), as stormwater and/or wastewater could be managed through managed aquifer recharge, Option 28 (Investigation of water quality mitigation measures), as upgrades to water treatment facilities will be influenced by the water quality requirements of end users and Option 40 (Investigation to maintain amenity for regional towns during drought).
Considerations	The option requires: • consultation with local councils and communities to understand the level of acceptance for these alternative water supply and reuse options. This particularly applies to the use of recycled wastewater • an assessment of how the options should interact with individual town integrated water cycle management strategies. For cases where there is no integrated water cycle management strategy, consultation is critical to understand the council and community appetite for such initiatives. Note: A review of state-wide policy and regulations and the creation of clear guidelines are required to support water recycling and reuse in urban centres for the needs identified.
Objective	
Further information	**Information on broad water sensitive city principles:** **www.watersensitivecities.org.au/what-is-a-water-sensitive-city/**

Option 8: Burrendong Dam to Nyngan pipeline

Source: Lower Macquarie Water Utilities Alliance, Dubbo Integrated Water Cycle Management Plan, WaterNSW

Description	Pipeline through the length of the catchment downstream for towns (Dubbo, Wellington, Narromine, Warren and Nyngan) and the Cobar mines. Potential sub-options: • Option A: Burrendong Dam to Dubbo—two route options • Option A1: Burrendong Dam to Dubbo—includes Wellington with river route • Option A2: Burrendong Dam to Dubbo—highway route including Wellington and Geurie • Option B: Burrendong Dam to Narromine extension • Option C: Burrendong Dam to Nyngan with three water source options • Option C1: Supplementary bore water from Narromine • Option C2: Supplementary bore water from Warren/Nevertire • Option C3: Supplementary bore water from Nyngan.
Intent	Increase town water supply security by improving delivery efficiency to towns, communities and industries and communities in the regulated system.
Challenges addressed	• Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh. • Provide regional towns with multiple sources of supply.
Potential combinations	This option would be considered alongside Option 37 (Review of regulated river water accounting and allocation process)—including the potential for a 'cut off' trigger and additional water in reserve to meet town water supply challenges.
Considerations	• Options may be available to either (1) extend surface water supplies from storage by ceasing deliveries to the river, or (2) connect and share groundwater supplies amongst towns to effectively cease their reliance on surface water supplies from Burrendong Dam. • This option will need to incorporate the proposed Macquarie re-regulating weir to Nyngan pipeline. • Given the potential scale of works, this option could be undertaken in stages. • An economic assessment of the costs and benefits would be required. • The option requires consideration of environmental impacts, including impacts on the environmental value of systems and the implications of changed flow regime from piping, with threatened native fish species populations existing in this part of the valley. It also requires consideration of screening associated with pumping and piping infrastructure. • The option requires consideration of impacts on any Aboriginal cultural outcomes. • There may be potential impacts on the groundwater resource. • There will need to be an assessment of impacts due to flow modification and/or changed operational regime on connectivity including fish passage, native fish including threatened species, ecological communities and ecosystems, along with the outcomes of the Macquarie Long Term Water Plan. • Pump screening at waterways and reservoirs will be required. • Environmental impact assessment processes require sufficient scope to refer to the cumulative impacts of combined infrastructure options. • Councils have told us that this option would need to consider whether upgrades are needed to existing pipelines and pump stations to support a new pipeline. The option will also need to consider previous studies undertaken by Nyngan Council on the feasibility of pipelines in the region.
Objective	

Option 9: Pipeline from the proposed new mid-system weir near Gin Gin to Nyngan

Source: Department of Planning, Industry and Environment—Water

Description	Nyngan and Cobar towns and end of system mines rely on regulated supply from the Macquarie River and are located at the end of a long river system. Town water supplied through the Albert Priest Channel is subject to significant seepage and evaporation, reducing the reliability of supply. This option involves constructing a pipeline from the proposed new weir near Gin Gin to Nyngan, enabling water to be securely delivered to the towns and mines during wet, average and dry years.
Intent	• Reduce the risk of Nyngan (and subsequently Cobar) facing significant water shortfalls and reliability issues. • Improve water security for end-of-system mines.
Challenges addressed	Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh.
Potential combinations	This option would be combined with Option 37 (Review of regulated river water accounting and allocation process), Option 8 (Burrendong to Nyngan pipeline), Option 32 (End of system efficient stock and domestic delivery option) and Option 10 (Gunningbar Creek pipeline).
Considerations	The option would: • need to be considered in conjunction with other options to secure water supplies at the lower end of the river system • be subject to funding, governance and operational agreements • require consideration of environmental impacts, including the environmental value of systems and the implications of changed flow regime from piping, with threatened native fish species populations existing in this part of the valley • assessment of impacts on cultural values and heritage • require assessment of disturbance impacts to channel morphology and hydrology, such as impacts on connectivity including fish passage, in-channel habitat and native fish including threatened species, ecological communities and ecosystems • require pump screening at waterways and reservoirs. Note: • environmental impact assessment processes require sufficient scope to refer to the cumulative impacts of combined infrastructure options • this option will also need to consider previous studies undertaken by Nyngan Council on the economic viability of large pipelines in the region.
Objective	

Option 10: Gunningbar Creek pipeline

Source: Department of Planning, Industry and Environment—Water

Description	Replace Gunningbar Creek (from its offtake upstream of Warren to its junction with the Bogan River) with a pipeline to supply irrigators, stock and domestic users, and the Tritton mine. This could be an alternative to piping the Albert Priest Channel, as the potential water saving benefits (approximately 10 GL) of a Gunningbar pipeline are estimated to be higher than piping the channel (2 GL).
Intent	Improve delivery efficiency and supply reliability to lower Macquarie towns, communities and industries located at the end of a long system by reducing groundwater seepage and system evaporation.
Challenges addressed	• Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh. • Changing water needs, both within the agriculture industry and through strategic growth of regional centres.
Potential combinations	This option could be built alone or combined with Option 9 (Pipeline from the new mid-system weir near Gin Gin to Nyngan), Option 8 (Burrendong Dam to Nyngan pipeline) and Option 32 (End of system efficient stock and domestic water delivery option).
Considerations	The option would need to be considered in conjunction with other pipeline options to secure water supplies at the lower end of the river system. In the recent drought, Tritton mine was being supplied its water from the Nyngan-to-Cobar Pipeline. If the Gunningbar Creek pipeline is built, Tritton mine could be provided its annual supply via the pipeline. The options during non-drought periods would be: • continue to use the pipeline to supply towns and mines. This would free up the Albert Priest Channel for irrigators' use and control that is currently not practical • use the pipeline to supply the upstream irrigators along the Gunningbar Creek to save on water losses suspected of being worse at the upstream end. The option would also require: • consideration of environmental impacts, including the environmental value of systems and the implications of changed flow in the Gunningbar Creek, with threatened native fish species populations existing in this part of the valley • consideration of potential impacts on landowners who may have to fence boundaries where this has traditionally been provided by the creek • assessment of impacts on cultural values and heritage • assessment of disturbance impacts to channel morphology and hydrology from pipe construction and operation, such as on connectivity including fish passage, in-channel habitat and native fish including threatened species, communities and ecosystems will be required. Note: Environmental impact assessment processes would require sufficient scope to refer to the cumulative impacts of combined infrastructure options.
Objective	

