Department of Climate Change, Energy, the Environment and Water

Reconnecting River Country Program Murrumbidgee Project

Final Business Case Summary

16 July 2025

NSW GOVERNMENT

Acknowledgement of Country

Department of Climate Change, Energy, the Environment and Water acknowledges the traditional custodians of the land and pays respect to Elders past, present and future.

We recognise Australian Aboriginal and Torres Strait Islander peoples' unique cultural and spiritual relationships to place and their rich contribution to society.

Artist and designer Nikita Ridgeway from Aboriginal design agency – Boss Lady Creative Designs, created the People and Community symbol.

Reconnecting River Country Program Murrumbidgee Project

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More information

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Project overview

- Aims to improve the health of the Murrumbidgee River system by relaxing environmental flow constraints
- Securing a flow corridor that will enhance connectivity between rivers, wetlands, and floodplains

Problem statement and project objectives

Problem statements	Project objectives
1 Ecosystem health has declined along the Murrumbidgee River contributed to by river regulation and consumptive water use impacting the frequency of overbank flows connecting low-level wetlands and floodplains	**Objective 1: Ecosystem health** Protect and support the restoration, connectivity, functionality and long-term resilience of water-dependent ecosystems creating healthier functioning river systems in the Murrumbidgee Valley
2 Environmental water recovered to improve the health of river ecosystems is unable to be used above channel capacity as the river operator may not have the authorising environment to release these flows	**Objective 2: Productive environmental water use** Enable the more efficient and effective use of environmental water within the Murrumbidgee regulated river water source
3 Current environmental flow limits are constrained to avoid impacts on riparian landholders, public infrastructure and other stakeholders	**Objective 3: Mitigate impacts and explore opportunities** To fairly and equitably mitigate impacts on riparian landholders and stakeholders from the release of increased environmental flows, and support First nations people to equitably participate in and inform environmental water management

Engagement up to December 2024

- Over 9,300 interactions
- More than 900 discussions
- Engagement with 253 landholders representing 85% of the project's inundated area of private land

Project measures

- Securing environmental flow easements on private land and public land where required
- Developing strategies for alternatives to easements where landholdings have minimal inundation
- Infrastructure works
- First Nations enabling measures

The **recommended solution** is to increase the upper environmental flow limit to 40,000 ML/day at Wagga Wagga. Flows at this level will not commence until after 2031 and subject to continuing Australian Government support. This option demonstrates the best value for money by outperforming the other options across economic, First Nations and environmental indicators.

Economic indicators, benefits and sentiment	Indicators
Benefit Cost Ratio	1.3
Contribution to Sustainable Diversion Limit Adjustment Mechanism (SDLAM) offsets	10-20 GL
Increase in area of wetlands that can receive environmental water	187%
Increase in area of river red gum forest and woodlands that can receive environmental water	251%
Increase in area of river red gum communities in healthy condition during dry times	114%
Increase abundance of Golden Perch	26%
Private landholder support	72%
First Nations support	High

Implementation

- Phase 1 (to Dec 2026) – partial delivery focusing on flow corridor negotiations with the most affected properties, scoping public works, First Nations measures. Aligns with current Basin Plan timeframes and may support higher environmental flows (up to Water Sharing Plan limits) after 2026
- Phase 2 (2027–2031) – subject to funding and Basin Plan extension, full implementation to secure remainder of flow corridor, infrastructure works, First Nations enabling measures

Figure 1-1 Project overview

2 Executive summary

2.1 Project description

The Reconnecting River Country Murrumbidgee Project is a critical Murray-Darling Basin initiative. It aims to improve the health of the Murrumbidgee River system and Country by increasing the frequency and extent rivers connect to wetlands and floodplains.

The Reconnecting River Country Murrumbidgee Project is part of the Reconnecting River Country Program which considers the measures required to relax environmental flow constraints. These measures will achieve the Murrumbidgee component of the program goal. The program goal is to increase the frequency and extent rivers connect to wetlands and floodplains to improve the health of the Murrumbidgee (and Murray) river systems.

What is a constraint?

A constraint is any physical, policy or operational barrier which limits the flow of water in river systems. There are a range of flow constraints in the Basin. Some examples include physical restrictions such as low-lying watercourse crossings, weirs and levees. They also include operational restrictions such as dam outlets and channel capacity constraints, river operation rules and practices as well as regulatory barriers such as existing legislation.

By relaxing constraints, the project will enhance environmental water delivery to wetlands and floodplains, fostering a healthier system. This will benefit native vegetation, fish, waterbirds, turtles, frogs and other wildlife. Once fully implemented, the project is expected to deliver landscape-scale outcomes benefiting ecosystems, communities and future generations.

As of December 2024, the Reconnecting River Country Program is one of 36 Sustainable Diversion Limit Adjustment Mechanism (SDLAM) projects under the Murray-Darling Basin Plan (the Basin Plan) and is a NSW Government Basin Plan commitment. If the SDLAM projects are not delivered, they will not contribute to the 605 gigalitres (GL) offset target and the Australian Government may initiate further buybacks from consumptive users in the southern-connected Basin. Further buybacks have the potential to impact irrigated agriculture and regional communities.

The NSW Department of Climate Change, Energy, the Environment and Water (the department) has investigated measures to relax constraints to environmental flows along the Murrumbidgee River from Burrinjuck Dam to the junction of the River Murray. This includes the Yanco Creek system. Removing constraints is critical to achieving the Basin Plan's improved environmental outcomes and making best use of existing water recovered from communities. Without restoring key hydrological processes and improving water delivery, the ecological health of the region will continue to decline and further worsen due to climate change impacts.

Water recovery alone will **not** solve the Murrumbidgee River and floodplain health issues unless constraints on connectivity are also addressed.

Significant investment by the Australian Government in water buybacks and efficiency projects under the Basin Plan have increased the environmental water available to support connecting ecosystems. However, its use is constrained by potential inundation impacts to property, public infrastructure and access to both private and public land. No other projects or options can achieve the required or equivalent environmental outcomes.

Addressing constraints will provide river operators and environmental water managers the authorising environment and flexibility to deliver environmental water where and when it is needed. This will help realise the intended environmental benefits of the Basin Plan and Australian Government investment.

2.2 Project rationale

The project is key to achieving Basin Plan environmental outcomes and minimising further water recovery. Due to current constraints, environmental water cannot be used flexibly to reach the Murrumbidgee River's floodplains and wetlands, posing severe risks to the region's environmental assets. Reconnecting the Murrumbidgee with its floodplain and wetland environments more regularly will enhance the health and resilience of its ecosystem and achieve the intended Basin Plan environmental outcomes.

Without action, the benefits of the project will not be fully realised, and further water buybacks could be initiated by the Australian Government. This would lead to social and economic impacts as well as the continued decline of important environmental assets. No other projects or options can achieve the required or equivalent environmental outcomes.

2.2.1 Problem statements

Problem statement 1
Ecosystem health has declined along the Murrumbidgee River, contributed to by river regulation and consumptive water use impacting the frequency of overbank flows connecting low-level wetlands and floodplains.

The health of the Murrumbidgee River system is in decline due to river regulation, water extraction and constraints to more flexible environmental water delivery, which have reduced the frequency of overbank flows connecting wetlands and floodplain. Flows of 28,000-48,000 ML/day at Wagga Wagga have decreased from an average of 45 days annually (1916-1927 reflecting natural flows) to

16 days annually (1958-2018 reflecting highly regulated flows),[1] significantly impacting biodiversity and ecosystem health of wetlands[2], vegetation, fish[3] and waterbirds.[4]

Problem statement 2
Environmental water recovered to improve the health of river ecosystems is unable to be used above channel capacity as the river operator may not have the authorising environment to release these flows.

Since 2012, the river operator for the Murrumbidgee system, WaterNSW, has limited flows to 22,000 ML/day at Wagga Wagga. This is in response to concerns about potential inundation impacts, loss of access to productive land and road access above this level. Environmental water managers use held and planned environmental water to water wetlands and floodplains, support bird breeding or fish spawning and to reduce the severity of hypoxic blackwater events. The current operational delivery flow limit and channel constraints mean environmental water deliveries can reach only 17% of the Murrumbidgee's total wetland area, reducing the effectiveness of water recovered from consumptive users. This means the benefits of water buybacks to date cannot be fully realised.

Problem statement 3
Current environmental flow limits are constrained to avoid impacts on riparian landholders, public infrastructure and other stakeholders.

Increasing the operational limits for environmental flows in the Murrumbidgee River above the current 22,000 ML/day operational limit at Wagga Wagga would enable WaterNSW-planned environmental releases to flow overbank in some areas along the Murrumbidgee River. This will lead to both direct and indirect benefits (such as environmental, access and grazing production improvement) and impacts (such as inundation and loss of crop production). These would affect both private and public lands (such as access to public recreation sites and roads) and infrastructure (such as overloaded stormwater pump assets).

Increasing operational flow limits would heal and restore Country. Accompanying measures would also offer opportunities for First Nations communities to reconnect with and care for Country, enabling cultural, social and economic benefits while supporting environmental restoration.

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1 Kreibich, Jan, Gilad Bino, Hongxing Zheng, Francis Chiew, William Glamore, Jamie Woods, and Richard T. Kingsford. "River regulation and climate change reduce river flows to major Australian floodplain wetland." Journal of Environmental Management 370 (2024): 122962.

[2] Kingsford, R. & Thomas, R. (2004). Destruction of wetlands and waterbird populations by dams and irrigation on the Murrumbidgee River in arid Australia. Environmental Management, 34, 383–396.

[3] Gilligan D. (2005). Fish Communities of the Murrumbidgee Catchment: Status and Trends. Fisheries Final Report Series No. 75. NSW Department of Primary Industries, Sydney.

[4] Kingsford, R. & Thomas, R. (2004). Destruction of wetlands and waterbird populations by dams and irrigation on the Murrumbidgee River in arid Australia. Environmental Management, 34, 383–396.

2.2.2 Project objectives and benefits

The project's objectives and benefits (see Figure 2-1) closely align with a wide range of Australian and NSW statute, policies and strategies. Relevance for the NSW Government includes the NSW *Water Management Act (2000)*, the NSW Water Strategy, the NSW Groundwater Strategy, the Draft NSW Aboriginal Water Strategy, the Murrumbidgee Long Term Water Plan, *Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016* and the Draft Murrumbidgee Regional Water Strategy.

Objective 1: Ecosystem health
Protect and support the restoration, connectivity, functionality and long-term resilience of **water-dependent ecosystems** creating healthier functioning river systems in the Murrumbidgee Valley

Objective 2: Productive environmental water use
Enable the more efficient and effective use of environmental water within the Murrumbidgee regulated river water source

Objective 3: Mitigate impacts and explore opportunities
To **fairly and equitably mitigate impacts on riparian landholders and stakeholders** from the release of increased environmental flows, and support First Nations people to equitably participate in and inform environmental water management.

Figure 2-1: Project objectives

The project is expected to deliver the following benefits:

- improved health of the Murrumbidgee River system supporting ecosystems, communities and future generations
- more efficient and effective environmental water use achieving SDLAM offsets and reducing pressure on future water recovery under the Basin Plan
- better health of Country and opportunities for increasing First Nations people's participation in environmental water management, access and connection to Country
- overall improved agricultural outcomes
- improved community access during higher environmental flows and some natural higher flow events.

The Evaluation Outcomes section provides the quantitative (Cost-Benefit Analysis) and qualitative (Options Assessment Framework) results of these benefits.

2.2.3 Urgency for action

Immediate action is needed to relax constraints in the Murrumbidgee River system to address identified problems. Inaction will most likely have significant economic, social and environmental consequences including:

- **Irretrievable impacts to freshwater ecosystems of the Murrumbidgee River:** inaction could result in a further decline in the region's wetland and floodplain ecosystems, with

irretrievable impacts to endangered ecological communities and the region's native flora and fauna.

- **Increased pressure for buybacks:** without on-ground progress in relaxing constraints before the MDBA's reconciliation of SDLAM measures by December 2026, the NSW Government will fail to reach its SDLAM project commitments in the time required. This will leave a potential gap towards the 605 GL water recovery offset. This may lead to increased pressure for buybacks leading to economic losses and decreased agricultural productivity.
- **Ineffective use of environmental water as constraints mean environmental water cannot reach key ecological assets:** without action, the operational limit of 22,000 ML/day at Wagga Wagga will persist, preventing realisation of environmental outcomes from already recovered water.
- **Early works investments fail to realise full benefits:** capital investment in early infrastructure works needed to complement this project (such as Mundarlo Bridge[5], Mundowy Lane[6]) will not deliver the intended program benefits without relaxing constraints for river operators to deliver higher environmental flows.
- **Heightened vulnerability to climate change:** with a projected drier climate and increased frequency of extreme events, the need for managed environmental water interventions will grow, along with the urgency to optimise environmental water use.

2.3 Implementation options considered

2.3.1 Broad consideration of infrastructure and non-infrastructure options

The Basin Plan was developed as an integrated package of build and non-build measures to improve environmental outcomes for the rivers and tributaries of the Basin. Since 2007, the Australian Government has committed more than $13 billion[7] to a wide range of initiatives, many of which have been fully delivered. Within this context, the Reconnecting River Country Project's constraints relaxation measures were always recognised as critical to the original Basin Plan outcomes. Reconnecting the Murrumbidgee with its floodplain and wetland environments more regularly will enhance the health and resilience of its ecosystem and achieve Basin Plan environmental outcomes.

[5] https://water.dpie.nsw.gov.au/our-work/water-infrastructure-nsw/sdlam/reconnecting-river-country-program/program-measures/mundarlo-bridgereplacement

[6] www.dpie.nsw.gov.au/water/our-work/water-infrastructure-nsw/sdlam/reconnecting-river-country-program/program-measures/mundowy-lane-works-and-measures

[7] www.dcceew.gov.au/water/policy/programs/water-reform/mdb-funding#:~:text=The%20Murray%E2%80%93Darling%20Basin%20reforms,physical%20upgrades%20to%20water%20infrastructure

The NSW Government remains committed to delivering the Basin Plan in full, in partnership with the Australian Government and other Basin States. However, the NSW Government has been clear that this must be done in a way that minimises socio-economic impacts and allows regional communities to prosper. For this reason, NSW Government does not support water buy backs.

As a workable alternative, the NSW Government has introduced the *NSW Alternatives to Buybacks Plan*[8]. This Plan recommends a coordinated approach to delivering existing projects and proactively advancing new initiatives that contribute to Basin Plan targets, and by doing so, limiting the volume of Australian Government water buybacks from NSW communities. It also calls on the Australian Government to prioritise investment in recovering water through other mechanisms.

Without action, the benefits of the Reconnecting River Country Murrumbidgee project will not be fully realised under the SDLAM framework. This may lead to increased pressure for buybacks from the Australian Government leading to economic losses and decreased agricultural productivity.

Relaxing environmental flow constraints is the only feasible mechanism to provide the environmental flows needed to address the decline in ecological condition of the Murrumbidgee River and its wetlands and floodplains. The project satisfies the identified objectives and provides the furthest reaching benefits within the Murrumbidgee system.

2.3.2 Upper flow limit options and the base case

The Final Business Case (FBC) compares the cost and benefits of 3 flow limit options at Wagga Wagga against the base case of a flow limit of 22,000 ML/d at Wagga Wagga:

- flow limit option 1 (W32) - 32,000 ML/day flow limit, plus a flow buffer of up to 4,000 ML/day for mitigation measures
- flow limit option 2 (W36) - 36,000 ML/day flow limit, plus a flow buffer of up to 4,000 ML/day for mitigation measures
- flow limit option 3 (W40) - 40,000 ML/day flow limit, plus a flow buffer of up to 5,000 ML/day for mitigation measures[9].

These options, amongst others, were assessed in the Strategic Business Case (SBC) completed in 2022, with all 3 flow limit options recommended to proceed to a Final Business Case for further evaluation.

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[8] https://water.dpie.nsw.gov.au/our-work/plans-and-strategies/alternatives-to-water-buybacks-plan#:~:text=Minimising%20the%20exposure%20of%20regional,GL%20of%20additional%20environmental%20water.

[9] A flow buffer is adopted for each flow limit option considered. A flow buffer is not the target for flow delivery but is proposed as a risk mitigation measure. The buffer will act as a safeguard for landholders if, on rare occasions, flow targets are exceeded due to unforeseen rainfall and tributary inflows. The flow buffer will be used to define the outer extent of the flow corridor, and compensation will apply up to and including the flow buffer.

The base case, which is the benchmark for evaluating project option benefits and impacts, assumes the operational flow limit of 22,000 ML/day at Wagga Wagga. Although the Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016 specifies a 32,000 ML/day flow limit at Gundagai, WaterNSW has limited flows to 22,000 ML/day at Wagga Wagga since 2012. The base case offers limited opportunity to connect the Murrumbidgee River with its floodplains and wetlands. Relaxing constraints through the project will enable the NSW Government to raise the operational flow limit to the recommended flow limit option.

2.3.3 Frameworks, processes and systems to support delivery

To support the delivery of future environmental flows up to the recommended flow limit, the program has established a suite of frameworks, processes and systems to ensure WaterNSW operates within a clear and robust authorising environment. This includes legislative amendments, landholder negotiation processes, flow easements, improved notification systems and tailored landholder support services to enable responsible and transparent flow delivery.

To achieve the project's intended outcomes, WaterNSW will need to release overbank flows in parts of the Murrumbidgee River to connect the river with its floodplain and wetlands. It is essential the river operator has an adequate authorising environment and their operational requirements are fully considered in the project design. To address this, the program team explored a range of strategies to ensure WaterNSW is appropriately authorised to deliver environmental flows up to the recommended flow limit.

2.3.3.1 Strategies for creating a river operator authorising environment

The program developed a strategy including legislative amendments to allow overbank environmental flows and statutory protection for river operators from civil claims when releasing water for environmental purposes. Additional actions involve good faith negotiations, compensation through the Landholder Negotiation Scheme, securing flow easements, exploring alternative arrangements for properties with minimal impacts and improving notification systems and regulatory instruments. These include:

- The Landholder Negotiation Scheme (LNS): the LNS is a transparent and consistent process for the NSW Government to negotiate voluntary agreements with landholders affected by higher environmental flow releases across NSW. The LNS and negotiation guidelines will place the onus on the NSW Government to follow an additional negotiation process that extends beyond existing mandatory legislative requirements.
- Landholder support: the program is committed to providing landholders with emotional, psychological and mental health support during the negotiation process. In addition, landholder independent valuation and legal fees reasonably incurred will be reimbursed.
- Flow notification system: WaterNSW currently operates the Early Warning Network to notify downstream landholders of existing water releases from dams. The NSW

environmental water manager has a similar opt-in alert system for environmental flows on the Murrumbidgee. The project aims to provide landholders with improved information about flows potentially impacting them in an acceptable timeframe. The project will develop a flow notification system by December 2026.

2.3.4 Assessment of project measures

Mitigating third party impacts through project measures such as agreements, compensation, flow easements and infrastructure works with riparian landholders and other impacted stakeholders is central to the project. The project considered a wide range of measures to mitigate potential impacts, including easements in gross, covenants, deeds of release and event-based or 'fee for flow' agreements, among other measures. Easements in gross (flow easements) and associated compensation measures were identified as the preferred mitigation measure to secure enduring rights for river operators to release environmental flows over private property causing inundation. Flow easements meet the program's objectives. They also ensure landholders are compensated on just terms under an established framework, that aligns with the program's funding. For minimally affected landholdings, the program is also exploring alternative options such as a deed of agreement.

2.3.5 Project measures

The project investigated a range of processes and measures to mitigate third party impacts and realise opportunities. These have been the subject of community consultation to inform the approaches the project team is proposing to take to delivery. This section outlines the proposed third-party impact mitigation processes and measures for the project. These are as follows:

- **Environmental flow easements on private land:** the project aims to secure flow easements on private properties in the Murrumbidgee flow corridor using the Landholder Negotiation Scheme, ensuring a perpetual right to inundate within the flow corridor and in accordance with easement terms. Easement terms will outline the rights and limitations for river operators and environmental water managers, including maximum flow height. These terms will reference a Declaration Order providing additional contextual information for valuation and negotiation purposes during project delivery.
- **Environmental flow easements on public property:** public authorities hold 40% of land in the project's flow corridor, including Crown Land and National Parks. Easements and compensation for affected land and assets will involve engaging with Crown Lands and Aboriginal Land Councils and may include infrastructure like roads and bridges. Legal arrangements such as leases will mean that leaseholders are landholders during project delivery. Compensation and easement acquisition will address native title issues and require agreements from relevant councils.

- **Alternatives to flow easements:** Analysis of impacted riparian landholders showed a large number of properties have a relatively minor inundation footprint within the proposed maximum flow corridor. Given some landholder opposition to flow easements, and the limited cost-effectiveness of securing easements for minimally affected properties, the program is considering alternative strategies for landholdings with limited inundation. This approach aims to provide a more efficient and stakeholder-supported way to secure the flow corridor. While acquiring flow easements remains the preferred approach, a Deed of Release may be more suitable for properties with minimal impact.
- **Works on private property:** physical works on private property may be considered to mitigate the impacts of environmental water releases, focusing on critical infrastructure and value-for-money projects. Critical works provide access to essential assets during flow events, while value-for-money works would restore access to areas of land isolated by program flows. Design and construction will only proceed with landholder agreement to own and maintain the asset. All works agreements will include terms for funding, ownership and maintenance responsibilities.
- **Works on public lands:** Approximately 58 public land sites were identified that are likely to be affected by inundation from higher environmental flows and where works may be required. These sites are at different stages of design development, with preliminary designs and assessments completed for an initial group.
- **Works for environmental outcomes:** relaxing constraints and increasing environmental flow limits will achieve substantial outcomes. However, there are many built structures in the Murrumbidgee project area that will continue to restrict water movement to important environmental assets. The project aims to enhance environmental outcomes by removing or modifying some of these structures, like culverts and levees, to improve flow passage and benefit native fauna. Further field assessment of environmental works is needed, with landholder involvement, before the priority works to be addressed can be identified and options sought to remove or modify them.
- **First Nations Measures:** engagement with First Nations communities identified a range of measures for First Nations outcomes. The program will deliver First Nations capacity building, governance and water literacy measures, along with monitoring cultural values affected by relaxed constraints. These measures require further scoping and development in consultation with First Nations communities. Additionally, engagement identified a few public infrastructure works concepts for First Nations outcomes. However, these opportunities require more time to scope.

2.4 Stakeholder feedback and sentiment

Stakeholder engagement has been central to developing the project. Feedback was sought from a wide range of groups, including riparian landholders, reference groups, local councils, broad community, and First Nations communities. Between the projects' launch in August 2021 and December 2024, it has completed:

- over 9,300 interactions recorded between program staff and stakeholders
- more than 900 discussions, including in-person and online meetings, webinars, phone calls, emails
- engagement with 253 landholders representing 85% of the project's inundated area of private land
- engagement with First Nations communities, public authorities, peak bodies and the broader community.

2.4.1 Landholder engagement

In addition to 253 landholders directly engaged, other landholders were actively involved through individual meetings, landholder reference groups, public forums and communication via email and phone. This engagement has:

- informed decision-making with cultural, social, and economic insights
- fostered high project acceptance through active involvement
- established transparency among stakeholders.

The project will continue landholder engagement during implementation. Engagement will focus on increasing stakeholder awareness of the program and understanding of the impacts and benefits, as well gathering landholder feedback on the flow modelling.

Landholder support for flow limit options

The FBC compares the cost and benefits of 3 upper flow limit options at Wagga Wagga against the Base Case of a flow limit of 22,000 ML/d at Wagga Wagga:

- Flow limit option 1 (W32) - 32,000 ML/day flow limit, plus a buffer of up to 4,000 ML/day for mitigation measures
- Flow limit option 2 (W36) - 36,000 ML/day flow limit, plus a buffer of up to 4,000 ML/day for mitigation measures
- Flow limit option 3 (W40) - 40,000 ML/day flow limit, plus a buffer of up to 5,000 ML/day for mitigation measures

Surveys of private landholders in late 2023 and early 2024 showed positive support for the project when mitigation measures including works and compensation are included. Surveys of 130 landholders, covering approximately 66% of the private land potentially inundated by the project, showed support ranging from 80% for Option 1 W32 to 72% for Option 3 W40.

2.4.2 Engagement of key stakeholder groups

Since 2021, the program has worked with local government authorities in the Murrumbidgee project area to assess impacts, benefits and community sentiment, developing mitigation measures at several sites.

In early 2023, the project invited eligible landholders to join reference groups to provide feedback on draft program policies and processes.

Engagement with First Nations communities has been central to the project, with the First Nations reference group and On-Country assessments significantly contributing to program development. The project's ongoing collaboration ensures First Nation perspectives remain integral to the project's development and implementation.

The project has engaged with the broader community across the project area through a range of communication channels, forums, events and surveys. Feedback has been critical to informing program development and understanding impacts, benefits and sentiment.

2.5 Evaluation outcomes

The project flow limit options have been analysed through an economic assessment and an Options Evaluation Framework. The economic assessment adopted a cost-benefit analysis approach, monetising the costs and benefits of each flow limit option. Not all costs and benefits were able to be monetised and an Options Evaluation Framework, which considers environmental, social and First Nations themes, used non-monetary measures to compare each option's characteristics and performance. The cost-benefit analysis and Options Evaluation Framework assessment processes were separate yet complementary to one another (Figure 2-2). A preferred option was identified based on the outcomes of both assessments.

