Water purchasing programs

Vulnerability, potential impacts, and program design options

A final report prepared for the New South Wales Department of Climate Change, Energy, the Environment and Water

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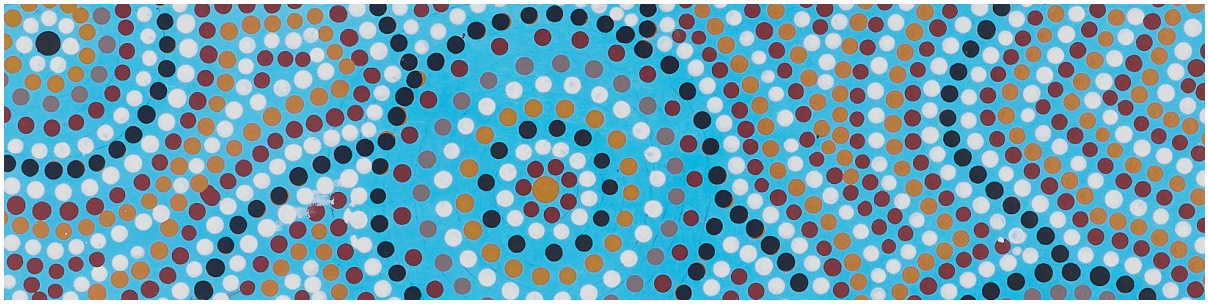
Acknowledgment of Country

Aither acknowledges First Nations people as the First Peoples of Australia and the Traditional Custodians of its lands and waters. We pay respect to the deep connection First Nations people hold with Country, and celebrate the continuing effect of cultural knowledge and practices on Country and communities across Australia.

We pay our respect to Elders past and present, whose knowledge and leadership has protected Country and allowed First Nations spirituality, culture and kinship to endure through the ages.

We recognise the injustices and hardship faced by First Nations communities and reflect on opportunities for all Australians to play a part in reconciliation and the development of mutual understanding and respect across cultures.



Executive Summary

Implementation of water recovery targets associated with the Murray-Darling Basin Plan 2012 (Cth) (Basin Plan) was not possible by the original deadline of 30 June 2024. As a result, in 2023 the Commonwealth formed an agreement with the Basin states (minus Victoria (VIC)) and sought changes to the deadline and the use of more options for water recovery, including water purchasing towards the 450 gigalitre (GL) target for additional environmental water. The Australian Parliament legislated the associated *Water Amendment (Restoring Our Rivers) Act 2023* in late November 2023, which meant that water purchasing programs could start in 2024.

The New South Wales (NSW) Government has stated that it '*does not support water purchases; however it recognises that the obligation rests with the Commonwealth government to deliver the Basin Plan*'.[1] Concerns exist about the potential for negative socio-economic impacts associated with water purchasing. The 2023 Ministerial agreement indicated the Commonwealth supports addressing any negative impacts associated with purchasing where they can be identified – including through the design of purchasing programs, and adjustment assistance. Further, the legislation requires the Minister consider socio-economic impacts before approving a water purchase program for the 450 GL.

Aither understands the NSW Government is now seeking to work with the Commonwealth to mitigate or manage any potential negative socio-economic impacts if water purchases are undertaken, consistent with Commonwealth commitments made as part of the 2023 Ministerial agreement and legislated obligations under the *Water Amendment (Restoring Our Rivers) Act 2023*.

The work completed by Aither and presented in this report was requested to help ensure the delivery of these commitments and obligations. Principles were outlined in the agreement which we understand the NSW Government wishes to ensure are fully and appropriately implemented. This report aims to improve understanding about how impacts may occur and how program design can mitigate or manage them.

Questions Aither was asked to address

The NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) asked Aither to:

- examine and identify which NSW communities (or regions) are most likely to be vulnerable to socio-economic impacts that would result from purchasing towards the 450 GL target
- analyse the extent of the impacts on those communities based on existing data and analysis
- explore elements of water purchase program design which would be most detrimental to the socio-economic welfare of affected communities identified, and
- recommend water purchase program design options that would minimise the socio-economic impact on communities identified.

Approach and methods

The approach and methods used for this report included:

- A conceptual framework for pathways to socio-economic outcomes from water recovery.

[1] Paragraph 9, *Agreement of Murray Darling Basin Ministers to Deliver the Basin Plan in Full* 2023, DCCEEW, viewed 24 January 2024, https://www.dcceew.gov.au/sites/default/files/documents/agreement-mdbp-delivery-full.pdf

- Synthesis of previous analysis on community vulnerability.
- A review of literature, analysis of selected data sources, and a hypothetical water recovery scenario (i.e. volumes recovered in NSW, as advised by NSW DCCEEW), to support impact assessment.
- Identification of purchase program design elements and analysis of their pathway to socio-economic impacts.
- A summary of recent and historic purchase programs and structural adjustment literature.
- Analysis and criteria-based assessment of water entitlements in NSW including data analysis.