Option 11: Increase Burrendong Dam's Full Supply Level

Source: Water NSW: Macquarie Priority Catchment Study

Description	Changing the operation of the Burrendong Dam to increase the Full Supply Level (FSL) and use a portion of the flood mitigation zone (FMZ) to increase storage capacity (without requiring major construction).
Intent	• Achieve larger (115%) storage capacity by reducing a conservative FMZ and instituting a permanent change to the dam's FSL. • Improve water security and supply reliability under all climate conditions: wet, average and dry.
Challenges addressed	• Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh. • Changing water needs, both within the agriculture industry and through strategic growth of regional centres.
Potential combinations	This option provides extra water to the regulated system, which would require Option 37 (Review of the current water allocation process) and assessment against Basin Plan requirements.
Considerations	Additional monitoring requirements and operating procedures may be needed to maintain the flood mitigation benefits of Burrendong Dam. Detailed modelling and policy consideration are required to assess the distribution of benefits and requirements under the Murray-Darling Basin Plan. Detailed modelling is required to determine the change to flooding risk and impacts as a result of reducing the FMZ volume available. Compensation and offsets may be required due to changes in downstream flows, particularly to unregulated water users, Barwon-Darling water users and Menindee Lakes who benefit from Burrendong FMZ evacuation. The option would also require: • consideration of environmental impacts including cold water pollution • assessment of impacts on planned environmental water, including consideration of possible (environmental) offsets needed to meet Basin Plan requirements • assessment (and/or decision) on how the potential benefits of the projects should be shared between urban, environment and industrial water licence holders in the Macquarie. This may require amendments to the water sharing plan • assessment of impacts on cultural values and heritage. Note: Environmental assessment processes would require sufficient scope to consider cumulative impact of combined infrastructure options.
Objective	

Option 12: Increase outlet valve capacity at Burrendong Dam

Source: Macquarie-Castlereagh Long Term Water Plan

Description	The maximum valve capacity at Burrendong Dam at Full Supply Level is 8,500 ML/d and less at lower dam levels. Increased outlet capacity will potentially improve wetland watering opportunities and reduce potential conflict between water users, including environmental water managers, during peak irrigation season.
Intent	• Manage competing water users' demands. This maintains reliability and may improve water delivery to wetlands. • Improve water reliability for water users and improve environmental outcomes.
Challenges addressed	Healthy water sources support the region's environment, which—in turn—supports liveable communities and thriving industries.
Potential combinations	This option could be combined with a range of policy and infrastructure supply options.
Considerations	The option requires: • analysis of cost-effectiveness • consideration of the benefits and potential impacts of increasing the size of environmental watering events on sections of the river channel with channel capacity constraints, such as in the Marebone area • assessment of impacts on cultural values and heritage.
Objective	

Option 13: Reliable access to groundwater by towns

Source: Department of Planning, Industry and Environment—Water and consultation with joint organisations and councils

Description	Strategic review and planning across NSW to identify: • towns where future water demands could exceed the capacity of surface water resources (including the adaptive nature of river operations during drought conditions—for example, rivers being cut off up-catchment of a given town) • the likelihood and consequences of such exceedances (for example: is water carting feasible and economically sound?) • towns where future water demands could exceed current entitlements • groundwater resources that could be used as a complementary water supply (identified with field- and numerical modelling-based information) • regulatory issues potentially slowing or preventing access to these groundwater resources • what infrastructure investments (borefields and pipelines) are needed and their timing • impact of changing groundwater access on other users (e.g. domestic and stock and industry). This option would improve processes and policies to address challenges faced by towns accessing groundwater during drought. This option would not replace the need for councils to have integrated water cycle management plans.
Intent	Increase the security and resilience of town water supplies by being strategic at a state-scale about the use of groundwater resources as an alternative water supply by towns.
Challenges addressed	Changing water needs, both within the agriculture industry and through strategic growth of regional centres.
Potential combinations	This option builds on the natural resource management framework, including options around managing groundwater resources sustainably using best-available science. It could be combined with Option 3 (Managed aquifer recharge investigations and policy). This option also relies on Option 38 (Improved data collection and storage) and Option 39 (Training and information sharing programs).
Considerations	The option requires an assessment of the roles and responsibilities of state versus local government. Further investigation is needed into: • access to reasonable quality groundwater from regions (Nyngan, Dubbo and Warren) • improving access to groundwater bores (Narromine) • groundwater as an alternate source to surface water for local water utilities in the long term (Dubbo) • potential impacts on alluvial groundwater users, groundwater dependant ecosystems and adjacent river flows • assess the impacts on cultural values and heritage.
Objective	

Image courtesy of Destination NSW.

Protecting and enhancing natural systems

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

Option 14: Address channel constraints to delivering environmental flows to the Macquarie Marshes	
Source: Macquarie-Castlereagh Long Term Water Plan	
Description	Environmental flows to the Marshes via Marebone Weir are currently constrained to 3,200 ML to 3,500 ML/day to avoid over-bank flows, particularly via breaks to the Crooked Creek. These breaks appear to be eroding over time, further reducing channel capacity. Works would stabilise and re-establish high-flow capacities in the main river.
Intent	Improve deliverability of water orders including environmental water in peak irrigation season.
Challenges addressed	Protecting critical environmental assets including the Ramsar Macquarie Marshes wetlands and in-stream ecological values (especially during extreme dry times).
Potential combinations	This option would need to be linked with Option 37 (Review of regulated river water accounting and allocation process).
Considerations	Flow rates between 3,200 ML/day and 4,000 ML/day are valuable to achieving floodplain connection in some areas, such as the southern part of the Eastern Marshes through 'the Jungle' (Back Swamp) and other flow paths. A smaller version of the constraint's management strategy being implemented in other valleys, such as the Gwydir, would benefit environmental water management in the Marshes.
Objective	
Further information	www.environment.nsw.gov.au/topics/water/water-for-the-environment/macquarie

Option 15: NSW Fish Passage Strategy

Source: NSW Fish Passage Strategy

Description	Remediation of fish passage at 46 priority weirs within the Macquarie valley to restore native fish access throughout mainstem waterways and to important off-channel habitat, including the Ramsar-listed Macquarie Marshes. Phase 1 involves fishway construction at three sites that are existing WaterNSW statutory requirements from the Burrendong Dam Safety Upgrade Project and that may proceed in the near future: Dubbo North Weir, Gin Gin Weir and Marebone Break Regulator. Following the successful completion of Phase 1, the Fish Passage Strategy recommends works at an additional 43 priority barriers that improve native fish access to nearly 800 km of waterway. The vast majority (37) of these sites are small, mainly private in-stream structures downstream of Marebone Weir, where remediation will significantly improve fish access to key breeding and recruitment hotspots, as well as improve migration connectivity to the Barwon-Darling River. These improvement projects will be re-visited as part of the 10-year review of the Fish Passage Strategy.
Intent	• Maintain and improve native fish access to core habitat in the Macquarie valley and to the Barwon River. • Improve fish movement through fishways and encourage breeding and spawning activities particularly for threatened species. • Improve recreational fishing and regional tourism opportunities.
Challenges addressed	Presently, the fish community of the Macquarie valley is in poor health.
Potential combinations	This option would add value to Option 20 (Implement the Native Fish Restoration program) and Option 22 (Cold water pollution mitigation measures), including in relation to the new Gin Gin Weir structure (Government commitment 1) and breaching of the existing weir there.
Considerations	The new weir may address the fish passage issue at the current Gin Gin Weir. If the Gin Gin Weir remains as a barrier to migrating fish, then an additional fishway will be required as per existing WaterNSW legislative obligations. Some of the requirements above are existing Water NSW commitments. There may be other sources of funding available to augment works undertaken, such as Murray-Darling Basin Authority Northern Basin Toolkit.
Objective	
Further information	www.environment.nsw.gov.au/topics/water/water-for-the-environment/macquarie

Option 16: Introduce flow variability in the distributary (effluent) creeks

Source: Department of Planning, Industry and Environment—Environment, Energy and Science

Description	Provide greater flow variability, including periods of drying, base flows and small freshes. This option would need to work with other options to provide security to water users along these systems.
Intent	Improve environmental outcomes in distributary creeks.
Challenges addressed	Increased climate variability, particularly during dry times, will place increased pressure on surface and groundwater resources and the ecosystems they support.
Potential combinations	This option would be linked to options related to stock and domestic and irrigation supply in distributary creeks. As there is unlikely to be a change in shares as a result of this option, the savings generated could provide some of the required flow variability.
Considerations	• In-stream ecology can be enhanced by more variable flows. • Certainty for landholders will be important, particularly around stock and domestic supply and fence lines. • Any reductions in baseflows, and particularly any periods of drying down, would need to be considered with regard to fish communities and refuge pools, which are shallow due to sedimentation. • Fish passage along these systems would need to be improved to allow access to refuge pools during drying conditions, and dispersal when flows return.
Objective	