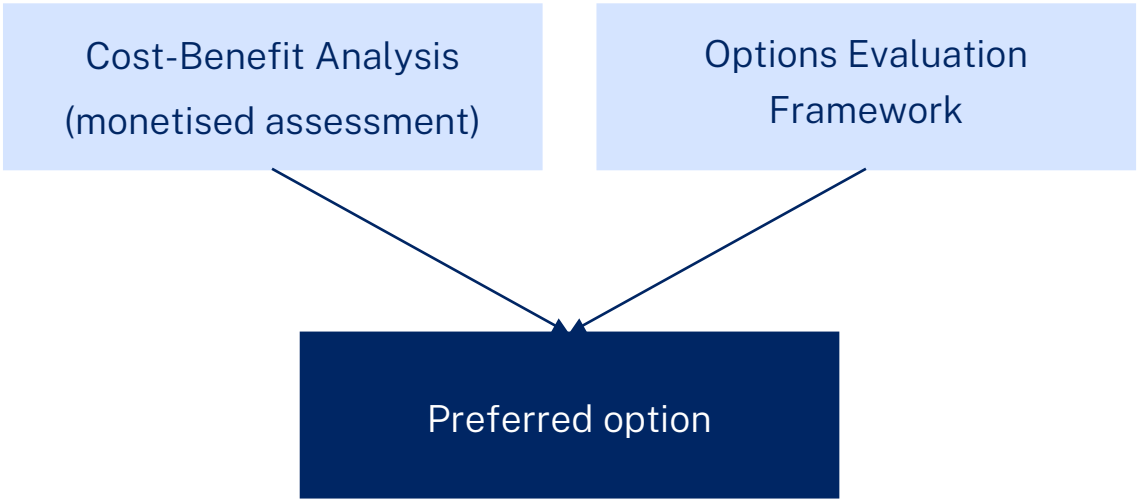

Figure 2-2: Cost benefit analysis and Options evaluation framework as complementary but separate processes to select a preferred option

2.5.1 Economic assessment

The purpose of the economic appraisal using a cost-benefit analysis is to quantify economic, social, and environmental costs and benefits in monetary terms across a range of project options. This enables assessment of a range of upper flow limit options, to compare their ability to be welfare generating against the base case.

Table 2-1 lists the economic costs and benefits assessed during the flow limit options evaluation.

Table 2-1: Economic benefits and costs

Economic Benefits	Economic Costs
Vegetation	Easement negotiation (economic)
Overall improvement (constant)	Private land works
Land use impacts – grazing native vegetation	Public land works
Land use impacts – grazing modified	Residual value
Land use impacts – cropping (incl. Irrigated)	Operating cost
Transport benefits	
Avoided entitlement water recovery	
Residual value	

The cost-benefit analysis used this data, along with cost estimates and investigations on community willingness to pay, to assess the value of each option. Table 2-2 shows the results of the cost-benefit analysis.

Table 2-2: Cost-benefit analysis results, NPV ($m), 5% discount rate, compared to W22 Base Case

Flow limit options	Flow limit at Wagga Wagga	Net present value ($m)	Benefit cost ratio
Option 1 W32	32,000 ML/day	-113	0.8
Option 2 W36	36,000 ML/day	130	1.3
Option 3 W40	40,000 ML/day	153	1.3

Option 3 W40 is the recommended flow limit option. It has the highest net present value and a benefit cost ratio of 1.3, meaning this option is social welfare generating (that is, the benefits are higher than the costs). This indicates the project would deliver a net benefit to NSW compared to the base case. Option 3 W40 also has the greatest vegetation and environmental benefits over the 40-year evaluation period.

In accordance with the NSW Government Guide to Cost-Benefit Analysis (TPG23-08), sensitivity testing was completed for several key assumptions and parameters and distributional outcomes were considered. Separately considering climate change with and without the project also resulted in improved economic outcomes across all flow limit options.

2.5.2 Options Evaluation Framework

The Options Evaluation Framework assessment indicates that increasing the environmental flow limit in the Murrumbidgee River delivers substantial environmental benefits by enhancing inundation frequency and extent. The 40,000 ML/day option (Option 3 W40) offers the best economic, environmental and First Nations outcomes. Option 3 W40 leads to the highest improvement in the river system's environmental health, expanding floodplain habitats, increasing golden perch populations, enhancing water quality, ecosystem health, and reducing geomorphic risk. Additionally, it can help prevent catastrophic ecological decline by breaking prolonged dry spells and providing greater adaptability to a changing climate. However, it requires a greater investment to mitigate social impacts.

Community surveys across 6 locations reveal that the river is central to local recreation and nature connection, with most people rating its health as average or poor. There is broad support for the highest flow option, especially if delivered with flexible mitigation measures. First Nations assessments highlight that healthy waterways are crucial for cultural practices and community wellbeing. Current flow management leaves Country in poor health, and Option 3 W40 upper flow limit is preferred for healing Country. However, further investment is necessary to support broader First Nations outcomes beyond healthy Country, as conditions are unlikely to improve without it.

2.6 Recommended solution

The recommended solution is to increase the upper environmental flow limit to 40,000 ML/day at Wagga Wagga (Option 3 W40). This option demonstrates the best value for money by outperforming the other options across economic, First Nations and environmental indicators.

Relaxing constraints to increase the upper flow limit from 22,000 ML/day to 40,000 ML/day at Wagga Wagga across the project's 40-year evaluation period will deliver the following benefits:

- A healthier Murrumbidgee River system, by:
    - Enhancing management of environmental water, directly benefiting native vegetation, fish, waterbirds, turtles, frogs, and other wildlife.
    - Reducing time between wetland-connecting events during drought by up to 40%, as shown in Figure 2-3.
    - Improving environmental resilience during dry periods, increasing system resilience to climate change increasing native vegetation area (estimated at 114%) remaining healthy during dry periods.
- More flexible and effective water management. It will:

    - Maximise the Sustainable Diversion Limit offset contribution for the project, offering large benefits over the lower flow options that may lead to a gap in the SDLAM adjustment and may necessitate further water buybacks.
    - Avoid buybacks through SDLAM, maintaining the current consumptive water volume for primary production.
- Better health of Country and First Nations people's participation. The project:
    - Strengthens First Nations connections, supporting sustainable culture and community through a healthy Country.
    - Provides opportunities for First Nations people's participation in environmental water management, access, and connection to Country.
- Overall improved agricultural and community outcomes. These include:
    - Improved water and nutrient availability for livestock, boosting graziers' production.
    - Enhanced community access during higher environmental flows and natural higher flow events.

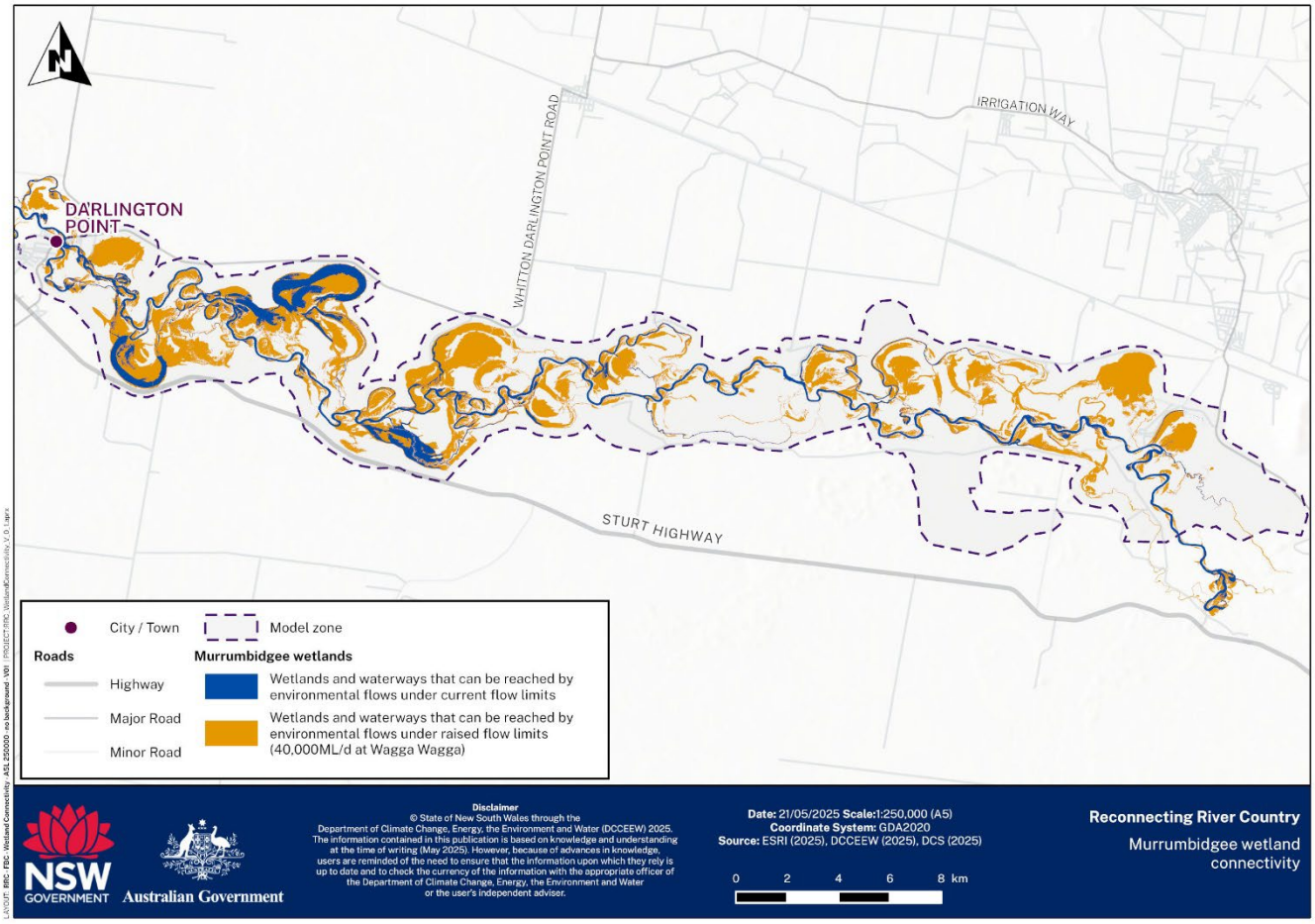

Figure 2-3: Environmental flow reach under current 22,000 ML/day operational constraint and 40,000 ML/day flow limit

2.7 Implementation

It is recommended to adopt 40,000 ML/day (W40) as the upper flow limit. This approach recognises the NSW Government's obligations to deliver outcomes under the current Basin Plan and is an opportunity to enhance environmental outcomes.

The first phase will focus on supporting flows in line with the Murrumbidgee Regulated Water Sharing Plan after December 2026.

Delivery is proposed over 2 phases to align with and maximise progress within Basin Plan timelines. The first phase includes establishing a legal authorising environment, initiating flow corridor negotiations with the most affected properties to the recommended upper flow limit, scoping public works and progressing First Nations enabling measures through to December 2026. This first phase will focus on supporting flows in line with the Murrumbidgee Regulated Water Sharing Plan after December 2026.

Phase 2 of the project will focus on securing the remainder of the flow corridor, construction of mitigation works and continuing to progress First Nations enabling measures. This phase is proposed to run from 2027 through to 2031, subject to funding and Basin Plan continuation.

Negotiations for Phase 1 will begin following the release of a Declaration Order, issued by the Minister for Water under the Landholder Negotiation Scheme.

2.7.1 Specialised capabilities for delivery

A diverse array of expertise, experience, and capabilities will be used to deliver the project. These include:

- **Securing flow corridor agreements:** a dedicated workforce is required to negotiate with affected landholders. These professionals will provide the landholders with procedural fairness and transparency, as well as providing the department with flexibility, probity and independence, in valuations and negotiations.
- **Infrastructure works:** A highly skilled design, approvals, engagement, and construction team, including regional contractor expertise, will be engaged to deliver works across numerous sites. These efforts will be project managed by departmental staff to ensure cost and schedule controls as well as safety, environmental, and quality outcomes.

2.7.2 Key project risks

The project has a robust risk management framework in place, with ongoing monitoring, reporting, and mitigation strategies to address these challenges and support successful delivery. The project monitors risks that could impact time, cost and schedule. These include uncertainties around the project scope and cost, organisational readiness for efficient delivery, establishment of a sufficient

authorising environment for environmental flow releases, and the availability of specialist technical contractors.

2.7.3 Project assurance

In February 2025, Infrastructure NSW (INSW) reviewed the project's Murrumbidgee Final Business Case. The review found it presented a strong case for investment in the recommended upper flow limit of 40,000ML/day at Wagga Wagga, with risk mitigation buffer of up to 5,000ML/day.

3 Project background

This publication summarises the Final Business Case prepared for the Australian Government to consider its continuing support of the Reconnecting River Country Program Murrumbidgee Project. The project is a critical Murray-Darling Basin initiative that aims to improve the health of the Murrumbidgee River system and Country, by increasing the frequency and extent rivers connect to wetlands and floodplains.

By relaxing constraints, the project will enhance environmental water delivery to wetlands and floodplains, fostering a healthier river system. This will benefit native vegetation, fish, waterbirds, turtles, frogs, and other wildlife. Once fully implemented, the project is expected to deliver landscape-scale outcomes benefiting ecosystems, communities, and future generations. The project will achieve the Murrumbidgee component of the Reconnecting River Country Program.

3.1 Background

The Murrumbidgee River, Australia's third longest river and a major tributary of the River Murray, stretches nearly 1,600 km from its headwaters in the Snowy Mountains to its confluence with the River Murray downstream of Balranald. Key towns along the valley, including Gundagai, Wagga Wagga, Narrandera, Griffith, Darlington Point, Leeton, and Hay rely on the river for irrigation and water supply. Flowing through agricultural landscapes, the river supports significant farming industries, such as grazing, rice, cotton, and fruit production. The Murrumbidgee region has access to both surface water and groundwater of varying quality, which support towns, recreational activities, cultural and environmental needs, as well as industry.

The project area is the fourth largest region in NSW in terms of economic output, population and employment. It supports a large productive irrigation industry.

The Murrumbidgee region lies west of the Great Dividing Range in southern NSW. The region varies from mountainous terrain in the east to open plains in the west. Extending across more than 84,000 km^2, the region is home to around 262,000 people and is the fourth largest region in NSW in terms of economic output, population and employment.[10] Economically, the Murrumbidgee River region is a significant contributor to Australia's agricultural output, particularly in irrigation-based farming. The area hosts a mix of rural farming communities, small towns, and growing urban centres.

[10] NSW Department of Planning and Environment, 2022, Draft Murrumbidgee Regional Water Strategy, https://water.dpie.nsw.gov.au/our-work/plans-and-strategies/regional-water-strategies/public-exhibition/murrumbidgee

The region is home to a diverse socio-demographic population, including First Nations communities who have lived in the area for thousands of years, contributing to the region's rich cultural heritage. First Nations groups within the catchment include the Bangerang, Barapa Barapa, Muthi Muthi, Nari Nari, Wadi Wadi, Wamba Wamba, Wolgalu, Yita Yita, Yita Nari, Ngunawal, and Wiradjuri nations. These Nations have been caretakers of the Murrumbidgee region for over 60,000 years. Rivers and wetlands are of great cultural, social, environmental, spiritual and economic importance to First Nations people. This connection provides valuable context and understanding of the need to better manage the Murrumbidgee River and the land surrounding it.

Irrigation farms are mostly located on riverine plains in the areas managed by Murrumbidgee Irrigation and Coleambally Irrigation Co-operative Limited. Established in 1912, the Murrumbidgee Irrigation Area is supported by substantial diversion weirs and supply and drainage canals.[11] It is one of Australia's most diverse and productive agricultural regions, contributing over $5 billion annually to the economy.[12] The river is regulated with dams, weirs and irrigation channels. The main structures are the Tantangara and Burrinjuck dams on the Murrumbidgee, and the Talbingo and Blowering dams on the Tumut River.

Water in the Murrumbidgee River is shared between users and the environment as defined by Sustainable Diversion Limits (SDL) in the Basin Plan and the *Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016*[13] (WSP). Environmental water aims to improve the health of forests, fish and bird habitat, improve river connections to floodplains and replenish groundwater.[14] However, despite these measures, the Murrumbidgee River is not sufficiently connected to its wetlands and floodplains to maintain the health of its high value ecosystems.

River regulation and allocation to consumptive water users have contributed to the reduction in the frequency and the extent of floodplain and wetland inundation, adversely impacting native vegetation, wetlands, fish, and waterbirds. Without restoring key hydrological processes and improving water delivery, the ecological health of the region will continue to decline and will further worsen from climate change impacts.

[11] Murrumbidgee Irrigation, Company Overview, https://www.mirrigation.com.au/ArticleDocuments/212/General%20factsheet%20-%20Company%20Overview.pdf.aspx?embed=Y

[12] Murray-Darling Basin Authority, 2022, Sustainable diversion limit adjustment projects. Retrieved from www.mdba.gov.au/water-management/basin-plan/sustainable-diversion-limit-adjustment-mechanism/sustainable-0

[13] As well as by the Water Sharing Plan for the Murrumbidgee Unregulated River Water Sources 2012, Murrumbidgee-Unregulated-River-WSP.pdf

[14] Murray-Darling Basin Plan, Schedule 5.

3.2 Key environmental assets within the project area

The Murrumbidgee region is home to 16 nationally significant wetlands, including the Lowbidgee and mid-Murrumbidgee wetlands. The rivers, floodplains and wetlands in the region support a range of water-dependent ecosystems and threatened and iconic species including the Murray cod, Macquarie perch, Australasian bittern and the southern bell frog.[15]

Figure 3-1 provides a project area map which shows:

- **National parks:** The Murrumbidgee region contains several national parks (NP), which protect extensive floodplain and wetland ecosystems and provides critical habitat for waterbirds and other riparian and aquatic species.
- **State forests:** Murrumbidgee Valley State Forests, including Narrandera and Mathews forests, contain significant river red gum communities that support biodiversity and provide ecosystem services like flood regulation and carbon storage.
- **Mid-Murrumbidgee wetlands:** Located between Wagga Wagga and Hay these wetlands consist of a complex network of lagoons and billabongs, with several listed as nationally significant in the Directory of Important Wetlands of Australia. The Mid-Murrumbidgee wetlands are part of the natural drainage system of the lower River Murray catchment, an endangered ecological community under the *Fisheries Management Act 1994*. These wetlands rarely dry out and provide drought refuge for many species, including many listed as endangered or threatened. They support river red gum forests and black box woodlands, habitat to threatened species like the southern bell frog and Australasian bittern. River regulation has significantly reduced inundation frequency and duration, resulting in the overall poor condition of these wetlands.[16]
- **Yanco Creek System wetlands:** The Yanco Creek System consists of Yanco and Colombo Creeks, and the regulated sections of the Billabong and Forest Creeks. It is an anabranch complex that connects the Murrumbidgee River with the Edward-Kolety River through over 800 km of interconnected waterways. It includes floodplain wetlands that provide important habitat for various species including threatened trout cod and freshwater (eel-tailed) catfish, and waterbird breeding. It supports the economy by providing town water, irrigation, and stock and domestic water and is a riparian corridor between the Murray River and the Murrumbidgee River.
- **Lowbidgee floodplain (wetlands), including Gayini:** This is the largest wetland in the Murrumbidgee River Valley, covering about 200,000 hectares (ha) between Maude and Balranald. It is listed on the Directory of Important Wetlands in Australia and is the natural

[15] Murray–Darling Basin Authority 2012, Assessment of environmental water requirements for the proposed Basin Plan: Lower Murrumbidgee River Floodplain; Assessment of environmental water requirements for the proposed Basin Plan: Mid-Murrumbidgee River Wetland

[16] Department of Agriculture, Water and the Environment (DAWE) 2021, Mid-Murrumbidgee wetlands profile, Australian Government, Canberra.

drainage system of the lower River Murray catchment. It is an endangered ecological community under the *Fisheries Management Act 1994*. The Lowbidgee floodplain contains Australia's third largest river red gum forest and a mosaic of black box woodland, lignum shrublands, reed beds, aquatic sedgelands and open water habitat, including Yanga Lake. It also supports one of the largest semi-permanent wetland systems and colonial waterbird breeding sites in Australia, particularly for the royal spoonbill, great egret, straw-necked ibis, Australian white ibis and glossy ibis.

- **The Gayini property:** This is made up of 80,000 ha of land in the Lowbidgee floodplain containing large areas of continuous lignum and supports various wetland-dependent species. Purchased in 2013 under agreement between the Australian and NSW governments as a water saving project, it aims to protect, maintain and enhance the environment, relax water delivery constraints and help meet SDLs. In 2019, ownership was transferred to the Nari Nari Tribal Council (NNTC). Gayini is managed by the NNTC in partnership with The Nature Conservancy and others.
- **Junction Wetlands:** Located at the junction of the Murrumbidgee and Murray rivers, these consist of a network of broad, shallow creeks such as Manie, Middle, Waldaira and Jack O'Briens creeks and their adjacent billabongs, swamps and lakes. The wetlands support extensive areas of black box, lignum and river red gum habitats. The creeks and adjacent wetlands connect the Murrumbidgee and Murray rivers and are filled by high flows from either river. The Junction Wetlands support waterbird populations and native fish species such as golden perch and the threatened freshwater (eel-tailed) catfish, silver perch and Murray cod.

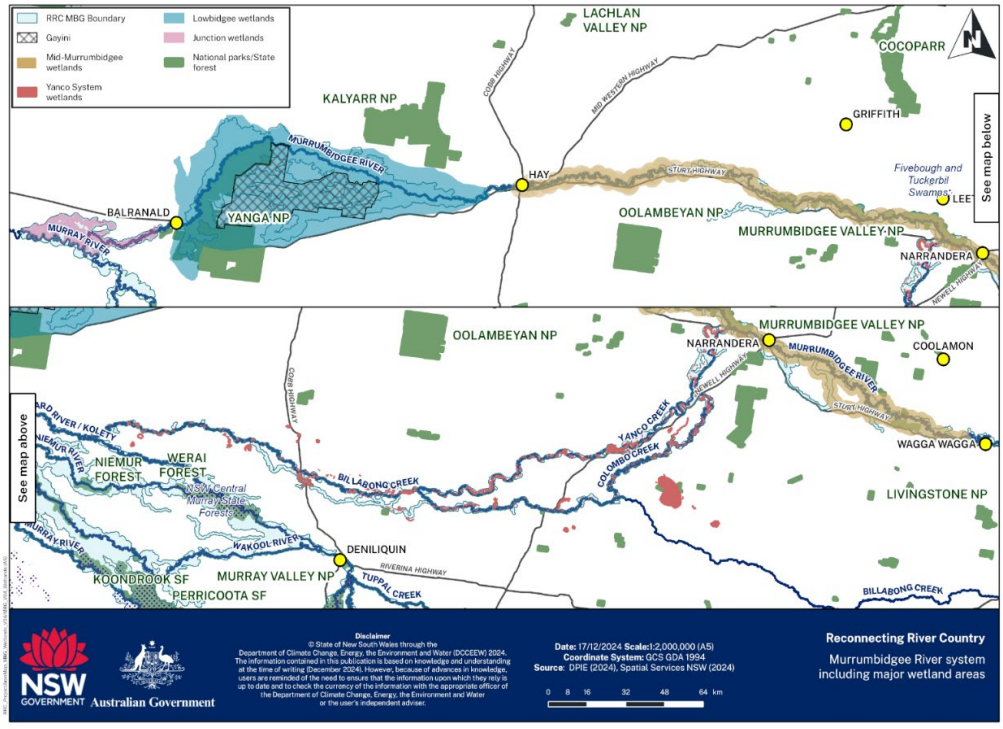

Figure 3-1: Overview map of Project area

3.3 Regional economic contribution and water security

The Murrumbidgee region is a significant contributor to the NSW economy, ranking as the fourth-largest region by economic output, population, and employment. The Murrumbidgee Irrigation Area (MIA) is a vital part of Australian agriculture, producing a large portion of the nation's rice, fruits, vegetables, and wine grapes. Annually, the MIA contributes over $5 billion to the national economy[17], supporting regional livelihoods and enhancing food security. The presence of food processing facilities and agribusinesses further increases the value of agricultural output, strengthening both domestic and global supply chains.

The region supports around 200,000 residents, with a workforce heavily involved in agriculture, logistics, and related service industries. Balancing economic growth with environmental preservation is essential for maintaining employment levels and the wellbeing of communities reliant on these industries.

Agricultural productivity is bolstered by Australian Government-funded programs like the Off-farm Efficiency Program (OFEP) and the Resilient Rivers Water Infrastructure Program (RRWIP). These aim to enhance infrastructure, provide extra water for the environment, and improve irrigation systems. These programs bring significant investment totalling $1.54 billion and $494 million respectively. They are also contributing to the 450 GL target of extra water for the environment under the *Water Amendment (Restoring Our Rivers) Act 2023*.[18]

3.3.1.1 Water security and availability

Reduced water security and availability has the potential to lower investment in water-using enterprises, leading to negative outcomes such as further water buybacks, economic decline and reduced availability of water for consumptive use. This impact on irrigators along the Murrumbidgee is highlighted by a media release from Coleambally Irrigation, Murray Irrigation and Murrumbidgee Irrigation. It noted that “we cannot afford to be left with this uncertainty, so we are calling on the NSW Government to immediately outline a clear pathway to show how they propose to protect irrigation communities from a further reduction in water availability.”[19]

[17] NSWIC, Murray-Darling Water Recovery, https://www.pc.gov.au/inquiries/completed/murray-darling-water-recovery/submissions/sub039.pdf

[18] NSW DPIE, Resilient Rivers Water Infrastructure Program, https://water.dpie.nsw.gov.au/our-work/water-infrastructure-nsw/grants-and-funding/resilient-rivers-water-infrastructure-program. NSW Department of Climate Change, Energy, the Environment and Water, Resilient Rivers Water Infrastructure Program 2024, August 2024, https://water.dpie.nsw.gov.au/__data/assets/pdf_file/0020/620750/resilient-rivers-water-infrastructure-program-guidelines-for-full-project-applictions.pdf

[19] Media Release, 14 April 2021, https://www.mirrigation.com.au/ArticleDocuments/256/Media%20Release_Joint%20Statement%20SDL%20Projects_140421_FINAL.pdf.aspx?embed=Y.