Limitations of Aither's advice

This report was prepared in a short period of time. It is a rapid and preliminary assessment reliant on Aither's water markets data and insights, selected prior work or research, and experience associated with prior water purchasing policy and programs. The purpose of this report was not to evaluate the robustness of previous studies, but rather, utilise such studies for indicative purposes.

The report does not quantify or model socio-economic impact using original empirical economic analysis. Further, it was not within Aither's scope to consider environmental benefits when advising on purchase program design options.[2] Advice on the design of adjustment or other assistance was also out of scope.[3]

Recommendations

Aither's overarching advice is that program design will have a substantial influence over the relative socio-economic impact of water recovery to meet the 450 GL target. The most material consideration is the types of entitlements that are targeted in various water systems. However, other factors matter, including those which influence irrigator and business confidence and the ability for remaining businesses to plan and make good long-term decisions. The key message is that elements of program design will likely have a significant bearing on short- and long-term outcomes in irrigation dependent communities.

Aither's specific recommendations for a strategic approach and their rationale are set out in the following table.

[2] Analysis of entitlements in this report has considered the Long-Term Diversion Limit Equivalent (LTDLE) of those entitlements and the contribution to the 450 GL Long Term Average Annual Yield (LTAAY).

[3] Appendix B provides a synthesis of some relevant structural adjustment literature.

Recommendation		Explanation	Rationale
1	Target entitlement purchases	Focus purchasing on entitlements that generate the least negative socio-economic impacts. Avoid purchasing entitlements that have the highest relative socio-economic impact (including based on their reliability and drought resilience characteristics). Undertake some recovery in the northern Murray-Darling Basin (MDB).	This is the most material and direct way to minimise socio economic impact. There is clear potential to select entitlements based on type and location that will be relatively less impactful on production and hence on economic and social outcomes. Strategies may be available to acquire large volumes of some targeted entitlement types. Conversely some entitlements should be avoided to mitigate socio-economic impacts.
2	Clearly communicate strategy and intent	High quality information on targeted entitlements, overall approach to purchase rounds, and the implications for water markets will help entitlement holders consider their options, and the implications of participating or not participating in programs.	When individual entitlement holders make decisions based on good information, the longer-term socio-economic outcomes are likely to be better than they otherwise would be. It will be beneficial to provide the time and information for entitlement holders and other people in irrigation communities to make informed decisions.
3	Design the program to manage timing and sequencing concerns	Any purchase program should provide sufficient notice for potential participants to carefully consider their options and give careful consideration to the possible impacts of achieving program targets quickly versus more slowly. If staging programs, this should be clearly signalled in advance and the rationale provided, and plans maintained once signalled.	The duration and speed of programs can influence planning and investment decisions of those participating and those that might experience flow on impacts. Providing more notice may provide more time to plan and adapt leading to better decisions and less impacts, while drawn out or uncertain processes (including those which change unexpectedly) can contribute to uncertainty and maladaptation, including shocks and uncertainty which destabilise communities and industries, and undermine confidence.
4	Execute the program effectively and efficiently	The approach to market should be clearly signalled in advance with sufficient detail. The execution of transactions (after closing periods) should also be as fast as possible, with implications made clear for future rounds of buyback based on results. Targeting specific entitlements first, then moving to other entitlements is likely to be beneficial.	An uncoordinated and ad hoc approach to market risks entitlement holders making poor decisions that increase negative socio-economic impacts. It would also adversely affect trust in government and water policy.

Recommendation		Explanation	Rationale
5	Consider exit grants in combination with buyback	Whilst not recommended due to high irrigation reliance, if pursuing High Security entitlement in the southern MDB consider combining buyback with exit grants particularly for small block permanent plantings.	Reducing High Security entitlement will increase water availability risks to remaining permanent plantings during dry periods. One approach to offset these risks is to combine buyback with an exit grant program. This would ameliorate the impacts on remaining irrigators and may be beneficial given current economic challenges facing many viticulturalists particularly.
6	Target industry and community assistance	If concentrating purchases in the southern MDB, consider targeted industry and community assistance in other areas likely to be most affected e.g. Upper Murray and Murrumbidgee – broadacre irrigation and rice growing industry and communities).	Evidence suggests that a large volume of water recovered in the southern MDB could result in material reductions in water used in these regions, which would likely have flow on impacts to vulnerable irrigation dependent communities. Assisting adjustment has the potential to reduce the socio-economic costs but needs careful design.
7	Consider system rationalisation opportunities	If purchasing from entitlement holders within irrigation districts, consider potential system rationalisation.	This will reduce the impacts on the viability of Irrigation Infrastructure Operators (IIOs) and remaining customers and potentially deliver enhanced water savings.

Findings in response to questions

Findings made in relation to the three main scope questions (which contributed to the recommendations) are as follows.