Option 17: Determine the feasibility of delivering water to the Talga Wetland/ Overflow of the Lower Crooked Creek

Source: Macquarie-Castlereagh Long Term Water Plan

Description	Investigate the viability of watering the Talga Wetland/Overflow in the unregulated Lower Crooked Creek, given potential flow constraints to the area. The option could also incorporate a trial of controlled watering using combined unregulated flows and managed environmental water. Other options for water delivery (via irrigation systems) could also be investigated.
Intent	Identify potential opportunities to provide environmental water to the Talga Wetland/Overflow area.
Challenges addressed	Protecting critical environmental assets (especially during extreme dry times).
Potential combinations	This option could be linked to Option 16 (Introduce flow variability in the distributary (effluent) creeks) and options examining piping water supplies to similar areas.
Considerations	Other flow-paths could also be considered, although the benefits should be balanced against costs and potential on-route losses. This water use itself would also need to be balanced against other annual priorities.
Objective	

Option 18: Undertake channel works to reinstate natural channel profiles in selected streams in the southern Macquarie Marshes

Source: Macquarie-Castlereagh Long Term Water Plan

Description	Undertake channel bed restoration works in the southern Macquarie Marshes to stabilise and restore incised channel profiles, allowing reconnection with wetlands and floodplains. This option would be informed by previous work undertaken as part of the *Southern Macquarie Marshes Geomorphic Scoping Study*.
Intent	To allow environmental outcomes in the southern Marshes to be achieved in areas such as the southern Macquarie Marshes Nature Reserve, the Old Macquarie River area and the Macquarie Marshes Nature Reserve 'Pillicawarrina purchase area'.
Challenges addressed	Protecting critical environmental assets including the Ramsar Macquarie Marshes wetlands and in-stream ecological values (especially during extreme dry times).
Potential combinations	This option would be linked to Option 19 (Formalise channel sharing arrangements) and Option 12 (Increase outlet valve capacity at Burrendong Dam).
Considerations	Identified works would need to maintain or facilitate fish passage and connectivity through the Macquarie Marshes.
Objective	
Further information	www.environment.nsw.gov.au/topics/water/water-for-the-environment/macquarie

Option 19: Formalise channel sharing arrangements

Source: Macquarie-Castlereagh Long Term Water Plan

Description	Develop formal channel sharing arrangements for managing the delivery of water when demands regularly exceed channel capacity. Without formal channel sharing arrangements, it is not clear which orders have priority when capacity is reached. This may result in deliverability and reliability issues for all water users, including the environment. Arrangements could be established that will provide river operators with clear guidelines and all users with greater certainty.
Intent	• Ensure equitable access to delivery capacity. • Provide river operators with clear guidelines and give certainty to all water users.
Challenges addressed	• Protecting critical environmental assets (especially during extreme dry times). • Increased climate variability, particularly during dry times, will place increased pressure on surface and groundwater resources and the ecosystems they support.
Potential combinations	This option would be linked to options related to Option 36 (New drought operational rules (Macquarie River)) and Option 37 (Review of regulated river water accounting and allocation process).
Considerations	• Discretionary planned environmental water (Environmental Water Allowance) should also be considered. Operational requirements would have to be considered with the operator—WaterNSW. • This option also needs to be in the context of NSW's response to the Murray-Darling Basin Authority's overview of constraints to the delivery of environmental water in the Basin.
Objective	

Image courtesy of Peter Robey.

Option 20: Implement the Native Fish Restoration program

Source: Department of Primary Industries—Fisheries

Description	Undertake a series of targeted in-stream rehabilitation activities to assist in the recovery of native fish.
Intent	• Develop a series of strategies to support recovery of native fish, including addressing priority barriers to fish passage in the Macquarie-Castlereagh region. • Restore native fish habitat and improve connectivity in relation to improved fish passage.
Challenges addressed	Presently, the fish community of the Macquarie valley is in poor health.
Potential combinations	This option could be combined with Option 15 (NSW Fish Passage Strategy), Option 21 (Diversion screens to prevent fish extraction at pump offtakes) and Option 22 (Cold water pollution mitigation measures).
Considerations	The option could include: • estimating the flow rates required to drown out barriers and provide connectivity through river reaches • implementing pump screening methods to prevent entrapment of native fish, larvae and eggs • works to achieve in-stream habitat improvement including re-snagging and aquatic revegetation • implementing the carp management strategy (and National Carp Control Plan) • ensuring mitigation of cold water pollution is achieved and maintained. Note: Some aspects of this project may have funding available under *Fish for the Future: Action in the Northern Basin—NSW proposal for Northern Basin Toolkit measures to promote native fish health (2017).*
Objective	

Option 21: Diversion screens to prevent fish extraction at pump offtakes

Source: Department of Primary Industries—Fisheries and Local Land Services, Department of Planning, Industry and Environment—Environment, Energy and Science

Description	This option will install screens on major irrigation pumps and diversion channels. Every year, native fish are extracted by pumps and diverted into irrigation channels, never to return to the Macquarie system (there are over 400 pump offtakes with a diameter greater than 200 mm in the Macquarie valley). Installation of screens at pump sites and diversion regulators will retain native fish within the region's waterways by preventing entrainment of adults, larvae and eggs. Screening infrastructure also improves water delivery and extraction efficiency due to reduced debris blockages, resulting in associated on-farm cost savings.
Intent	• Significantly reduce the loss of native fish (adults, larvae and eggs) from waterways, while improving water delivery and extraction efficiency. • Improve environmental outcomes and water user benefits in the Macquarie valley.
Challenges addressed	Presently, the fish community of the Macquarie valley is in poor health.
Potential combinations	This option could be combined with other options focused on protecting and enhancing natural systems to support a healthy regional environment.
Considerations	The option requires: • consideration of Local Land Services Central West's 'Fish Friendly Screens Pilot Project' in the Lachlan and Macquarie Rivers. This pilot project will verify program cost-benefits, including environment outputs, water delivery efficiency and long-term social and financial implications for water licence holders • assessment of incentive schemes for landholders to install screens. Note: Diversion screens have been used successfully for decades overseas (for example, in Western USA, Europe and New Zealand).
Objective	
Further information	**Local Land Services Central West Fish Friendly Screens Pilot Project:** **www.centralwest.lls.nsw.gov.au/__data/assets/pdf_file/0012/848694/Project_Fish-friendly-screens.pdf**

Option 22: Cold water pollution mitigation measures

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

Description	Augmentation of existing water supply infrastructure to mitigate cold water pollution in the Macquarie regulated system. Water releases from Burrendong and Windamere Dams historically display temperature decreases of 10°C or more in summer that extend up to 200 km downstream. Cold water pollution has significant deleterious impacts on riverine ecological function, particularly in summer where biological cues such as fish spawning are disrupted. It also has social and tourism impacts, with recreational use of affected rivers (such as for swimming and fishing) being constrained due to cold summertime water temperatures (15°C). Burrendong Dam previously tested a thermal curtain installed and Windamere Dam has a variable offtake tower which allows mitigation of cold water pollution. This option will confirm the effectiveness of these structures and undertake additional cold water pollution mitigation measures if deemed necessary to achieve natural downstream water temperatures.
Intent	• Restore near natural river water temperature to provide native and threatened fish species in the Macquarie valley with the necessary environmental cues and conditions to spawn, recruit, move and grow. • Improve social amenity (particularly swimming) through access to recreational pursuits, which will have flow-on economic benefits for regional communities.
Challenges addressed	• Presently, the fish community of the Macquarie valley is in poor health. • Healthy water sources support the region's environment, which—in turn—supports liveable communities and thriving industries.
Considerations	This option will need to align with the Macquarie Long Term Water Plan and the NSW Cold Water Pollution Strategy.
Objective	
Further information	**Department of Primary Industries—Fisheries—Cold Water Pollution explanation:** **www.dpi.nsw.gov.au/fishing/habitat/threats/cold-water-pollution**