3.3.1.2 Social and economic impacts of water buybacks

While committed to delivering the Murray-Darling Basin Plan in full, it is the NSW Government's position that this should be accomplished in a manner that minimises adverse effects on regional communities. To this end, the NSW Alternatives to Buybacks Plan was developed, which focuses on non-purchase methods for water recovery.[20]

3.4 Murray-Darling Basin Plan

The Murray-Darling Basin has experienced significant challenges due to over-allocation of water and severe droughts, leading to environmental degradation, loss of biodiversity, and declining water quality[21]. These issues have harmed river ecosystems and the agricultural economy and communities that rely on the Basin water resources for their water needs. First Nations cultural heritage and their connections to Country and water have also been threatened by these environmental changes.

Passed into law in November 2012, the Murray-Darling Basin Plan was developed to create sustainable sharing of water resources amongst all users. Achieving this goal will improve and maintain healthy rivers and floodplains, while supporting sustainable agriculture, industries and communities. A review of the Basin Plan is scheduled to be completed by late 2026, with key assessments informing the Basin's future management.

Central to the current Basin Plan are Sustainable Diversion Limits (SDLs), which limit the average amount of water that can be taken from the Basin for use by irrigation, industry and town water supplies. The original Basin Plan targeted 2,750 GL of water recovery to support environmental sustainability. This target was later adjusted, accounting for a 70 GL reduction in the Northern Basin based on updated modelling and 605 GL through SDLAM. After these adjustments, a residual 2,075 GL remains to be recovered compared to 2009 levels to achieve a healthy and productive Basin.[22]

3.5 Sustainable Diversion Limit Adjustment Mechanism

[20] NSW puts options on the table to avoid buybacks. 22 February 2024, https://water.dpie.nsw.gov.au/news/nsw-puts-options-on-the-table-to-avoid-buybacks

[21] https://www.csiro.au/en/news/all/articles/2018/april/murray-darling-basin

[22] 2,750 GL was originally described as the 'Bridging the Gap' target. Following amendments to the Basin plan in 2018, the total volume that needs to be directly recovered has been offset by 70 GL. This is as a result of an SDL increase in the northern Basin arising from the Northern Basin Review, reducing the recovery target by 70 GL to 2,680 GL.
Frontier economics, Social and economic impacts of Basin Plan water recovery in Victoria, 2022, https://www.water.vic.gov.au/__data/assets/pdf_file/0033/669426/social-and-economic-impacts-of-basin-plan-water-recovery-in-victoria.pdf

In 2017, the Basin Plan was amended to increase SDLs in the southern-connected Basin based on delivery of a package of 36 SDLAM projects.[23] These projects aim to use environmental water more efficiently, improving environmental outcomes, in place of acquiring further water from consumptive users for the environment. The Murray-Darling Basin Authority (MDBA) determined that implementing the proposed package of SDLAM projects could result in an offset to the SDL equivalent to 605 GL/year (see Figure 3-2).[24]

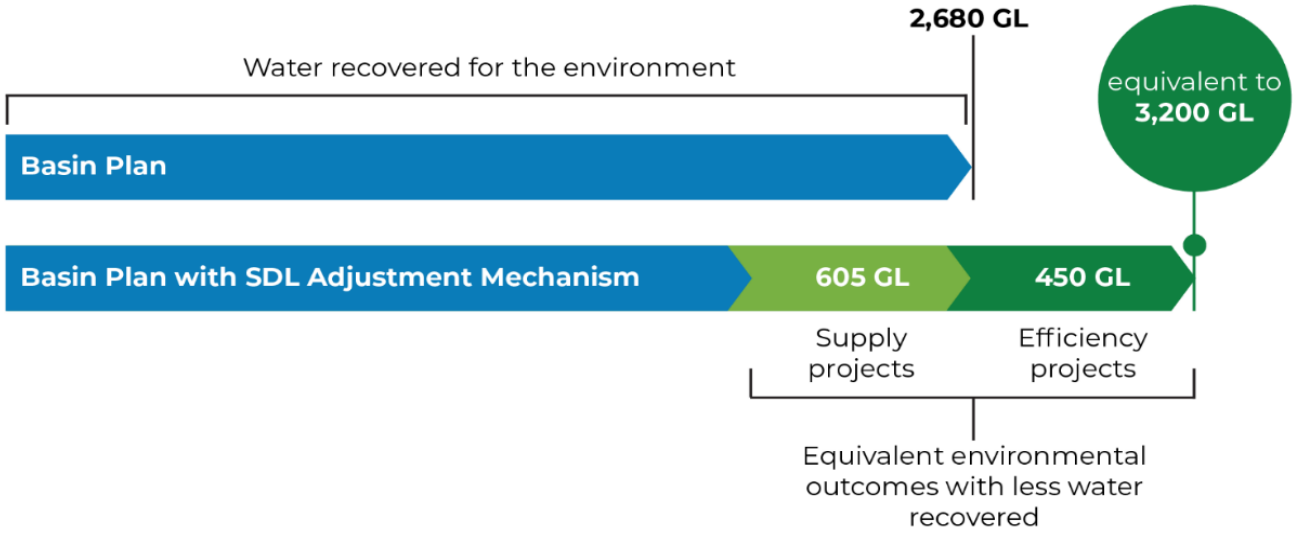

Figure 3-2: Illustration of the SDL Adjustment Mechanism[25]

The SDLAM projects include supply, constraints and efficiency measures:

- **Supply measure projects:** These deliver equivalent environmental outcomes with less water, reducing the volume of water that needs to be removed from productive use. Examples of projects or activities include building or improving river or water management structures (like weirs and regulators) or changes to the rules under which a river is operated.
- **Constraints projects:** These address physical, policy and operational barriers, such as crossings, bridges, and river management rules, to improve the delivery of water for environmental purposes.
- **Efficiency projects:** These contribute water savings to the 450 GL target of additional water for the environment by changing water use practices in ways that cause no adverse socio-economic impacts. For example, working with irrigators to improve water use efficiency and modernise irrigation infrastructure. The scope of these efficiency measure projects is not the subject of the Final Business Case.

[23] There were originally 37 projects as part of the SDLAM, but one has since been withdrawn.

[24] Murray-Darling Basin Authority, 2021, The Basin Plan: Sustainable diversion limit adjustment mechanism. Retrieved from https://www.mdba.gov.au/basin-plan-roll-out/sustainable-diversion-limits/sdlam.

[25] Murray-Darling Basin Authority, Sustainable diversion limit adjustment projects, https://www.mdba.gov.au/water-management/basin-plan/sustainable-diversion-limit-adjustment-mechanism/sustainable-0

Under the Basin Plan, the MDBA must assess if the notified measures, including the proposed constraints relaxation projects, are implemented as proposed and have achieved the 605 GL/year adjustment.[26] The MDBA will complete a reconciliation process by 31 December 2026, based on state-submitted evidence of implementation of supply and constraints measures.[27]

If SDLAM projects are not delivered or fail to achieve the expected offset volume through the reconciliation evaluation, an equivalent volume of water may need to be recovered through other means. This could be additional water recovery or buybacks from users.

SDLAM supports Basin Plan outcomes by protecting and enhancing Basin community and economic resilience by minimising the risk of additional buybacks. Also, without addressing system constraints, recovered water (existing or potential) cannot be delivered effectively to realise desired environmental outcomes.

3.6 Water policy

3.6.1 Commonwealth and State policy

The Australian Government is responsible for improving the sustainable management of Australia's water resources. The Australian Government water responsibilities are administered by the Australian Government Department of Climate Change, Energy, the Environment and Water. The *Water Act 2007* (Commonwealth) and the *Restoring Our Rivers Act 2023* are the legislative frameworks for ensuring that Australia's largest water resource, the Murray-Darling Basin, is managed in the national interest.[28] As well as the Australian Government Department of Climate Change, Energy, the Environment and Water, key Australian Government agencies involved in water management include the MDBA, the Inspector–General of Water Compliance and the Commonwealth Environmental Water Holder (CEWH).

The NSW Department of Climate Change, Energy, the Environment and Water, Water Group's responsibilities are primarily governed by the *Water Management Act 2000* (NSW) (WM Act) and the National Water Initiative (2004). They are responsible for surface and groundwater management, ensuring water security and reliability for NSW,[29] developing water sharing plans to enable the equitable sharing of surface and groundwater resources, and ensuring water entitlements and

[26] Murray-Darling Basin Authority, 2021, Sustainable Diversion Limit Adjustment Mechanism Reconciliation Framework. Retrieved from https://www.mdba.gov.au/sites/default/files/pubs/sustainable-diversion-limit-adjustment-mechanism-reconciliation-framework.pdf

[27] The relevant information the MDBA will use for reconciliation is the register of measures.
Australian Government, Sustainable diversion limit adjustment mechanism – register of measures, https://www.mdba.gov.au/publications-and-data/publications/sustainable-diversion-limit-adjustment-mechanism-register

[28] *Water Act 2007* (Cth).

[29] NSW Department of Climate Change, Energy, the Environment and Water - *Home*, Hyperlink: https://www.dpie.nsw.gov.au/water/home.

allocations are secure and tradeable.[30] In addition, the department prepares and manages the floodplain management plans which are the framework for coordinating development of flood works on a whole-of-valley basis.[31] The department also carries out planning, policy and regulation and leads negotiations with the Australian Government and MDBA or all Australian jurisdictions, to deliver NSW Government water management goals.[32]

The key government agencies responsible for developing, implementing and reviewing the regulatory framework for water management in regional NSW include:

- Department divisions - the Water Group, Conservation Program, Heritage & Regulation Group (CPHR), and the Natural Resources Access Regulator[33]
- WaterNSW (state owned corporation)[34]
- the independent Natural Resources Commission[35]
- the Independent Pricing and Regulatory Tribunal.

Collectively they are involved in the design and operation of the water market, setting water management rules, operating the river system and other water delivery systems within NSW, reviewing policy, encouraging and enforcing compliance with NSW water management rules and protecting the environment.[36]

3.6.2 Water Amendment (Restoring Our Rivers) Act 2023

Under the established agreements, southern Basin States, including NSW, are responsible for delivering the supply and constraints projects in their own jurisdiction so they can be operational by 31 December 2026.[37]

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[30] NSW Department of Climate Change, Energy, the Environment and Water – *What we do – How water is managed*, Hyperlink: How water is managed - Water in New South Wales (nsw.gov.au).

[31] NSW Department of Climate Change, Energy, the Environment and Water, Floodplain Management Plans https://water.dpie.nsw.gov.au/our-work/floodplain-management/plans

[32] NSW Department of Climate Change Water Energy, the Environment and *Water - About us*, Hyperlink: https://www.industry.nsw.gov.au/water/what-we-do.

[33] NSW Department of Climate Change, Energy, the Environment and Water, *Environment and Heritage is part of the Department of Climate Change, Energy, the Environment and Water*, (accessed 15th March 2024), https://www.environment.nsw.gov.au/about-us/who-we-are.

[34] WaterNSW is the state's bulk water supplier and operational manager of surface water and groundwater resources, including management of infrastructure for water supply – importantly, they are the current operators of Burrinjuck Dam and Blowering Dam.

[35] The National Resources Access Regulator is responsible for compliance and enforcement of NSW water law, amongst other key law enforcement responsibilities.

[36] NSW Department of Planning and Environment, *Roles of Water Management Agencies in NSW (PUB18/372),* Hyperlink: Roles of water management agencies in NSW.

[37] Legislative changes made through the *Restoring Our Rivers Act* include an extension of time from 30 June 2024 to 31 December 2026 for state-led SDLAM projects to be delivered. The *Restoring Our Rivers Act* also provides an opportunity for states to bring forward new projects until 2025 and amend projects until 30 June 2026. The MDBA will undertake SDLAM reconciliation and propose a new SDL adjustment by 31 December 2026.

Australian Government Department of Climate Change, Energy, the Environment and Water, Addendum to the 2012 Basin Plan Regulation Impact Statement, June 2024, https://oia.pmc.gov.au/sites/default/files/posts/2024/06/Addendum.pdf

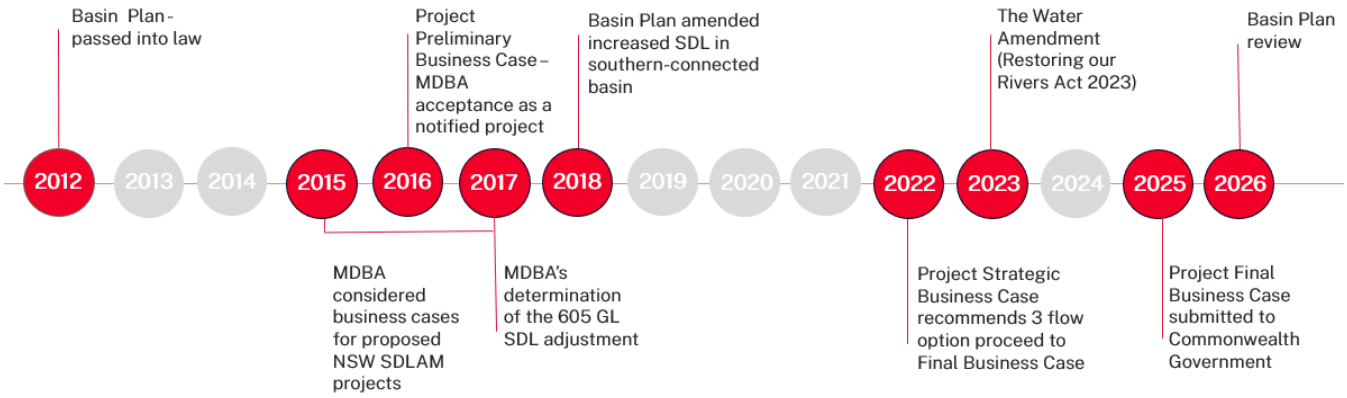
As of December 2024, SDLAM comprised of a package of 36 notified projects that were modelled as part of the 605 GL. Of these, NSW is the proponent or co-proponent of 21 projects and 12 of these are considered complete or in operation and close to completion. Together, these were projected to deliver 40-60% of NSW's share of the 605 GL SDL offset.

Given the challenges in meeting the original 2024 deadline and the need for greater flexibility in project delivery, the *Water Amendment (Restoring Our Rivers) Act 2023* was introduced to the Australian Parliament in September 2023 and commenced on 7 December 2023. This legislation amended the *Water Act 2007* and the *Basin Plan 2012* to address critical constraints in project delivery and environmental water recovery. Key changes included:

- extending legislated deadlines for SDLAM and efficiency projects to enable delivery of 450 GL of additional environmental water
- the notification of new SDLAM projects
- greater flexibility for recovering the 450 GL of additional environmental water including rules-based projects and water buybacks
- broadening the scope of activities eligible for funding under the Water for the Environment Special Account[38]
- repealing the limit on Australian Government purchases of water access entitlements. [39]

3.7 Program history

Figure 3-3 outlines key program and project milestones to date, and future key milestone of the Basin Plan review in 2026.



[38] The Water for the Environment Special Account (WESA) funds the recovery of environmental water in the Murray-Darling Basin to increase the volume of the Basin water resources that is available for environmental use by 450 gigalitres and help ease or relax constraints to deliver the environmental water.

[39] Parliament of Australia, Water Amendment (Restoring Our Rivers) Bill 2023, https://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/bd/bd2324a/24bd18

Figure 3-3: Reconnecting River County Program and Murrumbidgee Project history

Prior to 2021, the program was referred to as the constraints management strategy.

A Preliminary Business Case was completed in 2016, which allowed the MDBA to accept the project as a notified project.[40] It proposed an upper flow limit of 40,000 ML/day at Wagga Wagga and identified the next steps to refine the project, including developing the scope, engaging with the community and working through remaining issues. The business case and proposed flow limit were used to inform the MDBA's determination of the 605 GL adjustment to SDLs in 2017.

A 2022 Strategic Business Case (SBC) for the project, recommended 3 shortlisted upper flow limit options (32,000 ML/day, 36,000 ML/day and 40,000 ML/day at Wagga Wagga). These shortlisted options then proceeded to the FBC to further investigate stakeholder views and mitigation measures, which were both dependent on significant developments in program policy. The Australian Government subsequently allocated funding to develop this FBC, including funding for landholder and local community engagement, and validation of inundation impact through improved hydraulic and hydrological modelling.

3.7.1 Investigations completed since the Strategic Business Case to inform the case for change

This section outlines some of the wide range of investigations completed by NSW Government agencies since the SBC.

Extensive hydraulic modelling and the Operational Headroom Project quantified uncertainties in tributary inflow forecasts, easement extents and dam releases. These investigations, as well as the Murrumbidgee ecological and climate change assessments that tested ecohydrological benefits under different future climate scenarios, were key inputs to the Environmental Benefit and Risk Analysis update.

Extensive Policy development investigations created the authorising environment to secure the flow corridor and stakeholder engagement provided feedback to better understand project impacts and benefits. The Landholder Negotiation Scheme was developed to negotiate agreements with affected landholders, with public exhibition running from September to November 2024.

Infrastructure identification, design and geodatabase creation were key components of the cost estimation process. The Mundowy Lane and Mundarlo Bridge works were also progressed. These aim to improve community access during future environmental flow deliveries and some natural higher flow events. An Options Evaluation Framework developed alongside a cost benefit analysis, assessed upper flow limit options to support decision making.

[40] NSW Department of Primary Industries, *Murrumbidgee River Constraints Measure Concept Proposal Business Case*, Hyperlink: Murrumbidgee-River-Constraints-Measure-Business-case.pdf (nsw.gov.au)

4 Murrumbidgee project rationale

The Reconnecting River Country Program Murrumbidgee Project is key to achieving Murray-Darling Basin Plan environmental outcomes and minimising further water recovery. Due to physical, policy and operational constraints, environmental water cannot be used flexibly to reach the Murrumbidgee River's floodplains and wetlands. This poses severe risks to the region's environmental assets. Reconnecting the Murrumbidgee with its floodplain and wetland environments more regularly will enhance the health and resilience of its ecosystem and achieve Basin Plan environmental outcomes.

Without action, the benefits of the Sustainable Diversion Limit Adjustment Mechanism (SDLAM) projects in the southern Basin will not be fully realised. This would mean further water buybacks could be initiated, with social and economic impacts, and important environmental assets will continue to decline. No other projects or options can achieve the required or equivalent environmental outcomes.

4.1 Problem statements

4.1.1 Problem 1

Ecosystem health has declined along the Murrumbidgee River, contributed to by river regulation and consumptive water use impacting the frequency of overbank flows connecting low-level wetlands and floodplains

Floodplains are among the world's most abundant and diverse ecosystems, supporting a wide range of aquatic and semi-aquatic organisms adapted to a highly variable regime of flooding and drying.[41] However, their dependence on hydrological events that connect the river to the floodplain makes them vulnerable to human-induced change. In the Murray-Darling Basin, dams and water infrastructure for the capture and regulation of water have altered river flows as well as the extent and frequency of river to floodplain connections. Coupled with changing land use, this has impacted the number and type of plants, animals and ecosystem processes that regulated floodplain river ecosystems can support.[42]

Figure 4-1 highlights the importance of maintaining and enhancing river floodplain connection.

[41] Opperman J, Luster R, McKenney B, Roberts M and Meadows A (2010) 'Ecologically Functional Floodplains: Connectivity, Flow Regime, and Scale', JAWRA Journal of the American Water Resources Association, 46:211-226

[42] Thompson RM, Bond N, Poff NL and Byron N (2019) 'Towards a systems approach for river basin management — Lessons from Australia's largest river', River Research and Applications, 35(5):466-475

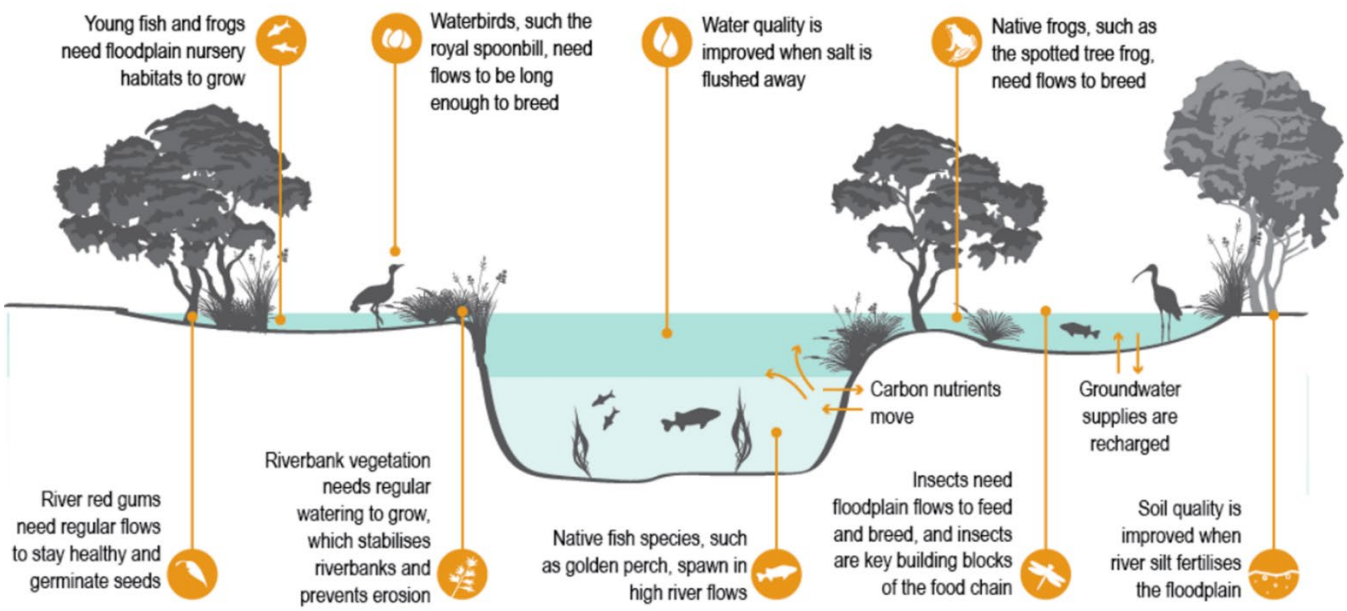


Figure 4-1: The importance of river floodplain connection[43]

River regulation and water extraction in the Murrumbidgee River has reduced the frequency of flow events that connect the river to its wetlands and low-lying floodplains.[44,45] Kreibich et al. (2024)[46] found that Murrumbidgee River regulation reduced wetland-connecting and overbank flows (flows approximately equivalent to 28,000-48,000 ML/day at Wagga Wagga) from an average of 45 to 16 days annually (natural period, 1916-1927 versus high regulation period, 1958-2018), and more than doubled the typical time between events. The reduced frequency of river connections has led to declines in native flora, fauna and ecosystem health.

These hydrological changes can be especially damaging during sequences of dry years, where the persistence of species is highly dependent upon the relatively few events that occur. Critically, dependent species will continue to decline until key hydrological aspects are restored. Figure 4-2 shows an example of the proportion of floodplain wetlands and native vegetation[47] that can

[43] MDBA (2015) Murrumbidgee reach report: Constraints Management Strategy. Murray-Darling Basin Authority, Canberra, ACT, Australia www.mdba.gov.au/sites/default/files/publications/Caveat-murrumbidgee-reach-report-July-2015.pdf

[44] Page, K., Arthur, R., Frazier, P., Mount, N. (2005). The effect of altered flow regime on the frequency and duration of bankfull discharge: Murrumbidgee River, Australia, River Research and Applications, 21(5).

[45] Rolls, R., Bond., N, 'Chapter 4 - Environmental and Ecological Effects of Flow Alteration in Surface Water Ecosystems', in Horne, A., Webb, A., Stewardson, M., Richter, B & Acreman, M., Water for the Environment, Academic Press, pp. 65-82.

[46] Kreibich, Jan, Gilad Bino, Hongxing Zheng, Francis Chiew, William Glamore, Jamie Woods, and Richard T. Kingsford. "River regulation and climate change reduce river flows to major Australian floodplain wetland." Journal of Environmental Management 370 (2024): 122962.

[47] Mapped native vegetation includes river red gum forest and woodlands, and black box woodlands.

currently be reached in the Murrumbidgee by water for the environment under current operational constraints.

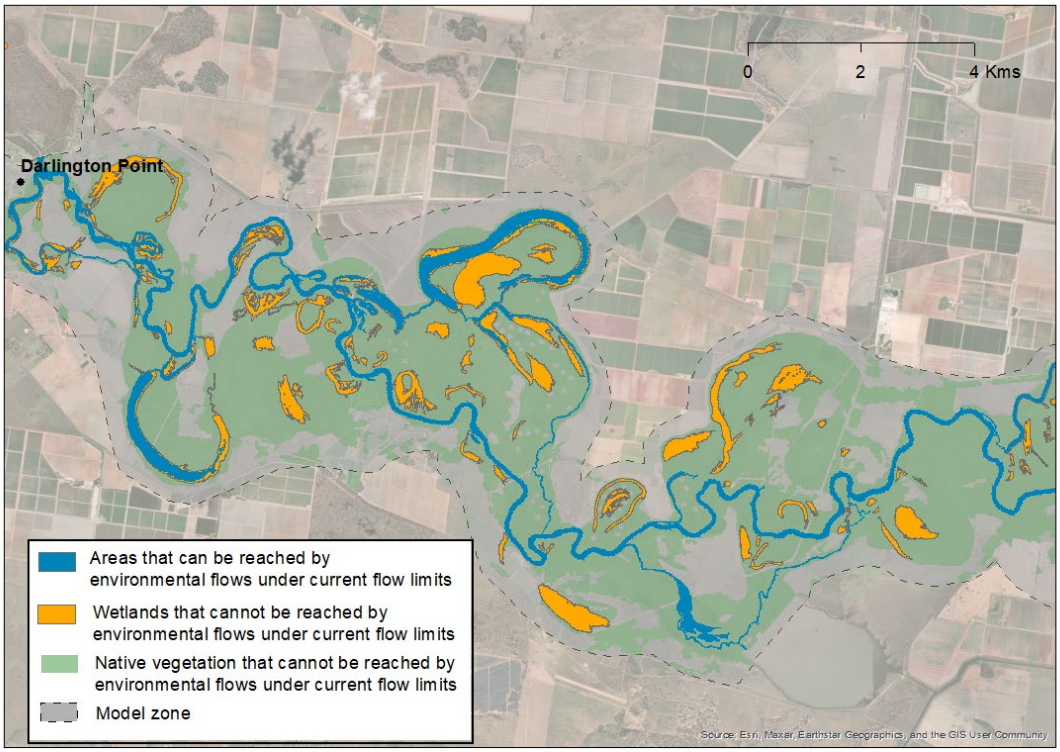


Figure 4-2: Wetlands and flow-dependent native vegetation than cannot be reached with environmental water under current flow limits – mid-Murrumbidgee near Darlington Point

If regulated flows remain at the current operational limit of 22,000 ML/day, water cannot be delivered with the necessary variability in magnitude, timing and duration to benefit local and downstream wetland, river and floodplain ecosystems. Relaxing physical, legislative, policy and operational constraints to river management in the Murrumbidgee River is essential to reversing these trends and improving the health of wetlands and water dependent ecosystems.

4.1.1.1 Impacts to native vegetation

The Murrumbidgee catchment is home to a diverse range of water dependent vegetation types. These include river red gum, black box, lignum, and various wetland herbland species such as spiny mud grass, giant rush and common reed. Hydrological changes have resulted in a decline in the extent and condition of water dependent vegetation communities which provide habitat for a range of flora and fauna.

Only 16% of river red gum forest and woodlands along the Murrumbidgee River can be connected under existing flow limits.

Due to the reduced frequency and duration of wetland inundation from river regulation and other human interventions[48], in the Redbank region (part of the Lowbidgee, upstream of Balranald) more than half of the original wetlands have been lost or degraded.[49]

A 2011 study by the then Office of Environment and Heritage, Department of Premier and Cabinet, Office of Water, and Department of Primary Industries modelled ecological outcomes for 60 key wetlands under various watering scenarios. The study assessed different water delivery methods, such as over-bank flooding vs. active diversions, and their timings. It found the highest habitat scores across wetlands occurred under pre-development conditions, emphasising that delivery timing and delivery method significantly influence habitat suitability.

In the Murrumbidgee corridor from Burrinjuck to Hay, the extent, persistence and condition of non-woody vegetation in the off-channel wetlands has declined. River red gum saplings, which are normally drowned out by repeated flow events, now colonise some of these areas.[50] The saplings change floodplain ecology and may also impede future flood waters getting to other areas of the floodplain and can increase localised flooding.

4.1.1.2 Community and First Nations sentiment towards declining ecosystem health

Perceptions of river health and community sentiment on the importance of the river to quality of life has been captured through broad surveys. These were completed to help develop the social theme assessment as part of the evaluation of the project's flow limit options.[51] The findings indicate that most respondents felt the health of the river was average to poor, with only a quarter believing its health to be good. The river is very important to the people of the Murrumbidgee[52] as many people depend on the river for recreation, relaxation, socialising and wildlife viewing.

Community sentiment on the considerable degradation of the ecosystem is consistent with that felt from First Nations people engaged as part of RRC Program who "have witnessed the continual degradation to our land. Out mother Country is sick, and is dying, and in need of healing".

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[48] Kingsford, R. & Thomas, R. (2004). Destruction of wetlands and waterbird populations by dams and irrigation on the Murrumbidgee River in arid Australia. Environmental Management, 34, 383 – 396.

[49] Wen, L., N. Marsh, C. Mackay, I. Salbe, N. Saintilan, and J. Ling. (2011). Linking wetland hydrology to ecological outcomes in the Lowbidgee wetlands in Southern New South Wales. In 19th International Congress on Modelling and Simulation-Sustaining Our Future: Understanding and Living with Uncertainty, MODSIM2011, pp. 2479-2485. Modelling & Simulation Society Australia & New Zealand

[50] MDBA (2015). Murrumbidgee reach report: Constraints Management Strategy. Murray-Darling Basin Authority, Canberra, ACT, Australia

[51] The Program Options Evaluation Framework was developed to provide a triple bottom line assessment of the project options, to inform selection of a preferred option(s) clearly showing the trade-offs between options, and to meet NSW Treasury guidance for business cases.

[52] Based on 114 participants surveyed during pop-up survey locations undertaken across 6 targeted locations - Balranald, Hay, Leeton, Narrandera, Wagga Wagga, and Gundagai in February 2024

Case Study – Environmental impacts from the Millennium drought

The Millennium drought (2000 to 2009) was one of Australia's longest and most intense droughts on record, heavily affecting NSW river systems like the Murrumbidgee. This prolonged dry period, compounded by river regulation and water extraction, placed immense stress on the Murrumbidgee River's ecosystems.[53]

The key environmental impacts on the Murrumbidgee River from this period included reduced river flows[54] and habitat loss. The drought drastically lowered river flows[55], limiting water available for floodplain habitats like the ecologically significant Lower Murrumbidgee Floodplain.

Seasonal flooding did not occur in many areas, reducing wetland areas essential for species like waterbirds, native fish and frogs.[56] Some of the effects were:

Biodiversity decline: Species dependent on regular flooding, such as fish and waterbirds, struggled to survive. Native fish populations had poor recruitment and increased competition with exotic species, leading to a decline in overall biodiversity.[57]

Invasive species spread: Dry conditions facilitated the encroachment of terrestrial and exotic species. Terrestrial plants replaced aquatic vegetation in some areas, altering ecosystem structures and reducing biodiversity.[58]

Degraded riverine vegetation: River red gum forests and woodlands along floodplains, reliant on overbank flows, experienced dieback in many areas.[59] As river red gum is a keystone floodplain species, its decline indicates broader wetland habitat deterioration.[60]

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[53] Davies et al., 2012, Sustainable Rivers Audit: The ecological health of rivers in the Murray-Darling Basin at the end of the Millennium Drought (2008-2010). Volume 3, Murray-Darling Basin Authority, Canberra.

[54] Wen, L., Rogers, K., Ling, J., & Saintilan, N. (2011). The impacts of river regulation and water diversion on the hydrological drought characteristics in the Lower Murrumbidgee River, Australia. *Journal of Hydrology (Amsterdam)*, *405*(3), 382–391. https://doi.org/10.1016/j.jhydrol.2011.05.037

[55] van Dijk, A. I. J. M., H. E. Beck, R. S. Crosbie, R. A. M. de Jeu, Y. Y. Liu, G. M. Podger, B. Timbal, and N. R. Viney (2013), The Millennium Drought in southeast Australia (2001–2009): Natural and human causes and implications for water resources, ecosystems, economy, and society, *Water Resource. Res.*, 49, doi:10.1002/wrcr.20123.

[56] Rogers, K., Saintilan, N., Colloff, M. J., & Wen, L. (2013). Application of thresholds of potential concern and limits of acceptable change in the condition assessment of a significant wetland. *Environmental Monitoring and Assessment*, *185*(10), 8583–8600. https://doi.org/10.1007/s10661-013-3197-0

[57] Davies et al., 2012, Sustainable Rivers Audit: The ecological health of rivers in the Murray-Darling Basin at the end of the Millennium Drought (2008-2010). Volume 3, Murray-Darling Basin Authority, Canberra.

[58] Shilpakar, R.L., Thoms, M.C., & Reid, M.A. (2021). The resilience of a floodplain vegetation landscape. *Landscape Ecology,* 36, 139–157.

[59] Wen, L., Ling, J., Saintilan, N., & Rogers, K. (2009). An investigation of the hydrological requirements of River Red Gum (Eucalyptus camaldulensis) Forest, using Classification and Regression Tree modelling. *Ecohydrology*, *2*(2), 143–155. https://doi.org/10.1002/eco.46.

[60] Doody, T. M., Colloff, M. J., Davies, M., Koul, V., Benyon, R. G., & Nagler, P. L. (2015). Quantifying water requirements of riparian river red gum (Eucalyptus camaldulensis) in the Murray–Darling Basin, Australia–implications for the management of environmental flows. Ecohydrology, 8(8), 1471-1487.

4.1.1.3 Climate change will result in worsening impacts to the ecosystem over time

The future climate in the Murrumbidgee region is uncertain. Analysis of different climate scenarios in the Draft Murrumbidgee Regional Water Strategy indicates that there could be more extreme events, hotter and longer droughts, higher evaporation rates, more unpredictable rainfall events and more variable flows.[61]

Figure 4-3 presents the significant outcomes of climate change on the Murrumbidgee region based on a plausible or likely future under a dry climate scenario.[62]

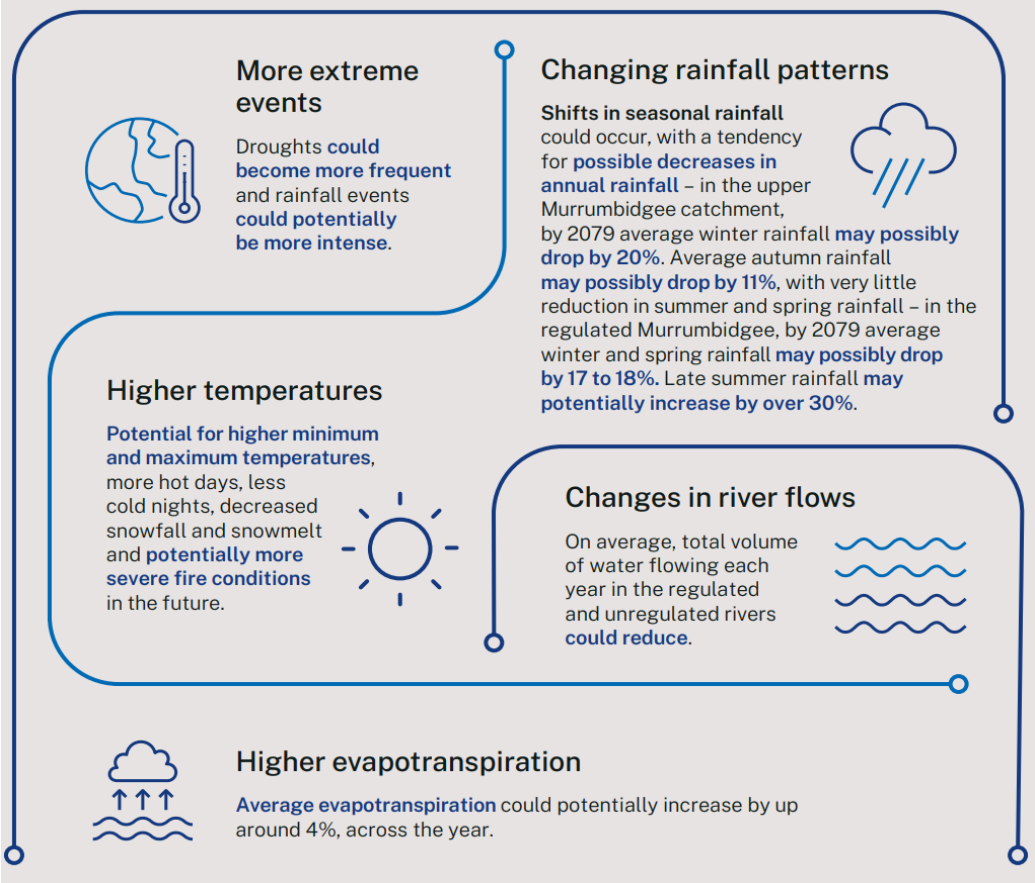

Figure 4-3 Potential future climate conditions in the Murrumbidgee region under a dry climate scenario[63]

[61] NSW Department of Climate Change, Energy, the Environment and Water, *Draft NSW Regional Water Strategy – Murrumbidgee: Shortlisted Actions – Executive Summary* (accessed 11 November 2024), Hyperlink: Draft NSW Regional Water Strategy – Murrumbidgee: Shortlisted Actions – Executive Summary

[62] The 3 plausible future scenarios considered in the FBC include historical data, long term historic climate projections (stochastic data) and Dry climate change scenario (NSW and Australian Regional Climate Modelling (NARCLiM)). Historical data assumes the future climate will be like the climate data that has been recorded over the last 130 years. Long term historic climate projections (stochastic data) assume the future climate is like what the science is indicating the long-term paleo climate was like and is based on a 10,000-year climate variability risk dataset, which includes a wider range of weather events compared to the historical data. Dry climate change scenario NARCLiM assumes a worst-case dry climate change scenario in the future and is also based on a 10,000-year dataset. Created by adjusting the long-term historical scenario with regionally downscaled factors from the NARCliM, this scenario models potential climate impacts under drier future conditions.

[63] NSW Department of Climate Change, energy, the Environment and Water, *Draft NSW Regional Water Strategy – Murrumbidgee: Shortlisted Actions – Executive Summary* (accessed 11 November 2024), Hyperlink: Draft NSW Regional Water Strategy – Murrumbidgee: Shortlisted Actions – Executive Summary

Historical data supports these projections, showing a steady rise in recorded temperatures since around 1950, with the largest increase in the most recent decades.[64] From 1970 to 2020, average spring temperatures have increased the most (0.4 to 0.6°C per decade) across the region. The increase in average winter and autumn temperatures has risen more in the Snowy Mountains and around the Australian Capital Territory (0.2 to 0.3°C per decade) than in the mid and lower parts of the region (0.05 to 0.15°C per decade).[65]

Rainfall seasonality and other sub-annual climate changes (such as bushfire regimes) may also affect floodplain ecosystems directly, independent of hydrological impact, and may limit the ecological outcomes of potential flow regime improvements. Increased temperatures are expected to further reduce streamflow due to higher evapotranspiration rates.

The regulated Murrumbidgee River's flow regime responds to climate scenarios in various ways. Figure 4-4 shows how the various modelled climate scenarios affect the mean (average) annual flow at Gundagai and Balranald on the regulated section of the Murrumbidgee River. Mean annual flows under the dry future climate projection are significantly reduced compared to both the historical climate and long-term historical climate results.

The reduction between the dry future climate scenario and long-term historical scenario is more significant (44%) at Balranald, which is at the end of the river system, than at Gundagai (33%), on the upstream reaches of the regulated system.

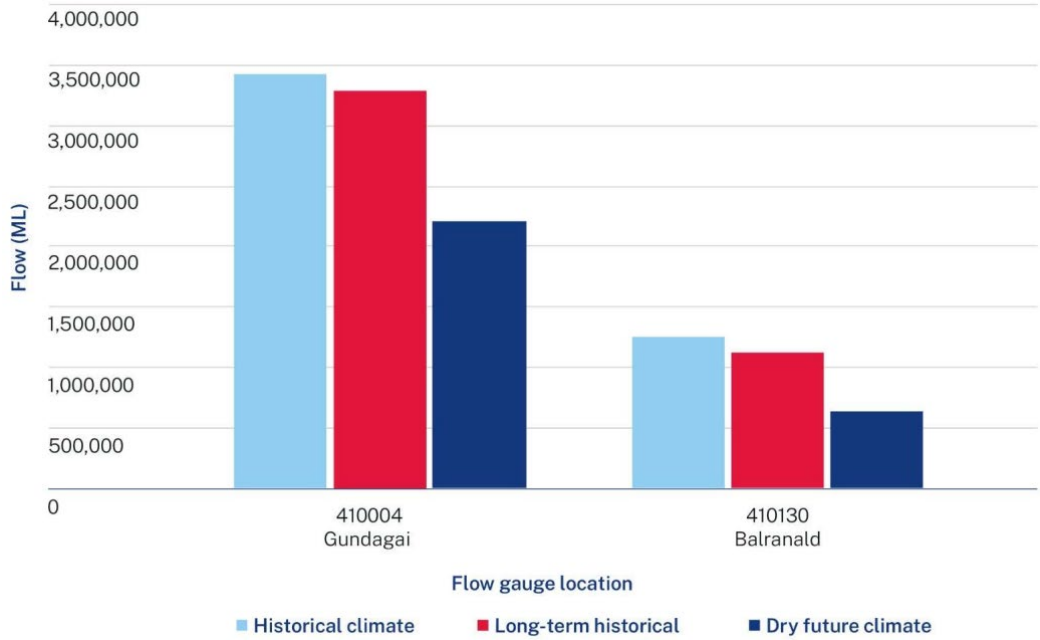

Figure 4-4: Impact of different climate scenarios on mean (average) annual flow in the Murrumbidgee River at Gundagai and Balranald

[64] Office of Environment and Heritage 2014, Murray Murrumbidgee Climate Change snapshot

[65] Bureau of Meteorology, Climate change — trends and extremes, www.bom.gov.au/climate/

In 2024, the program analysed potential climate change impacts for the project using the Murrumbidgee Source Model and climate change data from NSW Regional Water Strategies[66]. This work provided insights into likely effects of climate change projections on the frequency of unregulated flow events that connect wetland and floodplain ecosystems, both with and without the project. The project's wetland fauna assessment identified that a reduction in the frequency of wetland connecting flows due to climate change lowers connectivity. This is a substantial risk to flow-dependent species including native wetland vegetation, frogs, turtles, small-bodied native fish and waterbirds.[67] This follows a pattern observed globally by the Intergovernmental Panel on Climate Change who identify that *"climate change will significantly alter ecologically important attributes of hydrologic regimes in rivers and wetlands and exacerbate impacts from human water use in developed river basins"*.[68]

Similarly, studies[69] indicate that environmental water managers should ensure natural variability of flow frequency, duration and timing to achieve biodiversity and ecosystem benefits in climate change stressed ecosystems. Without addressing this, environmental conditions will worsen under the projected dry climate future.

4.1.2 Problem 2

Environmental water recovered to improve the health of river ecosystems is unable to be used above channel capacity as the river operator may not have the authorising environment to release these flows.

Environmental water managers use held and planned environmental water for specific environmental purposes like watering wetland and floodplains, supporting bird breeding or fish spawning, and reducing the severity of hypoxic blackwater events. As of 30 September 2024, the CEWH held 357 GL, and the NSW Government held 116 GL of High, General Security and Conveyance entitlements in the Murrumbidgee catchment. Over the long term, on average these entitlements yield approximately 232 GL and 69 GL respectively (long term diversion limit equivalent volumes).[70] Additionally, the Murrumbidgee Water Sharing Plan's Environmental Water Allowances provide a further 100-150 GL for environmental flows in many years.

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[66] Alluvium, 2024, Reconnecting River Country Program: Native wetland fauna assessment – Murrumbidgee, report prepared by Alluvium Consulting Australia for the NSW Department of Climate Change, Energy, the Environment and Water

[67] Döll, P., and Bunn, S. E. (2014). "Cross-chapter Box on the Impact of Climate Change on Freshwater Ecosystems Due to Altered River Flow Regimes," in Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Editors C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Biliret al. (Cambridge, UK; New York, NY: Cambridge University Press), 143–146.

[69] Capon, Samantha J., Ben Stewart-Koster, and Stuart E. Bunn. "Future of freshwater ecosystems in a 1.5 C warmer world." Frontiers in Environmental Science 9 (2021): 784642.

[70] CEWH, Water holdings, https://www.dcceew.gov.au/cewh/manage-water/basin/water-holdings#murrumbidgee
NSW DPIE, Held environmental water licenses, https://water.dpie.nsw.gov.au/our-work/projects-and-programs/environmental-water-management-in-nsw/environmental-water-data/held-environmental-water-data/held-environmental-water-licences-register

The Murrumbidgee Regulated Water Sharing Plan allows flows up to 32,000 ML/day at Gundagai. However, since 2012 WaterNSW has limited flows to 22,000 ML/day at Wagga Wagga due to landholder concerns about land inundation, loss of access to productive land and road access above this level. This lower operational flow limit restricts the effective use of environmental water. It is insufficient to achieve effective inundation of wetland and floodplain environments.

Environmental water orders must also share river channel capacity with irrigation orders for the Murrumbidgee and Coleambally irrigation districts as well as other irrigators. To achieve maximum possible environmental outcomes, environmental flows must be in the limited periods of time when irrigation orders are low. This reduces flexibility to respond to system conditions and environmental priorities, and limits the environmental outcomes possible.

As an example, the optimal timing for flows to support fish breeding is in spring when water temperatures start to rise, which generally corresponds with the start of the irrigation season. Alternatively, if environmental flows are delivered during periods of significant irrigation orders, the volume of environmental water that can be released within the 22,000 ML/day limit and the environmental flow outcomes downstream of the major irrigation offtakes are both substantially reduced.

4.1.3 Problem 3

Current environmental flow limits are constrained to avoid impacts on riparian landholders, public infrastructure and other stakeholders

Increasing operational limits for environmental flows in the Murrumbidgee River above the current 22,000 ML/day operational limit at Wagga Wagga would see some of WaterNSW releases flow overbank in some areas along the Murrumbidgee River. This will lead to both direct and indirect benefits and impacts to public and private lands and infrastructure.

4.1.3.1 Impacts to private land

Increasing operational flow limits would see some of WaterNSW releases flow overbank in some areas. This may result in inundation of agricultural land and create temporary access disruptions for some properties along the Murrumbidgee River. These impacts can occur where roads, tracks, or low-lying areas are intersected by creeks or natural flow paths. The extent and significance of these impacts vary depending on individual property characteristics, land use and the nature of local business operations.

The largest areas of potential private property inundation are in the lower reaches of the Murrumbidgee River from Maude downstream to Balranald (63% of the total inundated area), which includes both the Lowbidgee and Junction wetlands. The Euroley area west of Narrandera including Darlington Point and the upper Yanco Creek system has the highest number of affected properties. The degree of affectation varies significantly across properties, with a large proportion of properties inundated to a small degree.

Figure 4-5 shows that for a 40,000 ML/day flow at Wagga Wagga, 45% of the total number of private properties in the flow corridor will be inundated by less than 5% of the area of that property, with a further 16% of properties inundated between 5% and 10%.

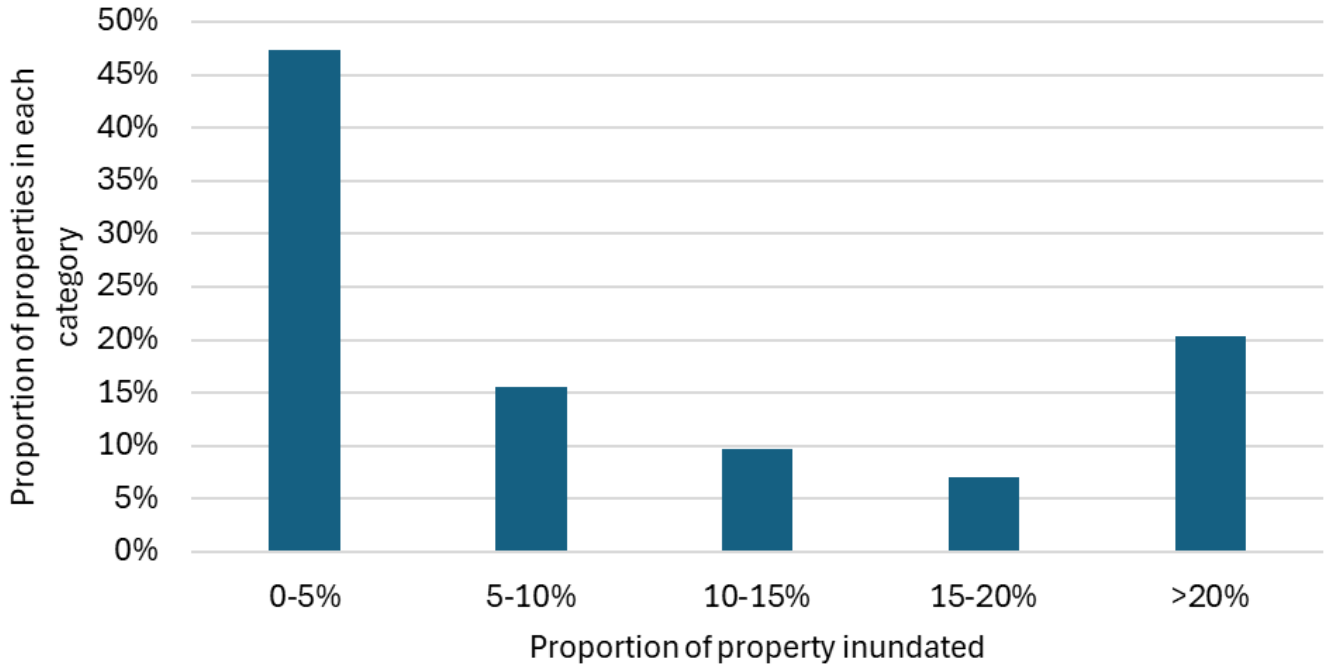


Figure 4-5 Number of properties (as a percentage of the total number of private properties in the flow corridor) in each inundation impact level (by percentage of that property inundated when a 40,000 ML/day flow at Wagga Wagga occurs).

Figure 4-6 shows the land-use of private land potentially inundated along the length of the Murrumbidgee River, noting the impacts of inundation differ depending on how they currently use potentially inundated land. Cropping, including dryland cropping represents just 10% of the area inundated, which may be negatively impacted due to higher flow limits. Likewise, a relatively small amount of the inundated areas is floodplain and lakebed cropping land uses, accounting for a further 4% of the inundated land.

In contrast, almost 80% of the private land inundated is grazing native vegetation. Grazing native vegetation is far more adaptable to inundation impacts with stock able to be moved if enough notice is given. Grazing mainly occurs in the lower reaches of the Murrumbidgee and can have beneficial impacts from inundation adding additional soil moisture and nutrients.