Option 23: Modification and/or removal of existing priority floodwork structures causing adverse impacts

Source: Floodplain Management Plan (2020)

Description	Some vital ecological assets in the region rely on floodplain connection to replenish and maintain critical elements. Works undertaken on the floodplain can prevent water moving to these areas. This option would modify or remove identified priority floodplain structures and barriers that impede delivery of water to priority ecological assets (such as wetlands and floodplain areas). These structures are identified in the *Floodplain Management Plan (2020)*.
Intent	• Protect priority ecological assets and improve water security by identifying and removing the risks posed by identified floodplain works. • Improve agricultural productivity (due to improved flow conditions).
Challenges addressed	• Protecting critical environmental assets including the Ramsar Macquarie Marshes wetlands and in-stream ecological values (especially during extreme dry times). • Increased climate variability, particularly during dry times, will place increased pressure on surface and groundwater resources and the ecosystems they support.
Potential combinations	This option would be linked to Option 37 (Review of regulated river water accounting and allocation process) and to options that affect connections to the floodplain, such as flood mitigation proposals, valve capacity proposals and bed restoration proposals.
Considerations	Modifying or removing existing identified floodwork structures presents significant costs. It also raises challenges in managing the permanent loss of production capability for some individuals.
Objective	
Further information	www.industry.nsw.gov.au/water/plans-programs/healthy-floodplains-project/harvesting

Option 24: Relieve flow constraints on the Cudgegong River at Rocky Waterhole Bridge

Source: Macquarie-Castlereagh Long Term Water Plan

Description	Cudgegong River flows are restricted to around 1,500 ML/day by the limited capacity of the Rocky Waterhole Bridge. This option would upgrade the Cudgegong River crossing to allow higher flows.
Intent	• Improve environmental water delivery in the Cudgegong system. • There is currently a crossing at Rocky Water Holes that gets closed with moderate flows in the Cudgegong. Raising the structure on the river would also address this constraint.
Challenges addressed	Increased climate variability, particularly during dry times, will place increased pressure on surface and groundwater resources and the ecosystems they support.
Considerations	Three locations where upgrades can be delivered to allow higher flows were identified through WaterNSW's Levels of Service Study: Rocky Waterhole Bridge, Melrose Road Bridge and Riverlea Road Bridge. These may also need to be examined.
Objective	

Image courtesy of Peter Robey.

Option 25: Improved understanding of groundwater processes

Source: Department of Planning, Industry and Environment—Water and the Central NSW Joint Organisation

Description	Groundwater management decisions are made using the best available information. Our understanding needs to continually improve based on the latest science. This option would progress the scientific understanding of five key groundwater processes: • recharge rates and their spatial-temporal variations, including the impacts from climate variation/change, on- and off-farm water efficiency projects and adapting river operations • dynamics of groundwater levels under evolving development conditions (e.g. shift from seasonal crops to permanent plantings) • connectivity between groundwater and surface water systems • changing patterns in groundwater quality over time • water needs of ecosystems that are partly or wholly dependent on groundwater and the impact on these ecosystems under different development scenarios. This would consider what ecosystems need in terms of groundwater levels or baseflows from aquifers to river systems. This option would be delivered in collaboration with consultancies and research centres. A combination of desktop studies, field studies and numerical models would be used. The outcomes from the option would provide the scientific evidence-base for future groundwater management decisions.
Intent	Increase scientific knowledge of the processes occurring in NSW's groundwater resources, from areas of recharge to areas of discharge and the complex interactions in-between.
Challenges addressed	Sustainable access to groundwater resources by all water users.
Potential combinations	This option would build on Option 38 (Improved data collection and storage). It provides the basis for Option 26 (Sustainable access to groundwater) and Option 27 (Improved clarity in managing groundwater resources sustainably).
Considerations	This option requires an assessment of how it could be implemented given the time required for scientific studies and the timing of the revision/replacement of water sharing plans across the state.
Objective	

Option 26: Sustainable access to groundwater

Source: Department of Planning, Industry and Environment—Water and the Central NSW Joint Organisation

Description	Groundwater extraction limits balance environmental and economic-social benefits and impacts. This option would establish a systematic state-wide process to ensure ongoing access to groundwater resources by the environment, landholders, towns, agriculture, mining and other industries. It will review existing groundwater resource extraction limits to incorporate up-to-date information, including: • scientific studies that give an improved understanding of groundwater processes • an investigation of ways to improve the integration of surface water and groundwater management • a review of social-economic impacts under different development scenarios.
Intent	This option would consider what groundwater resource extraction limits would need to be set in the future to ensure sustainable access to groundwater by both consumptive water users and the environment.
Challenges addressed	Sustainable access to groundwater resources by all water users.
Potential combinations	This option would apply the outcomes from Option 25 (Improved understanding of groundwater processes). It provides the basis for Option 27 (Improved clarity in managing groundwater resources sustainably).
Considerations	The option would need to consider: • required policy or regulatory changes • commitments made under the *Basin Plan 2012* and the mandatory review of Sustainable Diversion Limits in 2026.
Objective	
Further information	www.legislation.gov.au/Details/F2018C00451

Option 27: Improved clarity in managing groundwater resources sustainably

Source: Department of Planning, Industry and Environment—Water and the Central NSW Joint Organisation

Description	This option will review, revise and develop the necessary policies to give greater transparency and clarity in managing: • extraction within Sustainable Diversion Limits. This option would require a review of account rules and the annual groundwater allocation process. It would make the assessment process for Available Water Determinations more formulaic and transparent • ways to better manage systems where the entitlement exceeds the resource extraction limit, particularly those systems where extraction is currently or will likely exceed the extraction limit. It would give clarity to water users about how fully allocated groundwater systems will be managed as activation and use increases over the next 30 years • areas of concentrated extraction (for example, where groundwater extraction is causing declines in water levels in some areas to unacceptable levels). This option would develop a policy with a series of escalating management actions corresponding to stages of water level decline. It would provide certainty to all water users about what actions government will take and when.
Intent	Within a framework of sustainable access to groundwater by all users (Option 26), this option aims to provide greater transparency and certainty to water users about actions that will be taken by the NSW Government to manage groundwater resources at the water source and at local scales.
Challenges addressed	Sustainable access to groundwater resources by all water users.
Potential combinations	This option would apply the outcomes from Option 25 (Improved understanding of groundwater processes) and Option 26 (Sustainable access to groundwater resources).
Considerations	This option would need to consider required policy or regulatory changes. Note: The Department received comments on concerns regarding drawdown and management of groundwater during consultation on the water resource plan development.
Objective	

Image courtesy of NSW Department of Primary Industries.

Option 28: Investigation of water quality mitigation measures

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

Description	Investigate opportunities to support the water quality management plans that have been prepared for the Macquarie-Castlereagh surface water and groundwater water resource plans. This could include investigation of options such as: • real time water quality monitors/loggers to monitor dissolved oxygen • a water quality allowance in the Macquarie-Castlereagh region water sharing plans to help manage water quality issues.
Intent	• Reduce the risks of harmful algal blooms, dissolved oxygen and pH outside normal range, increased nutrients and turbidity, salinity, toxicants and pesticides, disruption to organic carbon cycling and thermal pollution in the Macquarie-Castlereagh region. • Make progress towards the Basin Plan water quality target.
Challenges addressed	• Presently, the fish community of the Macquarie valley is in poor health. • Healthy water sources support the region's environment, which—in turn—supports liveable communities and thriving industries.
Potential combinations	This option could be combined with other options focused on protecting and enhancing natural systems such as Option 22 (Cold water pollution mitigation measures) and options designed to strengthen community preparedness for climate extremes such as Option 36 (New drought operation rules (Macquarie River)).
Considerations	Water Quality Management Plans have been completed for the Macquarie-Castlereagh surface water and alluvium.
Objective	
Further information	**Water Quality Management Plan (surface water):** **www.industry.nsw.gov.au/water/plans-programs/water-resource-plans/drafts/macquarie-castlereagh-surface** **Water Quality Management Plan (groundwater):** **www.industry.nsw.gov.au/water/plans-programs/water-resource-plans/drafts/macquarie-castlereagh-alluvium**