The impact on landholders along the Murrumbidgee River from higher flows can be varied. However, this land is a floodplain which is subject to periodic natural inundation and land use is largely consistent with and often supported by inundation, such as through increased grazing production after flows recede.

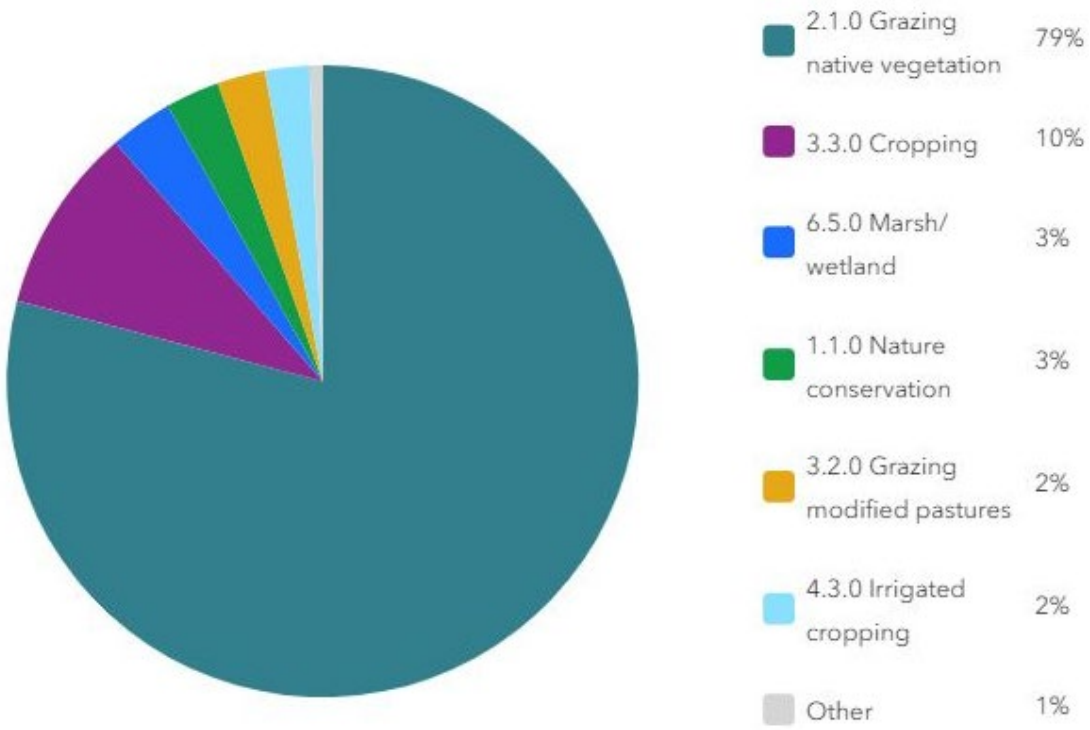


Figure 4-6: Land use types for areas potentially inundated for flows of up to 40,000 ML/day at Wagga Wagga

4.1.3.2 Impacts to public land and infrastructure

Increasing environmental flows above 22,000 ML/day at Wagga Wagga may impact some public infrastructure in the Murrumbidgee valley, potentially causing road overtopping with some requiring closure.

Potential impacts include:

- loss of access to some public recreation sites and infrastructure. These include National Parks, camping areas, cultural and heritage sites, cycleways and footpaths
- increased likelihood of some stormwater pump assets being overloaded from concurrent high rainfall events and high river flows
- some under capacity road culverts causing upstream flow storage until overflow occurs increasing risks to road users and/or road closures
- causeways maintain good flow passage but with very high road closure frequency, coupled with limited or no alternative routes, so that access is significantly impacted including for emergency services.

Public authorities with assets and infrastructure that may be affected include local government, Crown Lands, National Parks and Wildlife Service, WaterNSW, Water Administration Ministerial Corporation, Forestry Corporation of NSW, Local Lands Services, Goldenfields Water and Riverina Water County Council.

4.1.3.3 The project presents opportunities for long-term benefits for First Nations people

First Nations people in the project area have a strong spiritual connection to land and waters of the region. It is central to their culture, identity and wellbeing. They have a spiritual connection to care for land and water resources as part of their commitment to caring for Country. However, First Nations people have been alienated and displaced from ownership and connection to their Country by colonisation.

An independent assessment of social and economic conditions in the Basin[71] revealed that many First Nations communities in the Basin are experiencing poor social and economic conditions. Deterioration of health and wellbeing is negatively impacting identity and culture. To date, First Nations people have not been given enough opportunity to benefit from water reforms and have felt they have not had enough opportunity to participate in water access, planning and management decisions.

First Nations considerations have been embedded in project development and engagement to thoughtfully explore opportunities for benefit realisation for First Nations people to counteract the potentially widening gap. The project aims to improve the health of the Murrumbidgee River system and Country and has the potential to enable increased participation in land and water management to ensure holistic outcomes for First Nations people. These opportunities to connect to Country can promote well-being and enable knowledge sharing across generations enriching both cultural continuity and community bonds.

It is particularly important that these opportunities are identified by First Nations communities, who must play a leading role in developing, planning, and managing the necessary measures. Providing greater access and participation will allow communities to realise social and economic benefits, reinforcing their connection to Country while supporting environmental outcomes and healing the land.

[71] NSW Department of Climate Change, Energy, Environment and Water, Final Report: Independent assessment of social and economic conditions in the Murray–Darling Basin, Sefton et al, April 2020

4.2 Project objectives and benefits

Project objectives confirm intentions and goals and should align with the objectives of the government's existing commitments, policy, strategy, plans, investments, and legislative requirements to demonstrate strategic alignment. The project's preferred option and measures for investment should meet project objectives and make up the recommended solution.

Figure 4-7 presents the objectives for this project which closely align with the problem statements identified in Section 3.1. Specifically, Objective 1 relates to Problem Statement 1, Objective 2 relates to Problem Statement 2, and Objective 3 relates to Problem Statement 3.

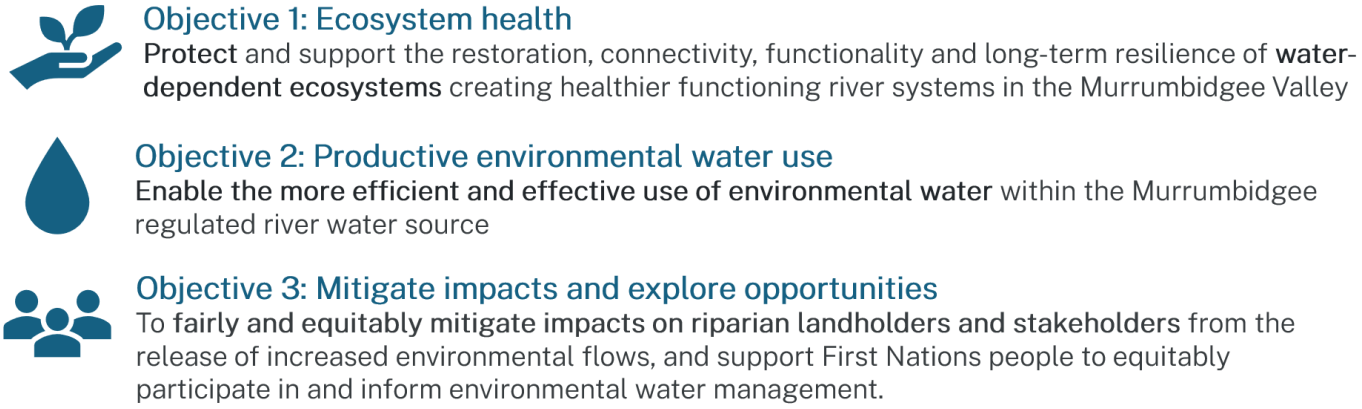


Figure 4-7: Project objectives

These were drafted with the objectives of relevant Australian and NSW State Acts, strategies, and programs in mind, mainly focusing on:

- The Commonwealth *Water Act 2007*
- The Basin Plan 2012
- SDLAM constraints and supply measures
- Constraints Relaxation Implementation Roadmap
- The NSW *Water Management Act 2000*.

The project is expected to deliver the following benefits:

- improved health of the Murrumbidgee River system, benefitting ecosystems, communities and future generations
- more efficient and effective environmental water use achieves SDLAM offsets and reduces pressure on future water recovery under the Basin Plan
- better health of Country and opportunities for increasing First Nations people's participation in environmental water management, access and connection to Country
- overall improved agricultural outcomes

- improved community access during higher environmental flows and some natural higher flow events.

4.3 Urgency for action

Immediate action is needed to relax constraints in the Murrumbidgee River system to address identified problems. Inaction will most likely have significant environmental, social, and economic consequences:

- **Irretrievable impacts to freshwater ecosystems of the Murrumbidgee River:** inaction is likely to result in further decline in the region's wetland and floodplain ecosystems, with irretrievable impacts to endangered ecological communities and the region's native flora and fauna.
- **Increased pressure for water buybacks:** without on-ground progress in relaxing constraints before the December 2026 Basin Plan Review, the NSW Government will fail to reach its SDLAM project commitments in the time required. This will leave a potential gap towards the 605 GL recovery target, potentially leading to economic losses and decreased agricultural productivity.
- **Ineffective use of environmental water as constraints mean environmental water cannot reach key ecological assets:** without action, the operational limit of 22,000 ML/day at Wagga Wagga will persist, preventing environmental outcomes from already recovered water.
- **Early works investments fail to realise full benefits:** capital investment in early infrastructure works needed to complement this project (such as Mundarlo Bridge and Mundowy Lane) will not deliver the intended program benefits without relaxing constraints for river operators to deliver higher environmental flows.
- **Heightened vulnerability to climate change:** as these events intensify, the need for managed environmental water interventions will grow, along with the urgency to optimise environmental water use. At the same time, reduced water availability and heightened demand due to warmer, drier conditions will strain resources further, creating challenges for both environmental preservation and consumptive water needs.

5 Implementation options considered

This section details why relaxing constraints and increasing environmental flows are required for a healthier Murrumbidgee River. It fulfills NSW Treasury TPG24-29 NSW Business Case Guidelines[72] requirement to revisit the assessment of a diverse range of alternate build and non-build options, explaining why these options were not considered further.

This section shows how the Reconnecting River Country Program Murrumbidgee Project's constraints relaxation measures are a critical component of a broader suite of measures in the Basin Plan. With nearly all the Basin Plan measures now implemented or underway, it is crucial to implement the project to realise the region wide benefits it can bring, including to other programs and initiatives. This section also highlights the benefits and potential impacts of the project flow limit options assessed and the approach to mitigate these impacts through physical, policy, and legal measures.

The Base Case and 3 project flow limit options[73] were evaluated using hydrologic, hydraulic, and ecological response models to assess their environmental benefits and potential adverse impacts on landholders and other stakeholders. Each assessment was undertaken at spatial scales in keeping with the models and data available at time of completion. All models were developed by independent experts or were subject to peer review, using contemporary and fit-for-purpose modelling. These are outlined below.

5.1 Broad consideration of infrastructure and non-infrastructure options

The Basin Plan was developed as an integrated package of build and non-build interventions to target improving environmental outcomes for the rivers and tributaries of the Basin. A decade of Basin Plan implementation and significant Australian Government investment has seen many of these initiatives either fully delivered or underway. Within this context the project's constraints relaxation measures were always recognised as critical to achieving the original Basin Plan outcomes. When compared to other Basin Plan initiatives aimed at improving environmental

[72] https://www.treasury.nsw.gov.au/sites/default/files/2024-11/tpg24-29_nsw-government-business-case-guidelines.pdf

[73] A fourth flow limit option of 48,000 ML/day, plus a buffer up to 5,500 ML/day was considered, however failed during the options assessment process. Concerns were raised by stakeholders during the preliminary business case (2016) that this flow limit option is approaching the minor flood level at Wagga Wagga.

outcomes, only relaxing constraints meets all identified project objectives and provides the broadest reaching benefits within the Murrumbidgee system.

The project reviewed the key Basin Plan initiatives relevant to the Murrumbidgee River and assessed them for their potential alignment with the project objectives (Section 3.2). They are ecosystem health, productive environmental water use and mitigation of impacts/exploring opportunities. All projects assessed aligned with one or 2 of the objectives, but none aside from the project to relax constraints met all 3. The projects assessed included:

- Enhanced environmental water delivery program
- On-farm efficiency measures program
- Dam airspace underwriting with environmental water project
- Off-farm efficiency measures program
- SDLAM Acceleration projects
- Mid-Murrumbidgee optimisation project
- Wetland pumping project
- Constraints relaxation (this project).

5.2 Base Case

The Base Case is the benchmark against which project option benefits and impacts are evaluated and quantified. The Base Case is the 'without project' scenario and represents the state of the catchment if constraints were not relaxed.

The Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016 requires WaterNSW to manage the water supply system considering delivery and channel capacity constraints. While it specifies Murrumbidgee's channel capacity constraints as 32,000 ML/day at Gundagai, in practice since 2012, flows in the Murrumbidgee River have been limited by WaterNSW to 22,000 ML/day at Wagga Wagga. As such, the Base Case adopts a 22,000ML/day flow limit at Wagga Wagga.

The Base Case used for hydrologic and hydraulic modelling, environmental benefit and risk assessments, and economic analysis assumes the level of environmental water that was available in December 2019. This assumption was adopted given the high degree of uncertainty in recovering the extra 450 GL of environmental water that existed when this work began.

As the Australian Government has now begun recovery of the extra 450 GL of environmental water, the potential environmental flow outcomes achievable with extra recovery have been sensitivity analysed. While there is uncertainty in the amount of extra water that will be recovered in the Murrumbidgee, additional environmental water would increase the potential environmental outcomes possible following relaxation of environmental flow constraints.

The current Base Case provides very limited opportunities for environmental water holders to connect the Murrumbidgee River with its floodplains and wetlands.

Interaction with Murray flows

The Murrumbidgee River is a major tributary of the River Murray with the confluence of the 2 rivers located west of Balranald near Boundary Bend. The area where the rivers join contains a complex of floodplain creeks, wetlands and billabongs often called the Junction Wetlands. Flows and inundation depth throughout this area are driven by both Murrumbidgee and Murray flows.

Investigations that underpin the options assessment and project development incorporate the impact of these elevated flows in the River Murray based on potential implementation of a future Murray constraints relaxation project. Benefit and cost estimates have been developed based on the combined flows and the resultant larger area of inundation. This was in recognition that flows released for the River Murray regulated system affect landholders some way up the Murrumbidgee system. The modelling supporting the inundation extent mapping has used the proposed Murray maximum flow rates to ensure their impact has been adequately considered for this project.

5.3 Upper flow limit options

The FBC compares the cost and benefits of 3 upper flow limit options at Wagga Wagga against the Base Case of a flow limit of 22,000 ML/d at Wagga Wagga:[74]

- Flow limit option 1 (W32) - 32,000 ML/day, flow limit, plus a flow buffer[75] of up to 4,000 ML/day for mitigation measures
- Flow limit option 2 (W36) - 36,000 ML/day, flow limit, plus a flow buffer of up to 4,000 ML/day for mitigation measures
- Flow limit option 3 (W40) - 40,000 ML/day, flow limit, plus a flow buffer of up to 5,000 ML/day for mitigation measures.

These options, amongst others, were previously assessed in the SBC with all 3 flow limit options recommended to proceed to a final business case for further evaluation. A fourth flow limit option of 48,000 ML/day, plus a 5,500 ML/day buffer was also considered. However, it failed during the options assessment process due to concerns raised by stakeholders that this flow limit option approaches the minor flood level at Wagga Wagga.

[74] https://water.dpie.nsw.gov.au/our-work/water-infrastructure-nsw/sdlam/reconnecting-river-country-program/inundation-mapping

[75] A flow buffer is adopted for each flow limit option considered. A flow buffer is not the target for flow delivery but is proposed as a risk mitigation measure. The buffer will act as a safeguard for landholders if, on rare occasions, flow targets are exceeded due to unforeseen rainfall and tributary inflows. The flow buffer will be used to define the outer extent of the flow corridor, and compensation will apply up to and including the flow buffer.

Each of the flow limit options assessed assumes that environmental flows will sometimes be delivered in combination with other flows in the river, specifically unregulated flows. This is sometimes called 'piggybacking', where environmental water is used to enhance the environmental benefits of the existing flow event and increase the efficiency of environmental water use. This type of operation will be particularly important with Option 2 W36 and Option 3 W40 as release capacity limitations at Burrinjuck Dam mean that these higher flow rates can only be achieved by timing dam releases concurrent with elevated tributary inflows. At this stage there is no proposal to upgrade the dam outlet infrastructure to achieve the new flow limit.

5.4 Frameworks, processes and systems to support delivery

To support the delivery of future environmental flows up to the recommended upper flow limit, the program has established a suite of frameworks, processes and systems to ensure WaterNSW operates within a clear and robust authorising environment. This includes legislative amendments, landholder negotiation processes, flow easements, improved notification systems, and tailored landholder support services to enable responsible and transparent flow delivery.

To achieve the program's intended outcomes, WaterNSW will need to release overbank flows in parts of the Murrumbidgee River to connect the river with its floodplain and wetlands. It is essential that the river operator has an adequate authorising environment and that their operational requirements are fully considered in program design. To address this, the program explored strategies to ensure WaterNSW is appropriately authorised to deliver flows up to the recommended flow limit.

5.4.1 Strategies for creating a river operator authorising environment

The NSW Government has developed a strategy to establish an adequate authorising environment for river operators. This includes legislative amendments that will enable release of overbank environmental flows up to the recommended flow limit. It is NSW Government policy that river operators should have statutory protection from civil claims when in good faith they make releases of water for environmental purposes. This principle underpinned amendments made to the *Water Management Act 2000* in 2018. Additional measures include a formal process for good faith negotiations and compensation through the Landholder Negotiation Scheme, securing flow easements to establish enduring right to inundate land, and exploring alternative arrangements for properties that have minimal impacts.

Further actions involve investigating how WaterNSW and other operators can act as agents or beneficiaries of flow easements, improving systems for notifying landholders and others ahead of environmental water releases and updating regulatory instruments such as water sharing plans and system operating rules.

5.4.1.1 Landholder Negotiation Scheme

The purpose of the Landholder Negotiation Scheme (LNS) as set out in the Water Management (General) Regulation 2018 is to set a transparent and consistent process for the NSW Government to undertake negotiations in good faith with landholders affected by higher environmental flow releases. The LNS will be a statewide framework applicable when negotiating agreements with landholders affected by proposed enduring changes to environmental flows that are outside of current operating practice. This includes, but is not limited to, flow limit options enabled by the project.

Flow easement compensation and works are designed to mitigate the impacts of any increase in flow limits.[76] The LNS will place the onus on the NSW Government to follow an additional negotiation process that extends beyond existing mandatory legislative requirements. The development of the LNS is a former NSW Government commitment, being honoured by the current NSW Government, to protect the interests of landholders during the negotiation process.

5.4.1.2 Landholder support options

The *Land Acquisition (Just Terms Compensation) Act 1991* (JTA) requires all NSW Government agencies comply with the Property Acquisition Standards and minimum requirements during the acquisition process. The Standards commit acquiring authorities to improve the experience of property owners and support property owners throughout the process by providing assistance tailored to meet individual circumstances. Assistance includes legal, financial and valuation information, ensuring fair, transparent, and consistent practices, in addition to emotional and psychological support.

The program is also committed to providing emotional, psychological and mental health support for landholders during the negotiation process. Table 4-1 identifies the landholder support option that is currently available, with other support options currently being explored. Landholder support costs are factored into the costs of delivery.

Table 4-1: Current available landholder support options

Service	Owner	Support	Availability
Centre for Property Acquisition – Property Acquisition Support Line	Centre for Property Acquisition	Emotional and psychological support, up to 5 free sessions per person	24 hours a day, 7 days a week, 365 days a year

In addition to these support services, each owner will have a dedicated Personal Manager who has been trained to help people impacted by property acquisition through the process.

[76] In determining compensation under the LNS framework, the program must, consider all relevant matters provided in Part 3 of the JTA, including Section 55 of the JTA.

5.4.1.3 Flow notification system

Flow notification is key for operating in good faith when delivering environmental flows that may inundate land. WaterNSW currently operates the Early Warning Network advising downstream landholders on an opt-in basis of existing water releases from dams. This occurs for high regulated releases and during flood operations. On the Murrumbidgee, environmental water managers also operate an opt-in alert process for environmental flow delivery, particularly further downstream.

The program aims to provide landholders with improved information about flows that may impact them in an acceptable timeframe, developing a case for an improved notification system. A working group has been established to scope requirements and plans to finalise the flow notification system by December 2026 in accordance with the existing funding agreement milestones.

5.5 Assessment of project measures

Raising the operational environmental upper flow limit in the Murrumbidgee system will provide ecological benefits by increasing inundation frequency and extent. However, this inundation affects some riparian landholders, public land and infrastructure, as well as other stakeholders. Mitigating these impacts is essential for the project's implementation and outcomes.

This section discusses the investigations undertaken by the program to formulate the project measures that will assist in mitigating impacts from increased environmental flows, enabling adoption of a higher upper flow limit, and providing opportunities for First Nations outcomes. Project measures seek to mitigate impacts that apply across all flow limit options. Investigations have been grouped by the party affected:

- WaterNSW through the creation of an adequate authorising environment to make releases that cause overbank environmental flows.
- Third parties, such as private and public landholders through the mitigation of impacts. Also, investigations into environmental works to enable enhanced environmental outcomes from the program improving connectivity to priority environmental assets, as defined in the Long-Term Water Plan.
- First Nations opportunities for equitable participation in and informing environmental water management through project implementation.

Together, these elements represent the best pathway for delivering program and project outcomes. As investigations continue, informed by ongoing project implementation, landholder engagement and ongoing engagement with WaterNSW, these elements may evolve.

5.5.1 Assessment of project measures

Easements in gross (flow easements) are the preferred mitigation measure to secure enduring rights for river operators to release environmental flows that may result in overbank inundation of private property. This approach not only supports the delivery of environmental outcomes in line with the Basin Plan, but also addresses key risks associated with liability, landholder compensation, and long-term program viability.

In 2021, the program comprehensively assessed a range of options against 4 criteria to determine the most suitable option to establish an effective flow corridor (Table 4-2). Each option was evaluated against the 4 criteria, which were developed using a risk-based approach to ensure risks to landholder interests, river operators and project delivery would be adequately mitigated. These criteria reflect the following considerations:

- alignment with project objectives
- the need to establish an enduring flow corridor and right for river operators to deliver environmental water releases under the program
- compatibility with program funding terms, including single compensation payments and landholder responsibility for ongoing infrastructure operations and maintenance
- ability to provide fair compensation to affected landholders
- ability to mitigate third party impacts associated with environmental water releases under the program

The assessment criteria and findings are summarised in Table 4-2. The program's assessment found that flow easements in gross meet all assessment criteria. Flow easements provide the most effective risk mitigation strategy to protect both landholder interests and river operator responsibilities, while achieving the project objectives. Flow easements provide an enduring right to the river operator to inundate land, while ensuring that landholders are compensated under an established framework for compensation on just terms, that is compatible with program funding.

However, the program is aware many landholders do not support flow easements. In response, alternative approaches, such as Deed of Release are being explored for properties that are minimally affected by program flows.

Table 4-1: Program measure options considered by the program and assessment against criteria

Program measure	Description	Addresses River Operator authorising environment	Enduring right to inundate (registered on title and survive title transfer)	Avoids future other administration and management costs	Ensures appropriate compensation, consistent with social support and with one-off funding basis	Finding
Flow easement	An easement in gross permitting periodic, temporary inundation of the land within the flow corridor	✓	✓	✓	✓	Meets all assessment criteria and achieves program objectives. Provides an enduring right to the river operator to inundate land, while ensuring that landholders are compensated under an established framework for compensation on just terms, that is compatible with program funding.
Covenant	A positive covenant that permits periodic, temporary inundation of the land within the flow corridor.	X	X	X	X	Does not provide an enduring right to inundate the land that will survive title sale or transfer. As such is not compatible with Australian Government funding principles as the option does not ensure creation of an enduring flow corridor. May be relevant for agreements involving works.

Program measure	Description	Addresses River Operator authorising environment	Enduring right to inundate (registered on title and survive title transfer)	Avoids future other administration and management costs	Ensures appropriate compensation, consistent with social support and with one-off funding basis	Finding
Mitigation works (without easement)	Works on private land without an easement to mitigate inundation impacts	X	X	X	✓	Does not provide an enduring right to inundate land unless the works are accompanied by an easement.
Event based or fee for flow agreements	Agreements with affected landholders on a single event basis to permit periodic, temporary inundation of the land within the flow corridor. A variation on the option could be to negotiate agreements that span several events until an expiry date	X	X	X	X	This approach is not sustainable for an enduring arrangement, as it relies on time-consuming negotiations ahead of each event. It will incur significant administration costs and offers little certainty to landholders, environmental water managers or river operators. There is no statutory requirement to ensure consistent or equitable compensation, and the event-based model is incompatible with current program funding arrangements. Governments are unlikely to support repeated compensation negotiations with hundreds of landholders over time. In addition, implementing such a scheme would require specific legislation.

Program measure	Description	Addresses River Operator authorising environment	Enduring right to inundate (registered on title and survive title transfer)	Avoids future other administration and management costs	Ensures appropriate compensation, consistent with social support and with one-off funding basis	Finding
Strategic Benefits Payments	An annual payment to affected landholders to permit periodic, temporary inundation of the land within the flow corridor. Note that variations on the option could include an annual payment in addition to compensation for a flow easement required by the Just Terms Act	X	X	X	X	While strategic benefits payments have been made for transmission line easements, this required specific legislation and a revenue stream and was additional to easements and compensation, not an alternative. Ongoing payments after program delivery is outside of Australian Government funding arrangements. Introducing a strategic benefits payment scheme would require further legislation as this scheme would require additional funding over 10 to 20 years or provision of a sinking fund. Such an arrangement would be costly, onerous and a source of ongoing uncertainty for affected landholders and for government. It provides no enduring right to inundate unless accompanied by an easement.

Program measure	Description	Addresses River Operator authorising environment	Enduring right to inundate (registered on title and survive title transfer)	Avoids future other administration and management costs	Ensures appropriate compensation, consistent with social support and with one-off funding basis	Finding
Floodplain management plans (FMPs)	FMP's establish zones that either prohibit or permit flood works under certain conditions. The option assessed is a FMP zone that identifies the flow corridor.	X	X	X	X	FMPs do not provide a mechanism to address river operator liability and do not provide an enduring right to the river operator to inundate land. FMP zones and the WM Act do not require nor establish a process or framework for negotiating compensation payments to affected landholders. FMP zones are useful in regulating flood works that will impact program objectives.
Conservation agreements	Conservation agreements under the Biodiversity and Conservation Trust that includes requirements for the landholder to permit periodic, temporary inundation of the land within the flow corridor.	X	X	X	X	Conservation agreements do provide payments to landholders in return for achieving conservation outcomes, but do not address river operator liability and the lack of enduring right for the river operator to inundate land means not viable within program funding arrangements.

Program measure	Description	Addresses River Operator authorising environment	Enduring right to inundate (registered on title and survive title transfer)	Avoids future other administration and management costs	Ensures appropriate compensation, consistent with social support and with one-off funding basis	Finding
Environmental Planning and Assessment Regulation and/or LEP amendments	Local Environmental Plan zone identifying the flow corridor area of periodic, temporary inundation.	X	X	X	X	Land use zones do not provide a framework to address river operator liability, nor provide a right to inundate. Compensation is not payable for changes in land use zones in LEPs.
Deed of Release	Deeds of release are contracts between the affected landholder and the government. A deed of release with the affected landholder to permit periodic, temporary inundation of the land within the flow corridor.	✓	X	X	✓	A deed will not be sufficient to meet the criteria of an enduring right to inundate particularly where properties have large inundation impacts, is not guided by equitable compensation framework and is not compatible with program funding arrangements. However, the program is considering whether deeds of release can be negotiated with some minimally affected properties.

5.5.2 Project measures

The program has investigated a range of processes and measures to mitigate third party impacts. These have been the subject of community consultation which has informed the approaches that the program is proposing to take to delivery. This section outlines the proposed third-party impact mitigation processes and measures for the project.

5.5.2.1 Environmental flow easements on private land

The project intends to use the LNS to voluntarily secure flow easements over properties located in the Murrumbidgee flow corridor, where required. These flow easements survive title transfer and are in perpetuity. They will provide an enduring right for river operators to inundate within the project's flow corridor.

The FBC's investigations and analysis recommended adopting an upper flow limit of 40,000 ML/day, with a flow buffer up to 5,000 ML/day at Wagga Wagga. It is important to note that the flow buffer is not the target for flow delivery, but is proposed as a risk mitigation measure. The buffer will act as a safeguard for landholders if, on rare occasions, flow targets are exceeded due to unforeseen rainfall and tributary inflows. The flow buffer be used to define the outer extent of the flow corridor, and compensation will apply up to and including the flow buffer.

5.5.2.2 Easement form

The project has identified a practical and efficient approach to establishing easements across a large scale and dynamic river system. The project completed an *Assessment of easement survey methods* to evaluate options for mapping and defining easements. The desktop methodology approach with a Deed of Agreement was identified as the most cost and resource efficient approach for the creation of flow easements. Under a Deed of Agreement approach, impacts are proposed to be defined by the flow limit at Wagga Wagga, expressed as gauge height, rather than a surveyed mapping approach under metes and bounds. The Deed of Agreement would be accompanied with an illustrative map displaying the property and the flow corridor boundary.

5.5.2.3 Easement terms

Easement terms define the rights and limitations of the easement holder. For the project the easement terms will define the rights and limitations of the river operator and environmental water managers in delivering higher environmental flows in the future – that is, the flow rate, and potentially the frequency or conditions under which flows can be delivered.

The flow easement terms will refer to a Declaration Order, a legal document that is required under the LNS which will provide additional contextual information outside of the easement terms. It will describe the likely future frequency, timing, and duration of flows, to give additional information to inform the valuation and negotiation process during project delivery.

5.5.2.4 Environmental flow easements on public property

Public authorities account for 40% of land tenure in the project's flow corridor, consisting of Crown land (around 25%) and National Parks. For public authorities, the "right to inundate" may be achieved at an organisational level, rather than at the individual parcel level.

Legal exclusive use arrangements such as leases may be in place between public authorities and third parties. In accordance with the LNS, these third parties will be treated as landholders during delivery of the project. Where easements and compensation payments are necessary, a test of compensable interest would need to be applied. The program will be engaging with Crown Lands in relation to native title issues, and agreements to support easement acquisition on land under Aboriginal Land Claim would be sought from Crown Lands (where a determination has not been made), the NSW Aboriginal Land Council and the relevant local land council.

Public authorities may wish to seek compensation for land and assets affected by increased environmental flows. Assets in public authority ownership potentially affected may include sealed/unsealed roads, bridges, footbridges, culverts, walking tracks and recreational furniture.

5.5.2.5 Strategies to address variation in property affectation

The program assessed easement establishment approaches and project cost estimates, incorporating property values and compensation estimates based on the JTA.[77] Analysis of impacted riparian landholders showed many properties have a relatively minor inundation footprint within the proposed maximum flow corridor. As acquiring flow easements for many of these minimally affected properties may not represent value for money, the program is exploring strategies for alternatives to easements where landholders are minimally affected as a streamlined and cost-effective approach to securing the flow corridor.

5.5.2.6 Alternatives to flow easements

The program has explored alternative strategies to flow easements. While the default position remains that flow easements are preferred for all impacted properties where required, there may be situations where a Deed of Release could be used as an alternative to an easement.

Progression of this approach requires:

- river operators have the legal authorising environment to release higher environmental flows
- clear messaging to landholders at the start of negotiations about the possible outcomes of the negotiations
- an established approach to publishing the flow corridor to inform future prospective buyers of properties that don't have an easement over the title.

The potential benefits of this approach include the following:

[77] Section 55 of the Land Acquisition (Just Terms Compensation) Act 1991 (JTA)

- A reduction in compensation and program administration costs. While there would be compensation costs associated with the Deed of Release, these costs would be less than the flow easement compensation as a deed of release does not provide an enduring right to inundate in the way that a flow easement does.
- That many landholders will prefer a Deed of Release to an easement over their land. Flow easements may change the market value of the land and endure on the title of the land which is recognised in the compensation that is payable. The project has received strong feedback from many landholders that easements are not preferred.

The program is seeking to ensure that all future buyers of land are aware the land may be subject to periodic inundation from higher environmental water releases, even in the case where easements have not been established. As such the project is exploring options to publish the flow corridor to notify future buyers.

5.5.2.7 Works on private property

Physical works may be considered on private property to mitigate the predicted impacts of the proposed releases of water for the environment. These mitigation works are likely to only be considered where they fall into 2 categories:

- Critical works: provides access to critical infrastructure/assets such as residences and significant business assets required for farm operations during an environmental flow event.
- Value for money works: equal or lesser cost than the estimated easement adjustment value for the isolated land area to which the works would restore access. This applies only to islands.

For all works, design and construction will only proceed where the landholder agrees to own and maintain the asset. Agreement to deliver works, funding, ownership and handover contracts will be subject to terms requiring the works to be maintained.

Funding operation and maintenance costs

Operational, maintenance and replacement costs for infrastructure constructed on private and public land will be the responsibility of the landowner. The Australian Government, via the Department of Climate Change, Energy, the Environment and Water, provides project funding through the Federation Funding Agreement for specified deliverables within the agreement term.

Funding will be available only until December 2026. Consequently, any future expenses related to the operation and maintenance of infrastructure will not be covered and will instead become the responsibility of the landholder. NSW has committed to delivering projects and works to implement the Basin Plan in line with funding provided by the Australian Government. As the NSW Basin Plan projects are required to be fully funded by the Australian Government, any future operation and maintenance costs will not be funded by the NSW Government.

5.5.2.8 Works on public lands

Investigations identified potentially affected sites on public land based on desktop GIS analysis, aerial imagery, hydraulic modelling, monitoring during high flow events and discussions with land managers and stakeholders. Initially, 120 sites on public land were identified as potentially impacted by the project's flow limit options.

The project team consulted public authorities including local governments, NSW Crown Lands, NSW National Parks and Wildlife Service, and the Forestry Corporation of NSW to refine the list and consider sites that may require mitigation works. An Eligibility Assessment Working Group tested works eligibility using the criteria.

A total of 58 sites have been identified for further examination and are currently at various stages of design development and evaluation. Preliminary designs, detailed initial cost estimates, topographical surveys, geotechnical assessments and hydraulic modelling have been completed for an initial group of sites. All sites are currently undergoing further assessment and evaluation.

5.5.2.9 Works for environmental outcomes

Relaxing environmental flow limits will achieve substantial environmental outcomes. In the Murrumbidgee project area there are many built structures, on the floodplain and near associated watercourses, that restrict the movement of environmental water to important environmental assets. This includes the higher environmental flows enabled by the project. These structures include watercourse crossings, embankments, levees, broken regulators and water control structures.

The project is an opportunity to enhance the environmental outcomes by removing or modifying some of these existing structures to enable improved passage of environmental flows[78]. Some examples of these works could include modification to undersized culverts and installation of pipe crossings to improve flow passage. Additional benefits of these environmental works will also include improved passage/movement opportunities for native fish and other fauna where applicable.

Whilst some scoping of potential environmental works was done as part of FBC development, further identification and assessment of works is required in the field, with landholder involvement as part of the negotiation process. This will be necessary before the priority works to be addressed can be identified, and options to remove or modify the existing works can be scoped with improved confidence.

5.5.2.10 First Nations opportunities

Engagement with First Nations communities identified a range of measures for First Nations outcomes. The program is proposing the following enabling measures:

- a capacity building, governance and water literacy program on environmental flows

[78] Subject to the rules in the Murrumbidgee Floodplain Management Plan

- a monitoring program assessing cultural values affected by environmental flows
- exploring opportunities for infrastructure works for First Nations communities on public land.

These measures require further scoping and development in consultation with First Nations communities, stakeholder feedback and sentiment.

6 Stakeholder feedback and sentiment

Stakeholder engagement and communications has been critical to Reconnecting River Country Program development and will be continued during delivery. Effective engagement will help achieve the Murrumbidgee component of the program goal to increase the frequency and extent rivers connect to wetlands and floodplains, to improve the health of the Murrumbidgee (and Murray) River systems and Country.

In addition to the positive environmental outcomes, the Reconnecting River Country Program Murrumbidgee Project (the project) seeks to assess the benefits to stakeholders and the social, cultural and economic impacts. The project has identified and engaged with a broad range of stakeholders to increase awareness, gain social support and seek feedback on project measures. Between the projects' launch in August 2021 and December 2024, it has completed:

- over 9,300 interactions recorded between program staff and stakeholders
- more than 900 discussions (including in-person and online meetings, webinars, phone calls, emails)
- engagement with 253 landholders representing 85% of the project's inundated area of private land (including over 50 of the top 100 of those most inundated under the proposed flow limit options in the Murrumbidgee)
- engagement with First Nations communities, public authorities, peak bodies and the broader community.

A key focus of engagement has been to share information about the project, and to build understanding about the need for program. Engagement and communication activities have aimed to:

- raise stakeholder awareness of the project's aims, benefits and status
- increase stakeholder understanding of key aspects including flow limit options, modelling and program measures
- improve understanding of the potential benefits and impacts, and undertake on-ground validation to assess the accuracy of inundation mapping
- seek feedback and input on key aspects of the project to inform its development
- gauge landholder and community sentiment.

6.1 Strategies to increase stakeholder participation

6.1.1 Murrumbidgee awareness raising campaign

The landholder awareness campaign aimed to increase landholder, First Nations and other stakeholder awareness of, and engagement with, the project. The campaign was rolled out in January 2024 and featured a call to action for landholders to 'Connect with the Reconnecting River Country Program' by registering for further engagement.

The campaign achieved a 34% increase in program registrations in the Murrumbidgee, with 76 landholders registering. Refer to Table 6-1 for outcomes of communications activities.

6.2 Summary of communications activities

To extend the reach of program awareness, seek registrations from affected stakeholders and encourage participation and feedback, the program has delivered a comprehensive array of communications activities across the project area (see Table 6-1). Recognising the broad distribution and diversity of stakeholders, a variety of communication mechanisms were used to optimise the likelihood of success.

Table 6-1: Summary of key communication and engagement activities to date

Communication and engagement channel	Outcomes
Program website	>20,000 views and >4200 active users (2023–2024 data)
Program information hub	2,000 active users (Feb 2023–Nov 2024 data)
Newsletters and electronic direct mails	17 electronic direct mail issued since 2022 Current subscriber list 930
Water News articles	10 articles published. >4200 subscribers per edition
Project landholder awareness campaign	76 landholders registered Website traffic increased by 68% Radio reached 306,000 people Social media reached 160,026 people
Media releases	8 media releases, 18 media statements, 8 media interviews Landholder Negotiation Scheme (LNS) 12 media statements (mentioning the program), 2 interviews (mentioning the program)
Advertising (print, radio and digital)	Case Study EOI, Landholder Reference Group, Expressions of Interest (EOI), Landholder awareness, Draft LNS, Early works

Communication and engagement channel	Outcomes
Social media campaigns (Facebook, LinkedIn)	Landholder Reference Group EOI, Landholder awareness
Feedback surveys	6 surveys developed during 2023–2024
Fact sheets and flyers	14 fact sheets, 5 Environmental Benefits and Risk Assessment brochures, 2 flyers and 1 poster (2024)
Water enquiries phone line and email	53 enquiries from March 2022–November 2024
Admin program email	85 emails received (May 2022–Nov 2024)
Ask a question function?	23 questions received (early 2023–Nov 2024)

6.3 Summary of engagement activities

An extensive program of engagement activities has been delivered, guided by the communications and engagement strategies tailored to the stakeholder groups identified. Table 6-2 summarises engagement activities since the start of the program.

Table 6-2: Summary of engagement activities delivered since program inception

Engagement activities	Description	Outcomes / attendees
Community information sessions	Program and LNS community information sessions held in Wagga Wagga and Darlington Point (Oct 2024).	• Over 100 attendees
Private landholder engagements	Registered private landholders engaged through a series of meetings to understand the program and provide feedback.	• 253 landholders engaged in the Murrumbidgee, representing 85% of the project's inundated area of private land and over 20% of the landholder base
Regional focus groups	Regional focus groups meetings.	• Yanco Creek and Tributaries Advisory Council x 2 • First Nations of the Murrumbidgee Regional Focus Group x 1
Community snapshots	Series of meetings with self-nominated stakeholders to provide an overview of the program and receive feedback.	• 17 community snapshots (August 2021 and March 2022)
Community vox-pop surveys	Survey pop ups to gather data on community awareness of the program and how they used and felt about the river.	• 111 responses from 6 locations along the Murrumbidgee and 2 special interest group events (January 2024)

Engagement activities	Description	Outcomes / attendees
On-Country assessments	First Nations led engagements to better understand the significance of sites, potential benefits, impacts and measures.	• 7 completed, 5 begun or progressed
Advisory Committee	Stakeholder consultative body for the program. Meetings with subject matter experts to provide program wide feedback, testing draft methods for feedback and refinements before broader stakeholder engagement, scoring the Options Evaluation Framework social theme.	• 9 members and 4 meetings
Landholder reference groups	Meetings with affected private landholders to test draft program policies and methods for feedback and refinement prior to broader stakeholder engagement. All feedback was considered, and a feedback summary report *Policy approaches to mitigation - feedback summary and next steps*[79] *report* was published to document program responses and how feedback has informed program development.	• 15 members and 75 declared stakeholders • 2 x groups Murray, 1 group Murrumbidgee • 4 meetings – Murrumbidgee • 2 meetings – Murray.
First Nations Reference Group	Meetings with members from both the Murray and Murrumbidgee. Provided input into program development. All feedback was considered, and a feedback summary report *Policy approaches to mitigation - feedback summary and next steps*[80] *report* was published to document program responses and how feedback has informed program development.	• 9 members, 4 meetings

[79] https://water.dpie.nsw.gov.au/__data/assets/pdf_file/0020/623612/policy-approaches-to-mitigation-feedback-summary-next-steps-report.pdf

[80] https://water.dpie.nsw.gov.au/__data/assets/pdf_file/0020/623612/policy-approaches-to-mitigation-feedback-summary-next-steps-report.pdf

Engagement activities	Description	Outcomes / attendees
Working groups	Flow notification system working group Werai Forest Early Works working group Technical Advisory Group (Early works)	• 15 meetings
Peak body engagements	Meetings with peak body groups.	• NSW Irrigators, Murray-Darling Association, NSW Farmers, Basin Community Committee, NSW Irrigators Council, Inland Rivers Network, Wentworth Group for Concerned Scientists, Murray Valley Private Diverters, Murray Regional Strategy Group
Community events and activities	Program representation to raise community awareness of the program and connect with affected landholders.	• Henty Machinery Field Days, Women in the Riverina Forum, Griffith field days, community markets in Gundagai and Narrandera, and Hay Fishing Classic (planned for January 2025)
Presentations to community and agency groups	Raise awareness of the program and provide progress updates.	• Wagga Bidgee Canoe Club, Yanco Creek and Tributaries Advisory Council, Murrumbidgee Community Advisory Group, Murrumbidgee Environmental Water Advisory Group, WaterNSW Customer Advisory Group, Committee on Aboriginal Water Interests, Murrumbidgee Aboriginal Water Committee.
Webinars	Inform stakeholders on a range of key program elements.	• 2 program (inundation modelling and Environmental Benefits and Risk Analysis) • 3 draft LNS Regulation public exhibition
Elected official briefings	Organised briefings about the program.	• 10 elected official briefings (LNS, and program)

Engagement activities	Description	Outcomes / attendees
Local government authorities	Engagement has focused on understanding the potential impacts, benefits, measures and sentiment towards the project. The program team has collaborated with affected LGAs to develop potential mitigation measures at several sites.	Local governments in the project area were engaged through meetings, webinars, phone calls, and face-to-face interactions. Those engaged include: Balranald Shire Council, Carrathool Shire, Cootamundra-Gundagai Regional Council, Edward River Council, Federation Council, Griffith City Council, Hilltops Council, Hay Shire Council, Junee Shire Council, Leeton Shire Council, Murray River Council, Murrumbidgee Council, Narrandera Shire Council, Snowy Valleys Council, Wagga Wagga City Council, Yass Valley Council.

6.4 Stakeholder engagement and communication next steps

Building on feedback received to date, the project's next phase of broad communication and engagement will continue to encourage landholder registration, and increase understanding of the Murrumbidgee environmental flow corridor, the project delivery strategy and Landholder Negotiation Scheme Regulation negotiation process.

The objectives of the communications and engagement approach will be to:

- increase awareness and understanding of the program, targeting affected landholders, First Nations communities, public authorities, and key stakeholders
- communicate the recommended flow limit option, property-level impacts, and mitigation measures to landholders
- inform stakeholders on the LNS framework, negotiation processes, and environmental flow corridor delivery strategy
- engage landholders and communities on the flow notification system.

7 Project analysis outcomes

This section evaluates the shortlisted flow limit options detailed in Section 5 against the Base Case to determine which offers the best value for money and is the most attractive when trade-offs are considered. To recommend a preferred flow limit option the cost-benefit analysis, an Options Evaluation Framework and financial analysis were used.

The cost-benefit analysis systematically assesses the program's Murrumbidgee project gains and losses. Where possible it quantifies the monetary value of costs and benefits to determine if the flow limit options are welfare generating and worth the investment compared to other projects or programs. It shows which flow limit option has the highest value for money.

The Options Evaluation Framework considers environmental, social, and First Nations themes, using non-monetary metrics to compare each option's characteristics and performance. The Options Evaluation Framework highlights relative benefits, especially when limited quantitative data is available or where it is inappropriate to quantify benefits in a cost-benefit analysis, such as for the First Nations theme. The Options Evaluation Framework is not a multi-criteria analysis and the themes do not have any weighting or implied ranking.

The cost-benefit analysis and Options Evaluation Framework assessment processes are separate yet complementary to one another (Figure 7-1). Each provide evidence for decision makers when evaluating the project.

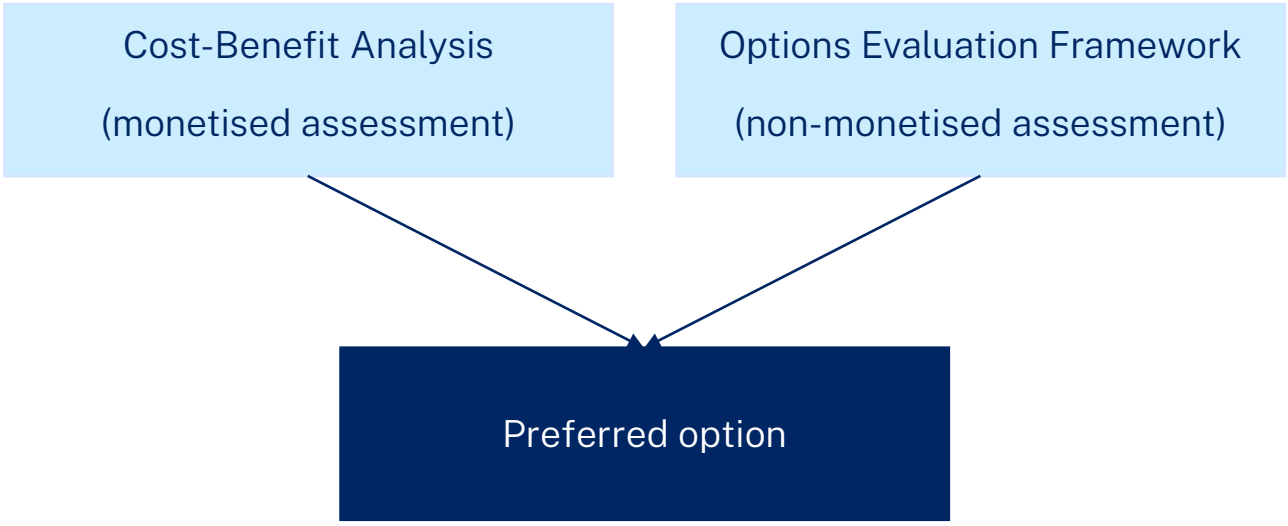


Figure 7-1: Cost-benefit analysis and Options Evaluation Framework as complementary but separate processes to arriving at a preferred option

A recommended option was established based on these assessments.

7.1 Economic appraisal

The purpose of the economic appraisal is to quantify the project's economic, social, and environmental costs and benefits in monetary terms. This section summarises the methodology, assumptions, and results of the economic appraisal for the project, which was informed by the following investigations:

- hydrological modelling, including long-term historic paleo-stochastic and climate change modelling using NSW and Australian Regional Climate Modelling (NARCliM) climate projections.
- delivery and ongoing lifecycle cost estimates, categorised by their expenditure category, as either capital expenditure or operational expenditure.
- environmental benefits and risk analysis synthesis
- willingness to pay values transfer studies to monetise the economic benefit of environmental improvement
- the methodology, investigations and results of the cost-benefit analysis.

Three options have been assessed incrementally against a Base Case, which assumes the continuation of the status quo. In the Base Case scenario, managed environmental flow releases in the Murrumbidgee River are limited 22,000 ML/day at Wagga Wagga due to impacts on productive land and road access.

Cost-benefit analysis has been a standard for over 80 years to evaluate investments. It helps understand the investment effects on community wellbeing by providing a transparent framework to quantify and compare benefits and costs. In addition, it is a NSW Treasury requirement for significant investments and projects. The analysis can compare multiple alternative futures, such as different infrastructure or non-infrastructure option(s) aimed at addressing the problem or opportunity against a Base Case.

7.1.1 Base Case

The Base Case is as the benchmark for evaluating and quantifying the benefits and impacts of project options, reflecting the existing operational constraints adopted by river operators. Since 2012, WaterNSW has limited flows to 22,000 ML/day at Wagga Wagga due to landholder concerns about land inundation, particularly in areas like Collingullie and the upper Yanco Creek. In response, this limit was adopted as the base case. It should be noted this is lower than the current water sharing plan listed operating limit of 32,000 ML/day at Gundagai.

The NSW Government has committed to raising the operational flow limits only after addressing potential impacts on landholders within the flow corridor, including through the acquisition flow easements and Deeds of Release with affected landholders. The Base Case used for hydrologic modelling, environmental benefit and risk assessments, and economic analysis assumes the volume of environmental water recovered and available in December 2019. This volume of environmental

water was assumed given the uncertainty in recovering the extra 450 GL through the *Water Amendment (Restoring Our Rivers) Act 2023* at the time of modelling.

The program aims to increase the environmental outcomes by relaxing environmental flow constraints. As the Australian Government has begun recovering the extra 450 GL of environmental water, sensitivity analysis of potential environmental flow outcomes with the extra water recovery has been undertaken demonstrating potential for additional benefits.

7.1.2 Options assessed

The FBC compared the cost and benefits of 3 flow limit options at Wagga Wagga against the Base Case flow limit of 22,000 ML/day at Wagga Wagga:

- Flow limit option 1 (W32) - 32,000 ML/day flow limit plus buffer[81] of up to 4,000 ML/day for mitigation measures
- Flow limit option 2 (W36) - 36,000 ML/day flow limit plus buffer of up to 4,000 ML/day for mitigation measures
- Flow limit option 3 (W40) - 40,000 ML/day flow limit plus buffer of up to 5,000 ML/day for mitigation measures.