Option 29: River Ranger Program

Source: Department of Planning, Industry and Environment—Water, Aboriginal consultation

Description	Investigate options for the establishment of an Aboriginal River Ranger Program to assist in maintaining the health and management of rivers and wetlands throughout the Macquarie-Castlereagh region. This role may be involved in: • pest management (fish and weeds) • remediation and mitigation of impacts on waterways including riparian zones • restocking native fish and vegetation species • working closely with compliance officers • being involved in monitoring, evaluation and research programs run by government.
Intent	• Improve the involvement of local Aboriginal people in the management and protection of waterways and water dependent sites, including future generations. • Enable a closer relationship with environmental water managers across NSW. • Use local knowledge to improve water management outcomes, in a way that is culturally appropriate and respects cultural knowledge and intellectual property.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways.
Potential combinations	This could be combined with other options for Improving the recognition of Aboriginal people's water rights, interests and access to water, such as Option 42 (Culturally appropriate water knowledge program), Option 49 (Regional Cultural Water Officer employment program) and Option 45 (Regional Aboriginal Water Advisory Committee).
Considerations	There are similar programs that could provide partnerships and learnings: • Indigenous Land Use Agreement land and waterway managers • Barkandji River Ranger Program—being developed under the Indigenous Land Use Agreement program with adaptive framework to better reflect a whole-of-catchment health approach • Local Land Services existing river management program • council pest species managers. Note: This option could be considered at a state level through a state-wide Aboriginal water policy. Considerations will also be given to the interactions between this option and the recent funding commitment made by the Australian Government to create four new Indigenous Ranger groups across the Murray-Darling Basin.
Objective	

Option 30: Secure flows for Beemunnel Aboriginal Place

Source: Department of Planning, Industry and Environment—Water, Aboriginal consultation

Description	Aboriginal people have a close spiritual connection with waterways. In the Macquarie-Castlereagh catchment, many water dependent cultural sites, including places of spiritual significance and places of traditional hunting, recreation and cultural uses, are susceptible to dry conditions. Communities are deeply affected during dry periods and drought due to the reduction in their ability to access water for cultural purposes. Beemunnel Aboriginal Place holds significant cultural value for the local Wailwan Nation. Beemunnel is a designated Aboriginal site on the Ewenmar Creek near Warren. This option would consider options for providing regular flows to Beemunnel.
Intent	• Ensure cultural sites are appropriately considered and supported in the Macquarie-Castlereagh water management system. • Improve recognition of cultural sites and their protection and management. • Improve community wellbeing and connection to Country.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways.
Potential combinations	This could be combined with other options for Improving the recognition of Aboriginal people's water rights, interests and access to water, such as Option 29 (River Ranger Program), Option 42 (Culturally appropriate water knowledge program), Option 49 (Regional Cultural Water Officer employment program) and Option 45 (Regional Aboriginal Water Advisory Committee).
Considerations	The option would need to consider: • where water would be sourced—surface water or ground water • how water would be delivered and whether new infrastructure is needed to deliver water to Beemunnel reserve.
Objective	

Option 31: Connectivity with downstream systems

Source: Department of Planning, Industry and Environment—Water

Description	Explore options to improve connectivity between the Macquarie-Castlereagh region and the Barwon-Darling River. The Barwon-Darling River and communities along the river rely on flows from Queensland as well as the Border Rivers, Gwydir, Namoi and Macquarie-Castlereagh catchments. Improving connectivity to the Barwon-Darling River was a recommendation of the *Independent Assessment of the 2018/19 fish deaths in the Lower Darling* and the *Independent Panel Assessment of the Management of the 2020 Northern Basin First Flush Event*. Potential options to improve connectivity between the Macquarie-Castlereagh region and the Barwon-Darling River include: • developing clear arrangements around how decision makers will aim to achieve connectivity within and between water sources after an extended dry period and embedding these into the regulatory and policy framework • using environmental water to achieve connectivity objectives • establishing additional end of system flow targets • implementing flow plan targets for unregulated water sources • using temporary water restrictions more frequently to achieve connectivity objectives • working with Queensland to enable more water to flow into NSW by protecting it from extraction • reviewing water sharing rules in the northern tributary valleys to enable greater connectivity with downstream catchments.
Intent	Enable critical human and environmental downstream needs to be met.
Challenges addressed	• Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh. • Increased climate variability, particularly during dry times, will place increased pressure on surface and groundwater resources and the ecosystems they support. • Presently, the fish community of the Macquarie valley is in poor health.
Potential combinations	This option could be combined with targeted environmental works, options to improve native fish movement and habitat, and options that incorporate 'active management' of flows.
Considerations	The option requires: • assessment of potential impacts on the environment and water users in the Macquarie-Castlereagh catchments • assessment of changes to existing river flow patterns and planned environmental water, including from unregulated tributary flows in the lower Macquarie-Castlereagh • assessment of the relative contribution of all the Barwon-Darling River major tributaries • amendments to the water sharing plan for the Macquarie-Castlereagh region that support implementation active management of environmental water • a review of the flow targets in the North-West Interim Unregulated Flow Management Plan and how the Macquarie-Castlereagh inflows can contribute to these. Note: This option will be informed by connectivity options arising from the Western Regional Water Strategy.
Objective	

Image courtesy of Destination NSW.

Supporting water use 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: End of system efficient stock and domestic water delivery options	
Source: WaterNSW: Macquarie Priority Catchment Study	
Description	Improve efficiency of water delivery to stock and domestic users downstream of Warren, including delivering water through pipelines and/or bores, and on-farm infrastructure (pumps, pipes, tanks and troughs).
Intent	• Improve end of system delivery to maximise water availability for users downstream of Warren including stock and domestic, irrigation, urban and industrial users. • Improve water delivery in effluent creeks and reduce transmission losses associated with other replenishment flows in the distributary (effluent) creeks.
Challenges addressed	The long river system presents challenges in delivering water to the end of the system.
Potential combinations	This option could be assessed in combination with Option 10 (Gunningbar Creek pipeline), Option 9 (Pipeline from the proposed new mid-system weir near Gin Gin to Nyngan) and Option 8 (Burrendong Dam to Nyngan pipeline).
Considerations	This option would require investigating a suite of sub-options, including: • investigating replacing current creek access arrangements with a permanent stock and domestic pipeline • allowing creeks to be run at lower levels to save water in dry and drought conditions while meeting minimum environmental requirements. While the option might benefit stock and domestic users, it may pose some risks to environmental assets relying on sustained flow in various parts of the system. Stakeholder engagement will be a critical component. The option would also require assessment of the environmental impacts of changed in-stream morphology and flow, along with any associated changes to the operational regime of the river system on connectivity including fish passage, riparian condition, water quality and native fish including threatened species and communities, along with the outcomes of the long term water plan.
Objective	

Option 33: Enterprise water use efficiency programs

Source: Department of Planning, Industry and Environment—Water

Description	Investigate options to improve water use efficiency for larger enterprises—including research and development opportunities (for example, in the food-processing sector).
Intent	Improve industry water efficiency through conservative use, reuse and recycling of water.
Challenges addressed	Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh.
Potential combinations	This option could be combined with Option 7 (Reuse, recycling and stormwater projects).
Considerations	Some industry users, including mines, have shown a strong interest in recycling and reuse of excess water. Some mines in the lower end of the system have also adopted efficient use of water.
Objective	

Option 34: Market measures to support Dubbo's town water supply

Source: Dubbo Integrated Water Cycle Management Plan, Department of Planning, Industry and Environment—Water

Description	Buying surface or groundwater entitlements to meet the city's urban water requirements.
Intent	Improve Dubbo's town water supply by accessing alternate water sources.
Challenges addressed	Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh.
Potential combinations	This option could be linked to options that aim to improve town water supply by giving towns access to alternate water sources.
Considerations	The option would require consideration of the impact on the temporary trade market.
Objective	

Image courtesy of Nicola Brookhouse.

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.

Option 35: Investigation of licence conversions

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

Description	Consider the potential benefits from voluntary conversion of general security licences to high security licences. The investigation would help to determine the level of water security achievable in the Macquarie-Castlereagh region. This option would improve security for general security licence holders for a smaller entitlement volume, should they opt to convert their general security licences into high security licences.
Intent	• Provide potentially greater flexibility in agricultural production, including long-term transition to higher value enterprises (such as vegetables and horticulture). • Reduce reliance on the 'boom-bust' cycle of annual water allocations.
Challenges addressed	• Changing water needs, both within the agriculture industry and through strategic growth of regional centres. • Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh.
Potential combinations	This option could be linked to Option 37 (Review of regulated river water accounting and allocation process).
Considerations	The option requires: • significant consultation to ensure the methodology for determining the conversion rate is accepted by water entitlement holders. Consultation is also required to understand the public acceptance of the option • an assessment of the interactions between the Basin Plan, water sharing plan/water resource plan requirements (including meeting the objectives and targets of the long term water plan and the no net reduction in planned environmental water requirement) • consideration of whether all general security users including environmental water entitlements could be given the opportunity to convert • any potential impacts on existing high priority water users • a long time period for implementation (10+ years).
Objective	

Option 36: New drought operational rules (Macquarie River)

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

NSW has developed an Extreme Events Policy that outlines the management of NSW Murray-Darling Basin water resources during extreme events. NSW has also developed an Incident Response Guide for the Macquarie regulated river that give water managers a toolkit of approaches from which to select as an event becomes more severe. The Incident Response Guide is based on the principles outlined in the NSW Extreme Events Policy.

Description	Based on new climate data and updated modelling for the regional water strategies, this option would review the effectiveness of the Macquarie Incident Response Guide, including assessing the merit of changing the current system operational rules (for example, limiting the delivery of water to different sections of the regulated river) to minimise delivery losses during extreme events and 'pulsing' water to that section of the regulated river.
Intent	• Improve water delivery and maintain effective reserves for high priority needs (regional towns, stock and domestic users and high-security entitlement holders) during extreme events. • Ensure better preparedness for future extreme events.
Challenges addressed	Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh.
Potential combinations	This option could be combined with Government commitment 1 (A new mid-system re-regulating weir on the Macquarie River), Option 9 (Pipeline from the proposed new mid-system weir near Gin Gin to Nyngan) and Option 37 (Review of regulated river water accounting and allocation process).
Considerations	The option requires: • assessment of the potential water security risk to regional towns and stock and domestic users in the lower Macquarie • assessment of potential environmental impacts (such as impacts on threatened species and ecological communities) and the implications of changes on planned environmental water (for example, changing the timing of water release could have implications on threatened species populations in the Macquarie) • consideration of possible (environmental) offsets needed to meet Basin Plan requirements • consideration of whether amendments to the current water sharing plan for the Macquarie regulated river are required • consideration given to shortening the river length and pulsing water from the dam • assessment of the impacts on water licence holders in the lower Macquarie • equity considerations between different users in different locations • stakeholder feedback on the acceptance of this option. Note: Further work is required (for example, separating specific components) to fully understand and assess risks to all water users in the Macquarie.
Objective	
Further information	**Extreme Events Policy and Incident Response Guide for the Macquarie:** **www.industry.nsw.gov.au/water/plans-programs/water-resource-plans/drafts/macquarie-castlereagh-surface**

Option 37: Review of regulated river water accounting and allocation process

Source: Department of Planning, Industry and Environment—Water

Description	Review different settings of the current water accounting and water allocation process in the Macquarie regulated system, including: • reserves held in storage for critical human needs • changing to a more conservative water allocation process (Available Water Determination (AWD)) to ensure more water is kept in storage for basic landholder rights, stock and domestic users and high security licences by providing a longer planning horizon • the effects of updating the 'worse inflow sequence' reference in the water sharing plan for the Macquarie regulated river (to incorporate more recent inflow records and climate change modelling) • changing the volume of water stored in Burrendong Dam for regional towns and stock and domestic water users (and applying different water delivery mechanisms) • investigating how conveyance 'losses' are accounted for.
Intent	Investigate options to more effectively meet basic landholder rights and the needs of stock and domestic water users and high security users in the Macquarie-Castlereagh region, particularly during dry times or under potential climate change conditions.
Challenges addressed	• Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh. • Healthy water sources support the region's environment, which—in turn—supports liveable communities and thriving industries.
Potential combinations	This option could be combined with Option 35 (Investigation of licence conversions) and Option 34 (Market measures to support Dubbo's town water supply).
Considerations	The option would include: • investigation of a more conservative water allocation process to ensure more water is kept in storage for basic land holder rights, stock and domestic users and high security licence holders (while providing an additional buffer to support town water security) • consideration of the likely benefits or impacts of any changes (including any accounting or operational changes to the delivery of water) on key environmental processes and cultural values • assessment of potential benefits to towns and high value industries during times of water scarcity • consideration of a 'cut off' trigger for town water security • weighing up the water security benefits against the economic costs of reduced allocations to general security water users.
Objective	
Further information	www.industry.nsw.gov.au/water/allocations-availability/allocations/how-water-is-allocated

Option 38: Improved data collection and storage

Source: Department of Planning, Industry and Environment—Water, Department of Primary Industries—Agriculture and consultation with joint organisations and councils

Description	Opportunities to improve data collection around water use by industry, the environment and towns in the Macquarie-Castlereagh region. This would generate better information to inform future water management decisions in the region. This option would investigate opportunities to refurbish existing infrastructure (such as groundwater monitoring bores) and install new infrastructure and technology to enable better collection of water flows, levels and quality parameters. It will also investigate ways to harness water data collected by industries (for example, in Environmental Impact Statements and annual compliance reports). The options would review the water monitoring programs that utilise the monitoring infrastructure. It will prepare a unified state-wide monitoring program strategy. Finally, the option would consider how best to publicly share data, and what information products are needed for different types of water users.
Intent	Inform future water management in the Macquarie-Castlereagh region (such as the operation of water sharing plans and water resource plans).
Challenges addressed	• Increased climate variability, particularly during dry times, will place increased pressure on surface and groundwater resources and the ecosystems they support. • Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh.
Potential combinations	This option would provide the basis for Option 25 (Improved understanding of groundwater processes). Option 26 (Sustainable access to groundwater) and Option 27 (Improved clarity in managing groundwater resources sustainably).
Considerations	Work by the Water Renewal Taskforce (such as new metering regulation) will assist in improving data collection on water use. This option will consider the recent announcement by the Australian Government to build a web-based, real time water information platform. Note: The Department received comments on the need for improved climate data during consultation on the water resource plan development.
Objective	

Option 39: Training and information sharing programs:
- new climate data/modelling
- managing groundwater resources sustainably

Source: Department of Planning, Industry and Environment—Water

Description	Training and information sessions on the new regional water strategy climate data and modelling to build confidence in the new approach and identify opportunities for wider use of the new datasets. Providing training and information about groundwater resources and how they are managed. This will assist councils and other water users to make more informed decisions about their water supply security. This option would also consider how best to publicly share data, and what data analytics and information products are needed for different types of water users.
Intent	Assist councils to make informed decisions about their water supply security (including groundwater), provide greater transparency around water management and water modelling, and inform councils in the development of their own integrated water cycle management strategies and regional town water strategies.
Challenges addressed	Increased climate variability poses new risks to towns, communities and industries in the Macquarie-Castlereagh.
Potential combinations	This option could be linked to other options designed to strengthen community preparedness for climate extremes, maintaining and diversifying water supplies, and protecting and enhancing natural systems.
Objective	