Each of the flow limit options assessed assumes that environmental flows will sometimes be delivered in combination with other flows in the river, specifically unregulated flows. This is sometimes called 'piggybacking', where environmental water would be used to enhance the environmental benefits of the existing flow event and increase the efficiency of environmental water use. This type of operation will be particularly important with Option 2 W36 and Option 3 W40, as limits on the release capacity at Burrinjuck Dam mean that these higher flow rates can only be achieved by timing dam releases concurrent with elevated tributary inflows. There is no proposal to upgrade dam outlet infrastructure to achieve the new flow limit.

7.1.3 Cost-benefit analysis methodology

A cost-benefit analysis has some similarities with financial analysis. Both quantify costs and benefits into the future and discount these to obtain a net present value (NPV). The key differences are how costs and benefits are valued and the discount rate that is used. This cost-benefit analysis has been completed in line with the NSW Government Guide to Cost-Benefit Analysis (TPG23-08).

An economic analysis is typically conducted over a long timeframe such as 40 years, as in the case of this project. The timeframe is chosen to reflect the expected lifespan of the policy or the useful life of an asset in this case, or to ensure that the timeframe is long enough to capture all the underlying variability in the system. This aims to make the modelling results more robust. In some cases where asset life exceeds the analysis period, residual values are used to capture the full

[81] A flow buffer is adopted for each flow limit option considered. A flow buffer is not the target for flow delivery but is proposed as a risk mitigation measure. The buffer will act as a safeguard for landholders if, on rare occasions, flow targets are exceeded due to unforeseen rainfall and tributary inflows. The flow buffer will be used to define the outer extent of the flow corridor, and compensation will apply up to and including the flow buffer.

benefits. For this study, some of the assets being constructed will last longer than 40 years, such as new bridges, and for these assets a residual value was factored into the analysis.

7.1.3.1 Hydrological modelling

The cost-benefit analysis was informed by hydrological modelling undertaken by NSW Department of Climate Change, Energy, the Environment and Water. The NSW Department of Climate Change, Energy, the Environment and Water, Water Group used climate modelling from the Regional Water Strategy Program to assess environmental flow outcomes from raised flow limits under potential climate futures. Two climate datasets were available from the Regional Water Strategy program:

- 10,000 years of stochastic climate data that represents characteristics of the historic climate (observed climate over the last 100+ years together with paleoclimate research covering the last 500 years). With 10,000 years of data, historically extreme patterns of climate are simulated.
- the same 10,000 years of stochastic climate data but scaled using NARCliM1.0 climate projections to reflect a far-future drier (2060-79) climate, under a high emissions scenario (SRES-A2).[82]

The study analysed forty 40-year replicates, split between stochastic and NARCliM datasets, to assess changes in vegetation and land-use inundation. Each sequence was randomly sampled and independent, ensuring a broad distribution of water availability probabilities within each climate dataset.

7.1.3.2 Agricultural productivity modelling

Impacts on grazing and winter cropping production systems were estimated using inundation mapping, inundation frequency data from hydrologic modelling, land use mapping, and an assessment of benefits and costs informed by discussions with floodplain graziers in the Murrumbidgee and Lachlan area. These consist of:

- For floodplain grazing, the analysis considered the duration of inundation to determine a duration of benefit and applied a rate per hectare to those benefits. Modelling assumes uniformity in grazing benefits and response across the Murrumbidgee but also completed sensitivity testing of those assumptions to test a broader range of outcomes.
- For winter cropping, the analysis assumed that inundation events between April and September will negatively impact the crop. The analysis assumes that for short duration inundation events (1-2 days) there would be no detrimental impact, while for longer duration events (3+ days) the crop would be downgraded.

[82] NSW Department of Climate Change, Energy, Environment and Water, New climate analysis informs NSW's regional water strategies https://water.dpie.nsw.gov.au/__data/assets/pdf_file/0004/500728/nsw-climate-model-report.pdf

7.1.4 Economic costs and benefits

This FBC cost-benefit analysis includes assessment of the costs and benefits associated with improvements to vegetation condition, productivity impacts (positive and negative) associated with inundation of agricultural land, and other regional social and economic benefits. These included transport outcomes, such as reduced travel time and operating costs due to modifications to bridges and access roads, making them passable during higher flow events.

Table 7-1 outlines the difference between market and non-market values of water.

Table 7-1: Understanding the difference between market and non-market values of water

Values	Description
Market values	The environment provides goods and services that people value and are willing to pay for. Some environmental assets, such as land and water entitlements, are traded in markets and have an explicit price reflecting their market exchange value. The value of others, such as rainfall, can be measured by estimating the contribution they make to production or consumption. For example, the value of rainfall water to agriculture production can be estimated based on the marginal contribution the water makes to the final production of the agricultural good. These types of values for water are known as market values.
Non-market values	In other cases, the value of water cannot be established or inferred through observed market prices because the goods gained are not related to market transactions. For example, recreation is often not linked to market transactions, nor is people's wellbeing from knowing that the environment exists and is in healthy condition, even if they do not visit or intend to visit the site. These types of values are known as non-market values.

7.1.4.1 Estimating the value of environmental benefits

The chosen modelling approach used is a widely respected method to determine the valuation of vegetation benefits, particularly in the context of other cost-benefit analyses completed to inform Murray-Darling Basin reforms. Some earlier environmental cost-benefit analyses used water market values as a proxy for the environmental value of the water, producer benefit and recreation values. However, this cost-benefit analysis has been informed by 40-year forecast replicates of the health of river red gum and black box communities. The approach used is well respected and considered by economists as an improvement on the use of water market values as a proxy for environmental benefit. Further, the investigations used in this cost-benefit analysis and previous INSW Gate reviews have been peer reviewed and tested by several INSW panels.

This study values improvements from river restoration projects in the Murray-Darling Basin including willingness to pay estimates for length of healthy river/native vegetation, improved native fish population and overall improvement.

Table 7-2 lists economic costs and benefits that were assessed during flow limit options evaluation.

Table 7-2: Economic benefits and costs

Economic Benefits	Economic Costs
Vegetation	Easement negotiation (economic)
Overall improvement (constant)	Private land works
Land use impacts – grazing native vegetation	Public land works
Land use impacts – grazing modified	Residual value
Land use impacts – cropping (incl. Irrigated)	Operating cost
Transport benefits	
Avoided entitlement water recovery	
Residual value	

7.1.5 Economic results

The economic analysis drew on the willingness to pay studies, as well as a set of cost estimates for the project capital delivery cost and operating expenditure. Table 6-3 details the results of the cost-benefit analysis for the central case. It shows that Option 3 W40 is the recommended upper flow limit, with a benefit cost ratio of 1.3 and the highest net present value (NPV), being $23 million in present value terms more than Option 2 W36. A benefit cost ratio of 1.3 means the option is welfare generating when compared to the Base Case or that for each $1 invested there is approximately $1.30 in net benefit. The Option 3 W40 upper flow limit has the highest vegetation benefits, followed by overall environmental improvement benefits across the project's 40-year economic evaluation period. Table 7-3 presents central case cost-benefit analysis results.

Table 7-3: Net Present Value and Benefit Cost Ratio results, 5% discount rate, average, central case

Flow limit options	Flow limit at Wagga Wagga	Net present value ($m)		Benefit cost ratio
Option 1 W32	32,000 ML/day	-$113		0.8
Option 2 W36		36,000 ML/day	$130	1.3
Option 3 W40	40,000 ML/day	$153		1.3

7.1.5.1 NARCliM climate replicates

Table 7-4 presents cost-benefit analysis results for the NARCliM climate replicates and shows that both the net present value and benefit-cost ratio values increase significantly with the NARCliM dataset. Option 3 W40 continues to have the highest net present value and benefit-cost ratio compared to Option 1 W32 and Option 2 W36. Option 3 W40's benefit-cost ratio is only marginally higher than Option 2 W36. Given that the majority of climate change modelling predicts a drier

future, these results suggest that the central case cost-benefit analysis benefit estimates above may be conservative.

Table 7-4: Net Present Value and Benefit Cost Ratio results, 5% discount rate, average, NARCLiM

Flow limit options	Flow limit at Wagga Wagga	Net Present Value ($m), stochastic	Net Present Value ($m), NARCliM	Benefit Cost Ratio, stochastic	Benefit Cost Ratio, NARCLiM
Option 1 W32	32,000 ML/day	*-$113*	$109	0.8	1.2
Option 2 W36	36,000 ML/day	*$130*	$464	1.3	1.9
Option 3 W40	40,000 ML/day	*$153*	$489	1.3	1.9

7.1.5.2 Sensitivity testing

Sensitivity analysis tests cost-benefit analysis results by altering the key assumptions used in estimating costs and benefits. Already, a degree of sensitivity analysis has been reported because the economic analysis results are reported not only for the median but also for the 10th and 90th percentile, demonstrating how the results varied with historic climatic conditions. In accordance with the NSW Government Guide to Cost-Benefit Analysis (TPG23-08), sensitivity testing for this project has been undertaken across several key assumptions and parameters.

- Sensitivity Test #1: Discount rates (3%, 7% and 10%)
- Sensitivity Test #2: Overall improvement (constant) (high/low)
- Sensitivity Test #3: Vegetation benefit
- Sensitivity Test #4: Inclusion of 'sunk costs'
- Sensitivity Test #5: Higher and Lower Capital Costs (+/- 20%)
- Sensitivity test #6: Agricultural Production impacts.

7.2 Options Evaluation Framework

In addition to the cost-benefit analysis, an Options Evaluation Framework was developed for the project to:

- evaluate the projects flow limit options to forecast environment, cultural and social outcomes
- inform the selection of a recommended flow limit option
- clearly show the trade-offs between options
- meet NSW Treasury business case guidelines[83].

The Options Evaluation Framework complements the cost-benefit analysis to support selection of the recommended flow limit option. The cost-benefit analysis assesses value for money of each flow

[83] 2024, TPG24-29 NSW Government Business Case Guidelines, www.nsw.gov.au/departments-and-agencies/nsw-treasury/documents-library/tpg24-29

limit option based on quantifiable monetised metrics. In comparison, the Options Evaluation Framework uses quantitative and qualitative information to assess the project options' environmental, social and First Nations impacts and benefits. The benefits discussed in this section and the cost-benefit analysis section are separate from each other, with this approach enabling a robust and transparent options assessment and considering the trade-offs for each flow limit option in the FBC.

The Options Evaluation Framework development, its application and assessment outcomes, is a point-in-time assessment supported by various data sources, including hydrological and ecosystem response modelling, GIS analysis, and program engagement activities, such as landholder and community surveys. A 'driver-response – trade-offs' model was used to synthesise theme assessments, evaluating critical program decisions and material responses to identify trade-offs and potential "win-wins" across the key themes.

Investigations underpinning the Options Evaluation Framework confirmed that increasing the operational environmental flow limit in the Murrumbidgee system offers environmental benefits by increasing inundation frequency and showed the impacts on riparian landholders, public infrastructure, and other stakeholders. Results varied by flow limit option, with the highest upper flow limit Option 3 W40 delivering the best environmental, First Nations and economic outcomes. However, Option 3 W40 has the highest negative social impact of all the options. These metrics are summarised in section 7.2.4.

7.2.1 Environment theme

7.2.1.1 Methodology

The environmental assessment was based on detailed investigations across 9 sub-themes comprising:

- 6 benefits themes: native vegetation, waterbirds, native fish, other native wetland fauna, ecosystem production and supplementary work looking at inundation patterns under each flow scenario.
- 3 risk themes: invasive weeds, water quality and geomorphology.

The risk of increased populations of invasive fish species including carp was incorporated into the assessment by subject matter experts as an additional consideration.

Environmental flow and ecological response modelling was undertaken on each of the benefits and risk themes. Each model considered the full regime of flows affected by each flow limit option, with changes to the frequency, timing and duration of events over a modelled historical time period spanning more than 100 years.

The environmental assessment involved developing an evaluation framework and criteria drawing on the Northern Basin toolkit ecological prioritisation framework.[84] Outcomes for each environmental theme were evaluated by each panel member, with resulting scores incorporated into the final aggregation.

7.2.1.2 Results

Relaxing flow constraints will deliver significant environmental benefits across the Murrumbidgee River system. All flow limit options will greatly increase the reach of environmental water to wetland habitats and substantially expand the area of river red gum forest and woodland that can be supported. They will also improve the frequency and extent of connections between rivers and wetlands, enhancing the health and resilience of these ecosystems. Additionally, the abundance of native species like golden perch will increase, supporting biodiversity and the overall ecological function of the river system. A separate carp modelling assessment indicated no expected increase in the size of the carp population in response to program flows for any of the relaxed constraints scenarios over the long term.

Positive outcomes are particularly expected during sequences of dry years, where natural inundation is less frequent due to regulation and may not occur for extended periods. When extended periods between floodplain inundation creates extreme conditions on the floodplain or exceeds the 'recruitment window' for short-lived species, widespread ecosystem loss can result. Raising flow limits can break long dry spells, prevent catastrophic ecological decline and support faster recovery post drought.

The flow limit options present a gradient of increasing environmental benefits in line with increased environmental flow, each with distinct impacts on biodiversity, habitat, and ecosystem health:

- Option 1 W32: Offers modest improvements over the Base Case, with slight increases in wetland inundation and connectivity. Benefits for fish and native vegetation are low to moderate, enhancing habitats, food sources, and biological processes like breeding. However, there is a risk of boosting invasive fish species, resulting in some moderate negative outcomes for fish. Expected improvements in water quality, ecosystem production, and weed control remain relatively low, and geomorphic risks are neutral to marginally beneficial under this scenario.
- Option 2 W36: Provides significantly greater benefits compared to W32, with enhanced connectivity and inundation supporting high to very high levels of ecosystem interaction. There are notable gains in native vegetation, especially for river red gum forest and woodlands, and black box woodlands, primarily during dry years. Fish, particularly golden perch, show double the benefits relative to W32. Waterbird support improves, with more

[84] Murray-Darling Basin Authority, (2020). Northern Basin toolkit ecological prioritisation framework, Murray-Darling Basin Authority, CC BY 4.0

frequent years of breeding success. Other areas like ecosystem productivity, water quality, and geomorphic stability see slight improvements.

- **Option 3 W40:** Represents the highest environmental benefit potential, with significant gains across all sub-themes. Fish, especially golden perch, native vegetation, waterbirds, and wetland fauna receive substantial support. This scenario also shows clear benefits for ecosystem production, water quality, and geomorphic risk, contributing to overall system health.

7.2.2 Social theme

7.2.2.1 Methodology

The assessment drew on qualitative and contextual data including surveys, desktop analysis, and background reviews to understand the impacts and benefits for affected landholders, the wider community and on community assets and infrastructure. It also considered qualitative and contextual data to inform the consideration of mitigation and flow limit options.

The objectives of the social assessment were to:

- assess the social impacts and/or benefits on community assets and social infrastructure of the flow limit options and project measures
- understand from directly affected and indirectly affected stakeholders their attitudes about the impacts / benefits of the flow limit options
- understand sentiment on project measures to mitigate impacts from the flow limit options, ranging from no mitigation to mitigation
- understand how the flow limit options may affect the livelihoods, wellbeing, and socio-economic conditions of Murrumbidgee communities
- support government decision making for the program in considering flow limit options recommendations and project measures to mitigate impacts.

Table 7-5 presents the criteria applied in the social assessment. A scoring panel evaluated each flow limit option based on its impacts and benefits to Murrumbidgee River area assets, individuals, and communities.

Table 7-5: Social theme criteria

#	Criterion	Description
1	Public assets and infrastructure	Recreational and other public assets, infrastructure or activities that may be directly or indirectly, negatively or positively impacted
2	Social capital	Networks of relationships among people who live and work in a particular society, enabling that society to function effectively

#	Criterion	Description
3	Community views	Communities along the Murrumbidgee and their experience of the river and its importance to social values and perceptions
4	Impacts or benefits for affected landholders	Landholders with properties that are inundated by flow limit options and their experience of positive benefit or negative impact as a direct or indirect result of water for the environment deliveries

7.2.2.2 Results

Engagement activities delivered to inform the social theme of the Options Evaluation Framework revealed broad project support.

In 2024, the project surveyed over 100 community members across 6 locations in the Murrumbidgee to ascertain sentiment on the importance of the river to quality of life, perceptions of river health and program benefits. Findings show the river is very important to the people of the Murrumbidgee. Many people depend on the river for recreation, relaxation, socialising and wildlife viewing. Most respondents felt the health of the river was average to poor, with a quarter believing its health to be good. This was supported by a complementary survey delivered to selected special interest groups in which 7 out of 10 respondents were supportive of the flow limit options.

130 landholders, covering approximately 66% of the area of private land potentially inundated by the project, completed a Flow Limit Options Sentiment Survey[85] of which the majority supported each flow limit option. Results indicate overall support for higher flows with support increasing with flexible options for mitigating impacts. With mitigation measures, support for flow limit options ranges from 80% at 32,000 ML/day to 72% at 40,000 ML/day at Wagga Wagga.

The flow limit options had varying levels of landholder support, perceived environmental benefits, and community impacts. Key differences are as follows:

- **Option 1 W32:** Landholder support ranged from 17% without mitigation measures to 80% with impact mitigation. Supportive landholders saw benefits primarily in riparian health, vegetation growth, wetland health, and agricultural production. This scenario had no significant negative impact on Murrumbidgee communities' adaptive capacity and impacts on vulnerable communities and recreation access are expected to be low, although Leeton, Cootamundra-Gundagai, and Narrandera local government areas (LGAs) may experience some impacts.
- **Option 2 W36:** Landholder support slightly decreased to a range of 15% without mitigation and up to 77% with mitigation measures. Supportive landholders perceived high

[85] Landholders who completed the full landholder engagement process were invited to complete the survey, which meant all respondents were well informed about the program.

environmental benefits, particularly in riparian health, biodiversity, wetland health, and a return to natural river processes, with 79% citing environmental improvements as a benefit. Like W32, there was no notable negative impact on community adaptive capacity, with low expected impacts on vulnerable communities and recreation access. The same LGAs had potential recreational access impacts.

- **Option 3 W40:** Landholder support slightly decreased, ranging from 12% without mitigation to 72% with mitigation measures. Environmental benefits were perceived by 77% of supportive landholders, including biodiversity, wildlife health, and ecosystem restoration. There was no significant impact on adaptive capacity or vulnerable communities, with recreation access impacts also remaining low across the LGAs of Leeton, Cootamundra-Gundagai, and Narrandera.

7.2.3 First Nations theme

7.2.3.1 Methodology

The First Nations assessment was informed by respectful and collaborative engagement with First Nations communities. It aimed to present information to best represent the aspirations of First Nations communities and explore impacts and benefits across the project area including complexities and nuances at a local scale.

A review of government obligations and commitments was completed to understand how the project aligns and supports these from a First Nations perspective. The assessment used information and data collected through:

- On-Country assessments
- desktop assessment of quantitative and qualitative information to provide a broad spatial perspective across the Murrumbidgee Valley
- environmental modelling and assessment, which provided supporting information about how the flow limit options would support Country
- the First Nations Reference Group, which provided advice and feedback at a high-level on project approaches and findings.

Table 7-6 presents the criteria developed collaboratively with First Nations people to assess potential First Nations benefits and impacts. The criteria were used for assessment and scoring undertaken in December 2023 by the First Nations Reference Group.

Table 7-6: First Nations criteria

#	Criterion	Description
1	Caring for and healing Country and wellbeing (Healthy Country and Healthy Mob)	The role of flows moving across landscapes in healing Country and supporting caring for Country, including supporting all living things who live in the water and on the land, connecting communities from upstream to downstream and across Country. Healing Country can in turn heal the spiritual connection to Country and wellbeing of First Nations people.
2	Healthy, living, evolving culture (Healthy Culture and Healthy Mob)	The role of flows and access to Country in revitalising cultural practices through supporting culturally important species, maintain cultural food sources and resources, celebrate the significance of water in ceremonies, songs, and stories, and support the ability to practice cultural obligations in communities along the river. Cultural sites and artefacts are respected and protected.
3	Self-determination and equity for healthy futures (Healthy Futures and Healthy Mob)	Self-determination and equity include the rights for First Nations people to set priorities, make decisions, and freely pursue their own development on their own terms.
4	Economic opportunities for healthy futures (Healthy Futures and Healthy Mob)	Ability for Country and cultural sites to support economic opportunities (opportunities for tourism).

7.2.3.2 Results

Based on First Nations engagement through the First Nations Reference Group, the Advisory Committee and on country assessments, and reinforced through desktop assessment, the following was consistently heard:

- The importance of maintaining healthy waterways and Country, where plants and animals can thrive. This is not just about environmental health; it is deeply tied to the ability to practice and maintain culture. Healthy ecosystems are essential for the continuation of cultural traditions and the wellbeing of the community.
- Under current management of flows (Base Case), Country is unhealthy. First Nations people have shared their aspirations for Country to be healed and for revitalising cultural practices.
- First Nations groups view the outcomes along the river as interconnected. While flow limit options may vary at different points along the Murrumbidgee River, the general view is that the flow limit option providing the best outcomes for all communities is preferred. This

holistic approach underscores the interconnectedness of environmental health and community wellbeing.

- Flow limit options that provide opportunities for healing Country and support environmental outcomes along the whole system were consistently supported by First Nations people engaged through this process.
- Providing greater access to Country and involvement in land and water management is critical to ensuring that First Nations outcomes can be supported.
- The key findings consistently indicated that while the environmental benefits from higher flow limit options were critical for healing Country, investment in measures for First Nations benefits beyond healing Country were critical. Without further investment in measures to support First Nations outcomes, the current situation for First Nations people will remain unchanged.

Key results specific to flow limit options included:

- Option 1 W32: Expected to provide relatively minor environmental benefits compared to the Base Case, especially in sub-themes like habitat and biodiversity. The First Nations Reference Group found that benefits to Country under Option 1 W32 are significantly lower than Option 3 W40 due to reduced flexibility for natural flow regimes. The desktop assessment indicates some cultural gains with more culturally significant water-dependent scarred trees inundated, but on country assessments highlight that Option 1 W32 offers minimal benefits for healing Country.
- Option 2 W36: Provides a notable improvement in environmental benefits over Option 1 W32, with enhanced outcomes for habitat connectivity and biodiversity. Higher flow flexibility at Option 2 W36 enables more natural inundation of floodplain and wetland areas, as noted by the First Nations Reference Group. A large increase in inundated scarred trees is expected, providing cultural benefits, while on country assessments indicate that Option 2 W36 could support improved water quality, adding to environmental gains.
- Option 3 W40: Shows the highest anticipated environmental benefits, with substantial improvements across all sub-themes, including fish, native vegetation, wetland fauna, and water quality. The First Nations Reference Group identified Option 3 W40's high flow as supporting more natural environmental flow delivery, which is crucial for cultural sites. Numerous First Nations voices emphasised Option 3 W40's alignment with cultural needs, supporting instream values like fish breeding and wetland health. On country assessments endorse Option 3 W40 as the only option offering comprehensive healing benefits, supporting native flora, fauna, and medicinal plants along the river system.

7.2.4 Assessment outcomes

Table 7-7 presents a visual summary of key findings for each theme across each of the project flow limit options.

Table 7-7: Options evaluation framework assessment outcomes

Themes / Criteria	W32	W36	W40	Reasoning
Environment General findings across indicators	◑	◕	●	• Environmental benefits increase significantly from Option 1 W32 to Option 3 W40. • Option 1 W32 delivers only minor improvements, limited to specific low-lying areas and ecological communities. • Option 2 W36 shows substantial improvement in wetland connectivity and vegetation. • Option 3 W40 achieves the most widespread benefits across ecosystems, including major gains for fish, wetland fauna, and ecosystem productivity.
Social Landholder support Social capital Community views	◕	◕	◕	• Community support for flow options is highest with mitigation measures across all scenarios, but declines slightly from Option 1 W32 (80%) to Option 3 W40 (71.5%). • Option 1 W32 has minimal public infrastructure investment resulting in limited river health improvement. • Option 2 W36, and particularly Option 3 W40, have greater infrastructure commitment and stronger health outcomes for the river, which are important to supporting community wellbeing. • The need for compensation and mitigation is evident across all flow levels to maintain community support.

Themes / Criteria	W32	W36	W40	Reasoning
First Nations Healthy Country Investment in First Nations measures	◑	◕	●	• Support from First Nations communities increases with higher flow limit options. • Investment in First Nations measures is consistently identified as critical to achieving meaningful change, particularly in relation to Healthy Country outcomes. While all scenarios include this investment, its impact is more pronounced as flows increase from Option 1 W32 to Option 3 W40.

Indicator	Description	Indicator	Description
○	No contribution or negative impact	◕	Moderate to strong contribution
◔	Minor or limited contribution	●	Strong positive contribution
◑	Mixed or moderate contribution		

8 Recommended solution

All flow limit options were assessed quantitatively and qualitatively, capturing the full suite of benefits. The cost-benefit analysis, where possible, monetises benefits and costs to determine if the proposals are welfare generating through a value for money assessment. Typically, quantitative methods of assessment are preferred for government investments.

Given that a range of the benefits and costs for the Reconnecting River Country Program Murrumbidgee Project are non-monetary, the Options Evaluation Framework was also adopted by the Murrumbidgee project. The Options Evaluation Framework considers environmental, social, and First Nations themes. The Options Evaluation Framework uses non-monetary quantitative assessments, such as the Environmental Benefits Risk Analysis, and qualitative data such as outputs from stakeholder engagement and landholder surveys, to more holistically assess project benefits and costs. No weighting was applied to the outcomes of the various themes.

The economic outcomes of the cost benefit analysis alongside the social, environmental and cultural metrics of the Options Evaluation Framework show that of the flow limit options assessed, Option 3 W40 demonstrates the strongest overall performance. Table 8-1 summarises the benefits, impacts and costs of the environmental flow limit options.[86]

[86] The results are based on 15 October 2024 project scope of works

Table 8-1: Flow limit option comparison

	Option 1 W32	Option 2 W36	Option 3 W40
Economic indicators			
Net present value (NPV)	-$113m	$130m	$153m
Benefit Cost Ratio	0.8	1.3	1.3
Benefits and stakeholder sentiment			
Contribution to Sustainable Diversion Limit Adjustment Mechanism (SDLAM) offsets[87]	0 GL	5-10 GL	10-20 GL
Increase in area of wetlands that can receive environmental water	119%	157%	187%
Increase in area of river red gum forest and woodlands that can receive environmental water	172%	213%	251%
Increase in area of river red gum communities in healthy condition during dry times	66%	114%	114%
Increase abundance of Golden Perch	7%	16%	26%
Private landholder support[88]	80%	77%	72%
First Nations support	Medium	Medium	High

[87] Based on MDBA 2015 stocktake. Actual amounts will be determined by MDBA during 2026 reconciliation, or through SDLAM offramp arrangements.

[88] This metric details the percentage of supportive private landholders that were surveyed. The landholders were surveyed for their sentiment toward the program should compensation and/or works be made available to mitigate impacts.

	Option 1 W32	Option 2 W36	Option 3 W40
Impacts			
Total area of flow corridor (ha, private and public land)	148,000	161,000	172,000
Number of private properties impacted (total)	1,116	1,165	1,205
Proportion of properties inundated by less than 10% (by property area)	74%	68%	63%
Proportion of properties inundated by 10-20% (by property area)	11%	14%	17%
Proportion of properties inundated by greater than 20% (by property area)	15%	17%	20%

Option 3 W40 will best support Basin Plan objectives, deliver substantial benefits across all environmental indicators considered, enhance regional economic growth, and improve opportunities for additional recreation uses along the river. It also received strong support from First Nations communities as it is projected to result in the greatest improvement to the health of the river and Country. Furthermore, the cost-benefit analysis identified Option 3 W40 as the most effective option, achieving the highest benefit cost ratio of 1.3, with most economic benefits attributed to the significant environmental improvements in the river system.

In relation to the SDLAM offset, Option 3 W40 offers the maximum offset potential compared to the lower flow limit options. By achieving the greatest SDLAM offset, Option 3 W40 will have the greatest impact on reducing pressure for further water recovery under the Basin Plan, and associated impacts on NSW communities. Although Option 3 W40 has slightly lower social support than the other options, it maintains high landholder support when paired with mitigation measures.

The recommended solution is to increase the upper environmental flow limit to 40,000 ML/day at Wagga Wagga, plus buffer of up to 5,000 ML/day[89] for mitigation measures (Option 3 W40). This option demonstrates the best value for money by outperforming the other options across economic, First Nations and environmental indicators.

8.1 Benefits of recommended solution

The recommended solution is to increase the upper environmental flow limit to 40,000 ML/day at Wagga Wagga, plus buffer of up to 5,000 ML/day for mitigation measures (Option 3 W40). This option demonstrates the best value for money by outperforming the other options across economic, First Nations and environmental indicators.

Figure 8-1 shows how relaxing constraints to increase the upper flow limit from 22,000 ML/day to 40,000 ML/day at Wagga Wagga across the project's 40-year evaluation period will deliver the benefits outlined below:

- A healthier Murrumbidgee River system:
    - Enhancing management of environmental water, directly benefiting native vegetation, fish, waterbirds, turtles, frogs, and other wildlife.
    - Reducing time between wetland-connecting events during drought by up to 40%
    - Improving environmental resilience during dry periods, increasing system resilience to climate change increasing native vegetation area (estimated at 114%) remaining healthy during dry periods.
- More flexible and effective water management:
    - Provides the highest Sustainable Diversion Limit offset contribution across the upper flow limit options, offering large benefits over the lower flow options that may lead to a gap in the SDLAM adjustment and may necessitate further water buybacks.
    - Avoiding buybacks through SDLAM ensures consumptive water remains for primary production.
- Better health of Country and First Nations people's participation:
    - Strengthens First Nations connections, supporting sustainable culture and community through a healthy Country.
    - Provides opportunities for First Nations people's participation in environmental water management, access, and connection to Country.

[89] A flow buffer is adopted for each flow limit option considered. A flow buffer is not the target for flow delivery but is proposed as a risk mitigation measure. The buffer will act as a safeguard for landholders if, on rare occasions, flow targets are exceeded due to unforeseen rainfall and tributary inflows. The flow buffer will be used to define the outer extent of the flow corridor, and compensation will apply up to and including the flow buffer.

- Overall improved agricultural and community outcomes:
    - Improved water and nutrient availability for livestock, boosting graziers' production.
    - Enhanced community access during higher environmental flows and natural higher flow events.
    - New transport infrastructure investment enhances flood resilience.

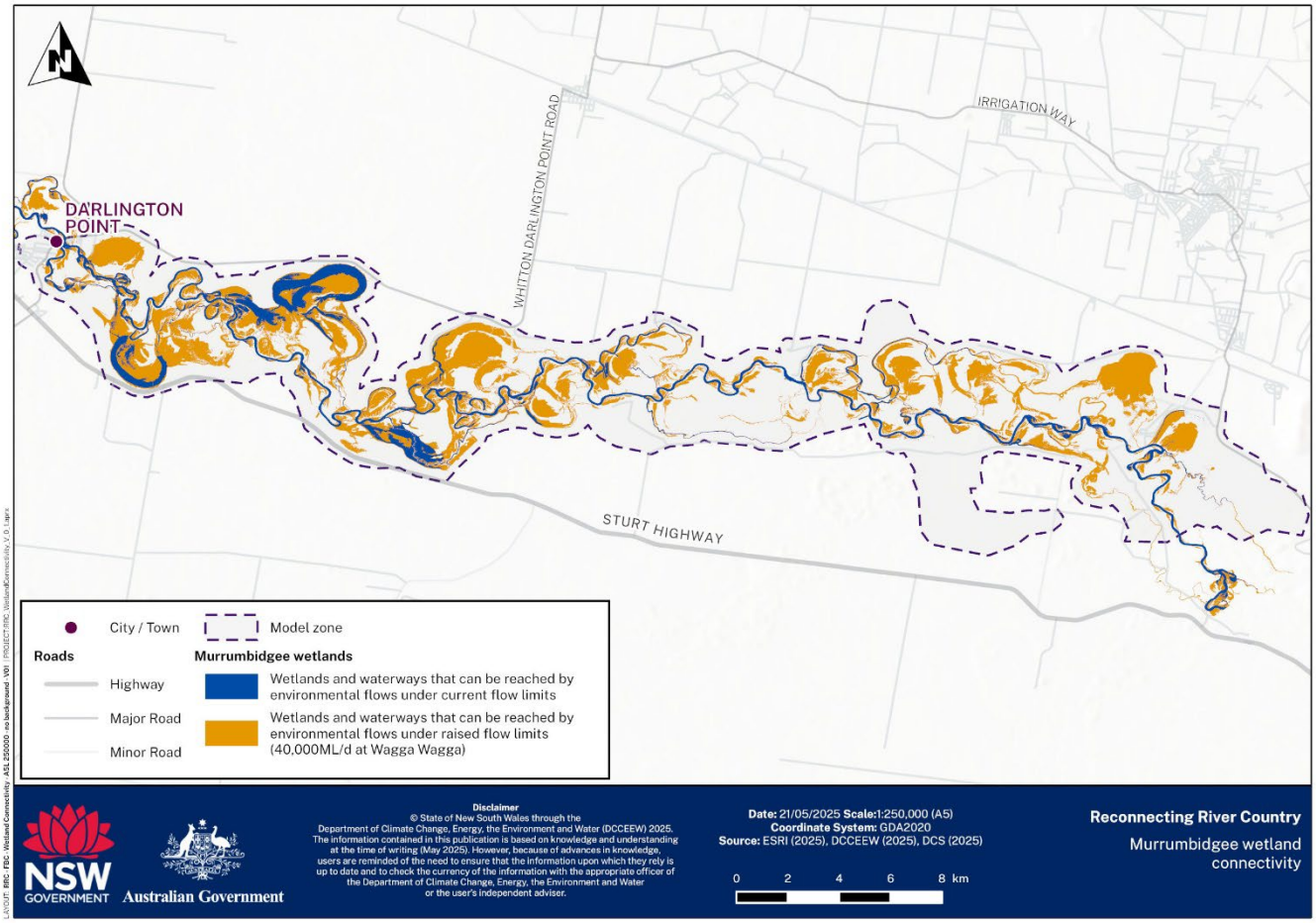


Figure 8-2: Environmental flow reach under current 22,000 ML/day operational constraint and 40,000 ML/day flow limit

9 Implementation

It is recommended to implement the 40,000 ML/day (Option 3 W40) as the upper flow limit option using the project measures outlined in section 5, in 2 phases. This phased approach recognises NSW Government's commitments to the delivery of outcomes under the current Murray-Darling Basin Plan and the opportunity to improve on these outcomes.

Full project delivery cannot be achieved by the current Basin Plan timeline of December 2026; it requires additional funding and a Basin Plan continuation. To maximise progress, the project will be delivered in 2 phases. For Phase 1, it is proposed to align delivery with current Basin Plan timelines

and the program's Federation Funding Agreement (FFA). The first phase includes establishing a legal authorising environment, flow corridor negotiations to the recommended upper flow limit with the most affected properties, scoping public works and progressing First Nations enabling measures through to December 2026. This will enable the project to maximise delivery in the period up until December 2026. The first phase will focus on delivery actions that will support flows in line with the Murrumbidgee Regulated Water Sharing Plan after December 2026.

Negotiations for Phase 1 will commence following the release of a Declaration Order, issued by the Minister for Water under the Landholder Negotiation Scheme.

Phase 2 will focus on full implementation to secure the remainder of the flow corridor, deliver infrastructure works and continue delivery of First Nations enabling measures. This phase is proposed to commence from 2027 through to 2031, subject to funding and Basin Plan continuation.

9.1 Specialised capabilities for delivery

A wide array of specialist skill sets, experience and capabilities will be used to deliver the project. These include:

- **Securing flow corridor agreements:** a dedicated workforce is required to negotiate with affected landholders. These professionals will provide the landholders with procedural fairness and transparency, as well as providing the department with flexibility, probity and independence, in valuations and negotiations.
- **Infrastructure works:** A highly skilled design, approvals, engagement, and construction team, including regional contractor expertise, will be engaged to deliver works across numerous sites. These efforts will be project managed by departmental staff to ensure cost and schedule controls as well as safety, environmental, and quality outcomes.

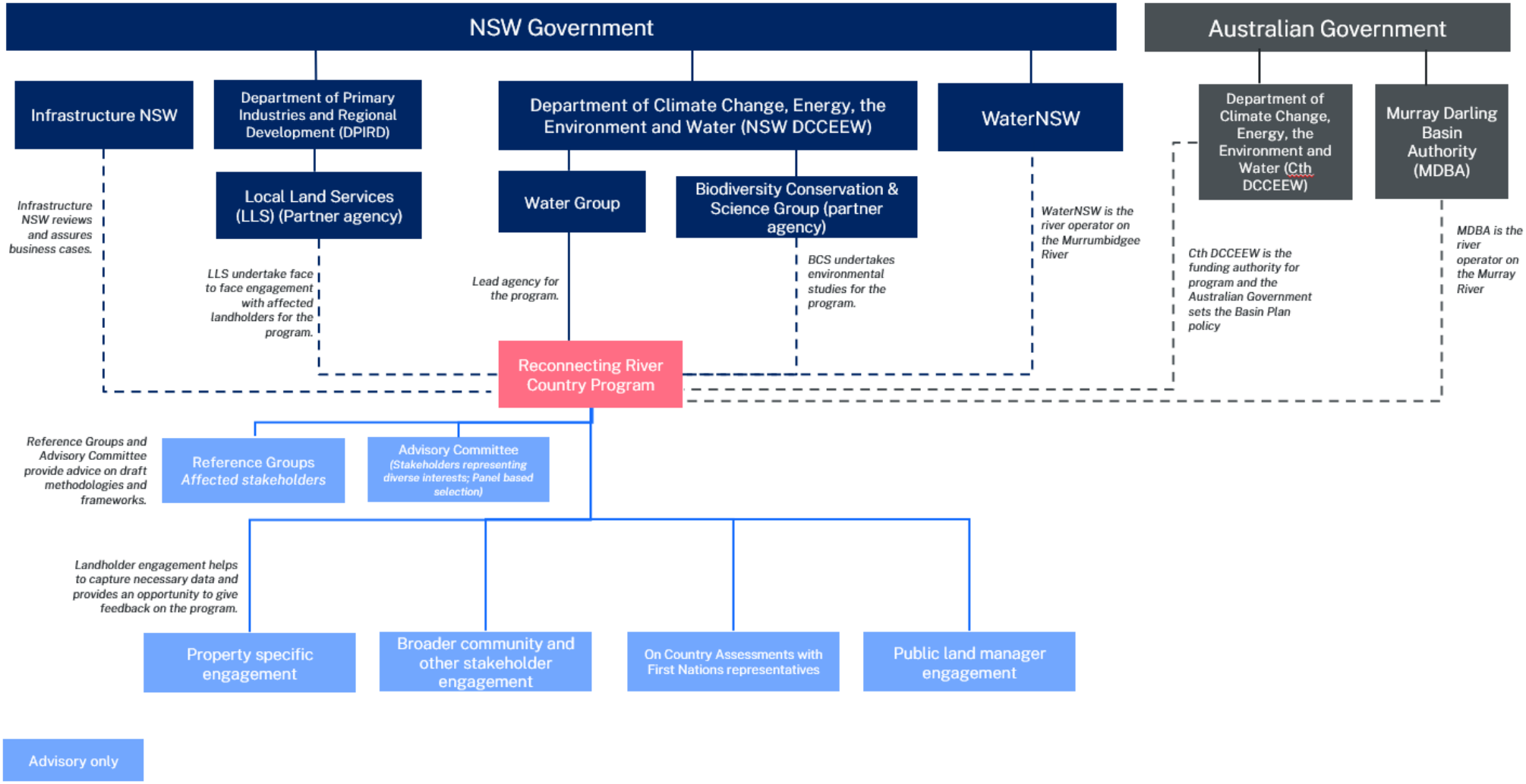
9.2 Governance

Governance is integral to the department and its program's success, encompassing the structure and processes for setting, managing and achieving objectives. Fit for purpose, Reconnecting River Country Program governance arrangements identify and manage risks, with escalation and mitigation steps ensuring timely decisions. The program's Murrumbidgee project is within an NSW Government delivery agency with an interagency and interjurisdictional portfolio, and program and governance context, associated with the Basin Plan.

The program applies a multi-tiered governance approach that ensures comprehensive oversight and benefits from expert input across various levels, while maintaining a clear decision-making hierarchy. Figure 9-1 illustrates the program's governance structure, aligned with the Water Group's project governance guidelines.

In addition to formal governance structures, the program engages regularly with the Australian Government Department of Climate Change, Energy, the Environment and Water on funding and delivery matters. It also draws on the insights of 3 external stakeholder groups — the Murrumbidgee Landholder Reference Group, the First Nations Reference Group, and an Advisory Committee established in 2023. These groups serve as important forums for testing policy approaches and methodologies, helping to inform the program's development and ensure it reflects a broad range of perspectives.

Figure 9-1 Program Governance Structure



9.3 Project schedule

The project schedule was developed collaboratively to align with project objectives, strategies, and deliverables. The process included defining the project scope and objectives, breaking down the scope into work activities, establishing dependencies, aligning workflow with strategies, estimating durations, calculating the critical path, incorporating risk assessment and reviewing and validating the schedule. The risk assessment analysed inherent and external risks and applied their impacts to the schedule during the risk assessment phase. This process estimated contingencies and accounted for uncertainties, ensuring the plan was robust and realistic.

Phase 1 activities are expected to be completed by December 2026. Phase 2 activities are proposed to occur from 2027 to 2031. Project handover and closeout reporting are planned for completion by the end of 2031.

9.4 Project risk management

The program's approach to risk and opportunity management aligns with the department's Water Group Risk Management Framework, which follows ISO31000:2018 and the NSW Public Sector's Internal Audit and Risk Management Policy. The program has assessed and managed risks to support the project development and establish risk adjusted cost estimates.

The project's risk management approach includes ongoing risk monitoring, reporting and review of risks to the project's schedule, cost and benefit realisation. Some of the key risks being monitored include:

- the potential for the scope of required works to exceed initial cost estimates
- aligning program structure and resources to support efficient project delivery
- ability to secure an adequate authorising environment to support the release of environmental
- the availability of specialist contractors to complete technical work within required timeframes.

These risks are being addressed through mitigation strategies that are routinely monitored.

9.5 Infrastructure NSW review

In February 2025, Infrastructure NSW completed a Gate 2 assurance review of the program's Murrumbidgee Final Business Case. Infrastructure NSW found the Final Business Case demonstrated a strong case for investment in the recommended upper flow limit of 40,000ML/day at Wagga Wagga.

Abbreviations and acronyms

Abbreviation	Definition
ABARES	Australian Bureau of Agricultural and Resource Economics
ACT	Australian Capital Territory
AG DCCEEW	Australian Government Department of Climate Change, Energy, the Environment and Water
APRA	Australian Prudential Regulation Authority
ASIC	Australian Securities and Investments Commission
ATO	Australian Taxation Office
BBW	Black box woodland
BCR	Benefit-cost ratio
CAPEX	Capital expenditure
CBA	Cost-benefit analysis
CEWH	Commonwealth Environmental Water Holder
CPI	Consumer price index
CPHR Division	NSW Department of Climate Change, Energy, the Environment and Water's Conservation Programs, Heritage & Regulation Group
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DPIE	NSW Government Department of Planning and Environment
EBRA	Environmental benefit and risk analysis
ECCS	Energy, climate change and sustainability
EDM	Electronic direct mail
EEWD	Enhanced Environmental Water Delivery Program
ELC	Executive Leadership Committee
EMP	Environmental Management Plan
EWRs	Environmental water requirements
FBC	Final Business Case
FFA	Federation Funding Agreement
FY	Financial Year
GIS	Geographic Information System
ha	Hectares
ICIP	Indigenous Cultural and Intellectual Property
IELC	NSW Department of Climate Change, Energy, the Environment and Water's Water Group Infrastructure Executive Leadership Committee
ILM	Investment logic map
INSW	Infrastructure NSW
IPART	NSW Independent Pricing and Regulatory Tribunal
JTA	*Land Acquisition (Just Terms Compensation) Act 1991*

Abbreviation	Definition
LALC	Local Aboriginal Land Council
LNS	Landholder Negotiations Scheme
LTWP	Long Term Water Plan
MALP	Minimally Affected Landholder Policy
MDB	Murray-Darling Basin
MDBA	Murray-Darling Basin Authority
MIA	Murray Irrigation Area
ML	Megalitres
NARCLiM	NSW and Australian Regional Climate Modelling
NNTC	Nari Nari Tribal Council
NP	National Park
NPV	Net present value
NPWS	National Parks and Wildlife Service
NSW	New South Wales
OCAs	On Country assessments
OEF	Options evaluation framework
OFEP	Off-farm Efficiency Program
OPEX	Operational expenditure
PCG	Project Control Group
PLC	Partnership Leads Committee
ROSC	River Operator Steering Committee
RPI	RP Infrastructure
RRC Program	Reconnecting River Country Program
RRG	Red river gum
RRWIP	Resilient Rivers Water Infrastructure Program
SBC	Strategic Business Case
SBP	Strategic Benefits Payments
SDLAM	Sustainable Diversion Limit Adjustment Mechanism
SDL	Sustainable Diversion Limit
SRES	Special Report on Emissions Scenarios
The Basin Plan	Murray-Darling Basin Plan
the department	NSW Department of Climate Change, Energy, the Environment and Water
The program	Reconnecting River Country Program
The project	Reconnecting River Country Murrumbidgee Project
The roadmap	Constraints Relaxation Implementation Roadmap
W22	Base Case - 22,000 ML/day at Wagga Wagga
Option 1 W32	Flow limit of 32,000 ML/day at Wagga Wagga, plus a buffer of up to 4,000ML/day for mitigation measures

Abbreviation	Definition
Option 2 W36	Flow limit of 36,000 ML/day at Wagga Wagga, plus a buffer of up to 4,000ML/day for mitigation measures
Option 3 W40	Flow limit of 40,000 ML/day at Wagga Wagga, plus a buffer of up to 5,000ML/day for mitigation measures
WAMC	Water Administration Ministerial Corporation
Water Act	*Water Act 2007*
WM Act	*Water Management Act 2000* (NSW)
WSP	Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016
WTP	Willingness to pay

Glossary

Term	Definition
Base Case	The Base Case is the benchmark conditions against which the benefits and impacts of Project options are quantified and evaluated. The Base Case is the 'without project' scenario. The Project Base Case assumes a flow limit of 22,000ML/day flow limit at Wagga Wagga, and the level of environmental water that was available in December 2019. The Base Case is further described in Section 5.2
Buffer	A flow buffer is adopted for each flow limit option considered. A flow buffer is not the target for flow delivery but is proposed as a risk mitigation measure. The buffer will act as a safeguard for landholders if, on rare occasions, flow targets are exceeded due to unforeseen rainfall and tributary inflows. The flow buffer be used to define the outer extent of the flow corridor, and compensation will apply up to and including the flow buffer.
Constraint	Under the Murray Darling Basin Plan, a constraint is a rule or structure which limits the volume and/or timing of the delivery of water for the environment. Constraints can include physical structures (such as low-lying bridges), river management practices, existing policy and legislation barriers and operational limits for river heights or flow rates.
Discount rate	The interest rate used to calculate the present value of future costs or benefits of a project.
Environmental water	Environmental water is water that is managed specifically to improve the health of rivers, wetlands, floodplains and other water-dependant ecosystems. It environmental water allowances defined in water sharing plans and held or licensed environmental water owned by the NSW and Australian Governments.
Floodplain	Low-lying land bordering a river or stream that is naturally subject to flooding and is made up of alluvium (sand, silt, and clay) deposited during floods.
Groundwater	Water located beneath the surface of the ground in the spaces between sediments and in the fractures of rock formations.
Hydrology	The study of the occurrence, distribution, and movement of water.
Inflows	The amount of water coming into a surface water source or groundwater source.
Operational rules	The procedures for managing releases and extractions of water (surface and groundwater) to meet the rules of relevant legislation and policy (such as water sharing plans, long-term water plans).
The program	The Reconnecting River Country Program considers measures required to relax environmental flow constraints. These measures will achieve the Murrumbidgee component of the program goal. The program goal is to increase the frequency and extent rivers connect to wetlands and floodplains to improve the health of the Murrumbidgee (and Murray) river systems.
The project	The Reconnecting River Country Murrumbidgee Project
P50	A 50% chance of delivering the project under this value, and a 50% chance of exceeding it. When considering the budget for a large program of multiple projects, it is expected that all of the unders and overs will balance out to achieve a P50 on average across the program.

Term	Definition
P90	A 90% chance of delivering the project under this value, and a 10% chance of exceeding it. The P90 value is typically adopted for project budgets, as it provides suitable contingency to mitigate the specific risks identified for the project and its delivery.
Regulated river	A river system where flow is controlled via one or more major man-made structures (such as dams and weirs). For the purposes of the NSW *Water Management Act 2000*, a regulated river is one that is declared by the Minister to be a regulated river. Within a regulated river system, licence holders can order water which is released from the dam and then taken from the river under their water access licence.
Resilience	Resilient water resources are those able to withstand extreme events, such as drought and flood, and/or adapt and respond to changes caused by extreme events.
Resilient	The ability of a system or process to withstand acute shocks, whilst continuing to function.
Robust	Strong and being able to withstand and adapt whilst also maintaining functionality over time.
Small overbank flows	Flows approximately equivalent to 28,000-48,000 ML/day at Wagga Wagga
Stochastic climate datasets	Stochastic climate datasets are extended climate sequences that are synthesised using statistical methods applied to observed data of rainfall and evapotranspiration and can include paleoclimatic data. These extended sequences include a more complete sample of climate variability, including more severe drought sequences than have been experienced in the observed climate record since the 1890s.
Storage	A state-owned dam, weir or other structure which is used to regulate and manage river flows in the catchment. There are also a range of storages owned by local water utilities. Also refers to the water bodies impounded by these structures.
Sustainable diversion limit	Sustainable diversion limits (SDL) define how much water, on average, can be used in the Murray-Darling Basin by towns, communities, industry and farmers in a particular surface water or groundwater source area. The limit is written into law in NSW through water sharing plans.
Water resource plan	A plan made under the *Water Act 2007* (Cth) that outlines how a particular area of the Murray-Darling Basin's water resources will be managed to be consistent with the Murray-Darling Basin Plan. These plans set out the water sharing rules and arrangements relating to issues such as annual limits on water take, environmental water, managing water during extreme events and strategies to achieve water quality standards and manage risks.
Water sharing plan	A plan made under the *Water Management Act 2000* (NSW), which sets out the rules for sharing water between the environment and water users, and between different water users, within whole or part of a water management area or water source.
Water source	Defined under the *Water Management Act 2000* (NSW) as 'the whole or any part of one or more rivers, lakes or estuaries, or one or more places where water occurs naturally on or below the surface of the ground and includes the coastal waters of the State'. Individual water sources are more specifically defined in water sharing plans.
Wetland	Wetlands are areas of land where water covers the surface of the ground, either permanently or episodically. They include swamps, marshes, billabongs, lakes, and lagoons. Wetlands may be natural or artificial, and the water within a wetland may be static or flowing, fresh, brackish, or saline.