Option 40: Investigation to maintain amenity for regional towns during drought

Source: Department of Planning, Industry and Environment—Water

Description	Investigate opportunities to maintain town water features, local parks and recreational areas during extended drought and make them less 'climate dependent' so they can be permanent features of regional towns.
Intent	Enable regional town centres to remain green, particularly during dry times. This would provide multiple benefits to the community, including town amenity, improved mental and physical health (access to recreational facilities, appealing spaces for social gatherings, general amenity value of the town), potential economic diversity for the towns (ability to attract tourism and host events to support local businesses) and possibly a refuge for fish when rivers are reduced to isolated pools.
Challenges addressed	• Healthy water sources support the region's environment, which—in turn—supports liveable communities and thriving industries. • Increased climate variability may pose new risks to towns, communities and industries in the Macquarie-Castlereagh.
Potential combinations	Potential combinations include options addressed under strengthening community preparedness for climate extremes, maintaining and diversifying water supplies, and supporting water use efficiency and conservation.
Considerations	The option requires: • identification of high value community 'green' assets (such as town water features, local parks and recreational facilities, street trees) • an assessment of the quantity of water required to maintain 'green' regional centres • investigation using regional water features, such as lakes, as a fish refuge during dry times • an assessment of available alternative water sources, including treated wastewater, aquifer recharge and storage, and groundwater. Harvested stormwater is unlikely to be an option as it is not available during dry times (although it could be encouraged for passive irrigation of street trees as part of future town planning): – for recycled wastewater, the assessment will need to consider existing treatment systems and the water quality requirements of the end use, proximity of the treatment facility to key assets, and operational costs – for groundwater and surface water use, the assessment will need to consider the impact of using these sources on critical needs.
Objective	

Option 41: Land use change impact on water resources

Source: Community consultation, peak groups

Description	Investigation of the potential impacts on water resources due to land use changes and population growth in the Macquarie-Castlereagh region.
Intent	• Provide important information to the NSW Government to help in its decision-making process regarding future land use applications in the region. • Examine the feasibility of land use planning controls.
Challenges addressed	Increased climate variability may pose new risks to towns, communities and industries in the Macquarie-Castlereagh region.
Potential combinations	This option could be combined with options designed to protect and enhance natural systems (such as environmental restoration/rehabilitation works, pump screening, environmental water management and other measures) or options Improving the recognition of Aboriginal people's water rights, interests and access to water.
Considerations	The option requires: • detailed assessment of existing planning controls • improved understanding of impacts on water resources from land use changes. Note: This option will require close collaboration with other government agencies.
Objective	

Image courtesy of Peter Robey.

Improving recognition of Aboriginal people's water rights, interests and access to water

Opportunities to protect and strengthen cultural landscapes, practices, knowledge and traditions. Supporting empowerment, self-determination and economic advancement of Aboriginal people, as well as strengthening community wellbeing.

Option 42: Culturally appropriate water knowledge program

Source: Department of Planning, Industry and Environment—Water, Aboriginal consultation

Description	The management of water can often be complex with many layers of government playing different roles in the management and delivery of water across the Macquarie-Castlereagh region. This option would develop a culturally appropriate water knowledge program that would aim to increase the capacity of Aboriginal people across the region so that they can more effectively participate in negotiations on water management and policy related matters that affect them. This program would include increased communication between Aboriginal groups and all of government agencies on key topics.
Intent	• Improve the ability of Aboriginal community to engage with the complexities of water management in NSW. • Improve water knowledge and participation across all ages and communities.
Challenges addressed	• Lack of culturally appropriate information about how governments manage water. • Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions.
Potential combinations	This could be combined with Option 43 (Water-dependent cultural practices and site identification project), Option 49 (Regional Cultural Water Officer employment program) and Option 29 (River Ranger Program).
Considerations	Ensure program training is created and delivered in a culturally appropriate manner. This may include: • building skills and accreditations/qualifications for key Aboriginal people who can take this back to the community • hosting training in the community or in appropriate settings • ensuring Aboriginal people have a chance to assist in the development and delivery of training programs. Note: • two-way knowledge sharing between Aboriginal people and local, state and federal governments will be critical to promoting improved Aboriginal cultural awareness • this option could be considered at a state level through a state-wide Aboriginal water policy.
Objective	

Option 43: Water-dependent cultural practices and site identification project

Source: Department of Planning, Industry and Environment—Water, Aboriginal consultation

Description	Options for Aboriginal people to classify and map water-dependent cultural sites throughout the Macquarie-Castlereagh region. This will include the identification and mapping of cultural sites, places of spiritual significance, and places used by Aboriginal people for traditional and contemporary uses, such as hunting, recreation and economic uses. Intellectual property and cultural knowledge would be protected and retained by Aboriginal people.
Intent	• Develop a resource for Aboriginal people to help with planning of cultural and environmental water and possible impacts of other management and development decisions. • Enable Aboriginal communities to educate the wider community to develop a greater understanding of cultural values and connections to rivers and wetlands across the Macquarie-Castlereagh region.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways.
Potential combinations	This could be combined with other options linked with Improving the recognition of Aboriginal people's water rights, interests and access to water, as well as options designed to protect and enhance natural systems such as Option 29 (River Ranger Program).
Considerations	We heard from Aboriginal people in the Macquarie-Castlereagh that Aboriginal people should retain ownership of information they share and determine how it will be used. Note: • mapping of different aspects of Aboriginal cultural values has previously been undertaken in the Macquarie-Castlereagh region by various agencies and organisations. These resources can assist with the implementation of this option • the Aboriginal Waterways Assessment tool has been piloted by the Murray-Darling Basin Authority and is currently being used across the Basin • this option could be considered at a state level through a state-wide Aboriginal water policy.
Objective	
Further information	**The Aboriginal Waterways Assessment program:** **www.mdba.gov.au/publications/mdba-reports/aboriginal-waterways-assessment-program**

Option 44: Shared benefit project (environment and cultural outcomes)

Source: Department of Planning, Industry and Environment—Water, Aboriginal consultation

Description	Water for the environment plays a vital role in sustaining the health of rivers and wetlands, and supporting their ecological, cultural and economic values. This option would investigate opportunities for shared benefits from using water for the environment to also achieve cultural environmental outcomes, recognising it does not replace the provision of cultural flows. Shared benefits may include fish movement and to support populations of nesting fish species such as Murray Cod.
Intent	• Where shared benefits may exist, explore cultural outcomes from the use of water for the environment. • Support, incorporate and implement traditional Aboriginal ecological knowledge into water management action plans for the environment. • Support the cultural connection of Aboriginal people to water-sustained environments.
Challenges addressed	• Aboriginal people have limited opportunities to influence water management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways.
Potential combinations	This could be combined with other options linked with Improving the recognition of Aboriginal people's water rights, interests and access to water, as well as options designed to protect and enhance natural systems such as Option 29 (River Ranger Program).
Considerations	The option would need to consider: • development of capacity and resources within Aboriginal communities to support their participation in environmental water planning • appropriate channels for Aboriginal community members to engage with environmental water holders to identify shared watering needs • the need and frequency of watering at different times of the year to achieve cultural outcomes. Note: • environmental water holders are responsible for the use of environmental water. The primary consideration in using this water is the achievement of environmental outcomes • options that identify water-dependent cultural practices and sites across river systems and waterways would provide more resources for Aboriginal people to work with Environmental Water Holders • this option could be considered at a state level through a state-wide Aboriginal water policy.
Objective	

Option 45: Regional Aboriginal Water Advisory Committee

Source: Department of Planning, Industry and Environment—Water, Aboriginal consultation

Description	Establish an Aboriginal Water Advisory Committee. This committee would improve the ability of Aboriginal people across the region to have a unified voice on water matters that affect them. The committee could also be responsible for matters including: • guiding the purchase and management of water entitlements for Aboriginal people to receive cultural flows • defining the cultural water flow needs for Aboriginal people in the region • providing representation for the wider Aboriginal community including those not part of a peak organisation or representative body.
Intent	• Improve the representation of the Aboriginal people in decision-making. • Provide a point of contact for water managers to engage with the region's Traditional Owners. • Broadly representing Traditional Owners of the region who have cultural knowledge and can speak for their Country.
Challenges addressed	• Aboriginal people have limited opportunities to influence water management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management.
Potential combinations	This could be combined with other options linked with Improving the recognition of Aboriginal people's water rights, interest and access to water, as well as options designed to protect and enhance natural systems such as Option 29 (River Ranger Program).
Considerations	Aboriginal people have raised considerations such as having: • Aboriginal people with an interest in water and cultural authority to speak for Country • legislative backing. This option will need to consider how the regional committee will interact and be involved with other groups, and the process for identifying and electing representatives to sit on the committee and governance framework. It will also need to consider how Aboriginal people are involved in water decision-making outside of this committee. Note: This option could be considered at a state level through a state-wide Aboriginal water policy.
Objective	

Image courtesy of Destination NSW.

Option 46: Water portfolio project for Aboriginal communities

Source: Department of Planning, Industry and Environment—Water, Aboriginal consultation

Description	Funding to support Aboriginal people purchase water entitlements and infrastructure (such as pumps) that can be used to improve economic and cultural outcomes across the Macquarie-Castlereagh.
Intent	• Support Aboriginal people using water entitlements for economic and cultural purposes. • Give Aboriginal people more secure access to water for spiritual, cultural, social, environmental and economic purposes, as well as open up opportunities for investment in water dependant initiatives and cultural projects.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways.
Potential combinations	This could be combined with other options linked with Improving the recognition of Aboriginal people's water rights, interests and access to water, such as Option 45 (Regional Aboriginal Water Advisory Committee) and Option 42 (Culturally appropriate water knowledge program).
Considerations	The option would need to consider the following: • the federal government's pledge of $40 million in funds to support the acquisition of water entitlements for cultural purposes across the Murray-Darling Basin • learnings from the Murray-Darling Basin Authority Water Efficiency Measures program in supporting the purchase of water entitlements for cultural flows in NSW • providing sufficient funding to meet ongoing Aboriginal needs. Investigation will need to be undertaken into the level of demand. Note: This option could be considered at a state level through a state-wide Aboriginal water policy.
Objective	
Further information	**National Cultural Flows Research Project:** www.culturalflows.com.au/

Option 47: Aboriginal cultural water access licence review

Source: Department of Planning, Industry and Environment—Water, Aboriginal consultation

Description	Water access licences allow licence holders to take water from rivers, lakes or aquifers for certain uses. This includes a category of specific purpose water access licences (Aboriginal cultural) that can only be held by Aboriginal people to access water for drinking, food preparation, washing and watering domestic gardens and cultural uses.[1] The utilisation of these categories of licences is low. This option will undertake a review of water access licences for Aboriginal cultural uses to determine their effectiveness and identify opportunities for improvement.
Intent	• Optimise water sharing mechanisms that support cultural values and uses, both traditional and contemporary, recognising that Aboriginal cultural values and uses have adapted over time. • Develop a framework for cultural flow allocations. • Improve uptake of water access licences for Aboriginal cultural purposes.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways.
Potential combinations	This could be combined with Option 45 (Regional Aboriginal Water Advisory Committee), Option 42 (Culturally appropriate water knowledge program) and Option 49 (Cultural Water Officer employment program).
Considerations	The option will need to consider: • the application and decision-making process for these water access licences • how the licences fit with the extraction and allocation limits within the valley • supporting services—including education and knowledge sharing about water markets and licences. Note: This option could be considered at a state level through a state-wide Aboriginal water policy.
Objective	

1. See Part 8, Section 49 (3) www.legislation.nsw.gov.au/#/view/regulation/2016/365

Option 48: Co-management investigation of Travelling Stock Reserves

Source: Department of Planning, Industry and Environment—Water, Aboriginal consultation

Description	Travelling Stock Reserves (TSRs) hold significant importance to Aboriginal people as they provide access and connection to Country, cultural practices and the protection of Aboriginal cultural heritage sites. However, Aboriginal people cannot always easily access and are not resourced to be involved in management decisions about these culturally significant sites. This option would investigate opportunities to improve the involvement of Aboriginal people in the co-management of TSRs that connect them to waterways and water dependent sites of cultural importance.
Intent	• Improve access to waterways and other water-dependent sites of cultural importance. • Protect cultural assets, songlines and important flora. • Improve environmental outcomes. • Support Aboriginal people's involvement in the management of TSRs that connect Aboriginal people to waterways. • Support Aboriginal people to have more input on decisions that affect them and their cultural values.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science is not effectively integrated into water management in culturally appropriate ways.
Potential combinations	This option could be combined with other options linked with Improving recognition of Aboriginal people's water rights, interests and access to water, such as Option 43 (Water-dependant cultural practices and site identification), Option 49 (Cultural Water Officer employment program) and Option 29 (River Ranger Program).
Considerations	This option would need to consider Local Land Services' state-wide plan for managing the delivery of better TSR services for the community. Note: This option could be considered at a state level through a state-wide Aboriginal water policy.
Objective	

Option 49: Regional Cultural Water Officer employment program

Source: Department of Planning, Industry and Environment—Water, Aboriginal consultation

Description	Investigate models for establishing Cultural Water Officer roles that assist with engaging with Aboriginal people regarding water management in the Macquarie. Responsibilities of this role could include: • increasing the general knowledge of the broader Aboriginal community on water management matters and the water licencing framework in a culturally appropriate way • coordinating engagement with local Aboriginal people on water management matters • promoting and supporting self-determination and representation • channelling information between Aboriginal people and government bodies and key stakeholders.
Intent	• Improve the awareness and involvement of local Aboriginal community members in the management of water resources across the Macquarie. • Enable local Aboriginal people to use their local knowledge and skills to assist in decisions about water use and management. • Enable more equitable and collaborative relationships with stakeholders and co-designed programs.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science is not effectively integrated into water management in culturally appropriate ways.
Potential combinations	This could be combined with other options linked with Improving the recognition of Aboriginal people's water rights, interests and access to water, as well as options designed to protect and enhance natural systems such as Option 29 (River Ranger Program).
Considerations	The option would need to consider: • the operational and project budget to support the program • the location of officers and whether they would sit within government or within an Aboriginal organisation.
Objective	

Options not progressed

Image courtesy of NSW Department of Primary Industries.

Three infrastructure options that were proposed in the WaterNSW 20-Year Infrastructure Study for the Macquarie-Castlereagh region are not included in the long list of options. WaterNSW has carefully considered the potential benefits and impacts of these options before recommending that they are not included in the Draft Macquarie-Castlereagh Regional Water Strategy.

Option	Description	Reason for not progressing
Construction of Ulmarrah Dam	Construction of a new 700 GL dam approximately 65 km upstream of Burrendong Dam on the Macquarie River	WaterNSW analysis has shown that reducing the existing Flood Management Zone and increasing the Burrendong Dam Full Supply Level are superior options compared to the construction of a new Ulmarrah Dam. Building a new dam at the proposed location would have an impact on inflows to Burrendong Dam. Currently, Burrendong Dam holds 489 GL of airspace for flood mitigation purposes. When considering average catchment inflows, Burrendong is an appropriate size dam that aligns with average annual inflows. With regard to the Ulmarrah Dam, the high building cost, complexity of implementation, potentially low future inflows due to climate variability and change, likely environmental impacts and Sustainable Diversion Limit limitations in the Macquarie-Castlereagh valley limited this option when compared against the option of increasing the Full Supply Level of Burrendong Dam.
Construction of a new dam on Bell river	Construction of a new 308 GL dam on the Bell River, downstream of the Burrendong Dam and approximately 60 km upstream of the Macquarie River confluence	The high dam building cost, complexity of implementation, potentially low future inflows due to climate variability and change, likely environmental impacts and Sustainable Diversion Limit limits in the valley limited this option when compared against the option of increasing the Full Supply Level of Burrendong Dam and mid Macquarie regulating storage. These other options support water saving and efficient water delivery down stream of Burrendong Dam at low cost and maximum benefits.
Raise the Burrendong Dam wall by six metres	Increase the height of Burrendong Dam wall by 6 m (and associated works to increase the full supply volume of the dam from 1,190 GL to 1,670 GL)	This option aims to improve water security for users; however, it was not shortlisted in Macquarie Priority Catchment Strategic Assessment due to lower benefits compared to the cost: Benefit Cost Ratio of 0.1. This option also received low stakeholder support as it provides low hydrological benefit.

dpie.nsw.gov.au