Community vulnerability

- Community vulnerability depends on the impact of a change or event, and the relevant region's adaptive capacity, where the level of adaptive capacity (where it exists) can potentially offset some of the impact, reducing vulnerability. Potential impact is a function of exposure and sensitivity to the change or event.
- Areas with relatively more reliable and/or greater volumes of surface water resources, and with established irrigation infrastructure and industries, tend to have relatively greater economic focus and concentration on irrigated agriculture (and associated activities). While not accounting for adaptive capacity, this suggests they are relatively more vulnerable to recovery.
- Analysis published by Australian Bureau of Agricultural and Resource Economics (ABARES) in 2012 suggested the Gwydir, Lachlan, Murrumbidgee, and Upper Murray were all relatively more vulnerable to changes in water availability (towns such as Balranald, Hay, Griffith, Leeton, Coleambally, Conargo, and Hillston), with the Murrumbidgee and Upper Murray regions suggested to be most vulnerable *following* a modelled 2,800 GL water recovery scenario (Stenekes et al. 2012).
- Conditions are likely to have changed since 2012, with significant volumes of water recovery having already occurred, and significant adaptation also likely to have occurred. However, areas with relatively more intensive irrigated agriculture in 2023-24, including greater economic activity focused on or around this sector, are likely to be relatively more vulnerable to further purchasing.
- Based on the 2012 analysis, and the notional water recovery scenario considered in this report, vulnerability in NSW is likely to be greatest in southern connected MDB in NSW (including as this scenario means greater exposure there). This includes the Murrumbidgee and Upper Murray, but this will depend on which specific entitlements are purchased.

Socio-economic impacts

These findings must be considered in the context of the limitations presented in Section 4.3.

Impacts of water recovery on Entitlement on Issue

- Based on the scenario provided by NSW DCCEEW,[4] recovering 150 GL (LTDLE) within NSW from major entitlement types in the southern connected MDB would equate to approximately a 6.25 per cent reduction in consumptive entitlement on issue (EOI) (LTDLE). When this recovery is expanded to 300 GL (LTDLE) across the southern connected MDB (NSW, VIC and South Australia (SA)), the reduction in consumptive EOI is slightly higher but similar at 6.56 per cent.
- Smaller volumes of EOI in the northern MDB mean that recovering 40 GL (LTDLE) from NSW in the northern MDB would equate to a 3.03 per cent reduction in consumptive EOI.

[4] No details were provided by the Commonwealth. To undertake analysis estimates were required and made based on assumptions.

NSW MDB agricultural profile

- In the NSW southern MDB over a 15-year period (2006-20), the average Gross Value of Irrigated Agriculture Product (GVIAP) was $1,389 million (m), or approximately 41 per cent of NSW GVIAP in 2017-18. There is a mix of permanent and annual irrigated cropping in the NSW southern MDB:[5]
  - The annual average GVIAP of permanent crops, including grapes ($252 m), fruit ($239 m) and vegetables ($118 m) was relatively high in the NSW southern MDB and the value of output was relatively stable between 2006 and 2020.
  - Annual crops, rice ($179 m), dairy ($128 m) and cotton ($125 m) contributed considerably to the average annual GVIAP in the NSW southern MDB but the average annual value was considerably more variable than permanent crops between 2006 and 2020.
  - Grazing pasture ($146 m) and other cereals ($141 m) contributed considerably to the GVIAP in the NSW southern MDB.
- In the NSW northern MDB, over a 15-year period (2006-20), the average GVIAP was $874 m. Cotton accounted for approximately 76 per cent of this gross value each year on average. Annual cotton GVIAP varied considerably across the period (Walsh et al. 2021).

Expected on-farm (water price and GVIAP) impacts from water recovery (300 GL in the southern MDB, 40 GL in the northern MDB)

- The first causal link from a reduction in water availability for irrigation is impacts on irrigated farms. If less water is available from the consumptive pool:
  - Water prices will increase over the long-term (Gupta et al. 2020; MJA 2019).
  - Production volumes in some crops will fall over the long-term, which will reduce GVIAP for that crop.
- In the NSW southern MDB, the ABARES analysis estimates that on-farm impacts will be highest in relative terms in rice, cropping for dairy, hay and other pastures and broadacre crops.
  - Based on applying ABARES two water recovery scenarios (future market, and future market (dry)), in the southern MDB **rice (-$24 m, -$54 m) and dairy (-$11 m, -$21 m) are likely to be the most impacted industries in NSW southern MDB.** Due to low current commodity prices not modelled within the ABARES scenarios, the bulk wine industry in the Murrumbidgee and Lower Murray is also expected to be impacted considerably.
- In the northern MDB, the water recovery scenario (40 GL) is most likely to come predominantly from irrigated cotton. **40 GL is approximately equivalent to 5 per cent of water applied on cotton each year in the northern MDB.**
  - The water recovery volume scenario in the northern MDB is less material in absolute and relative (compared to EOI) but could have material local impacts if recovery is concentrated in some valleys.

Industries, processing facilities and town most impacted by water recovery

- In the NSW southern MDB, impacts will be transmitted by the water market. Spreading purchases may not avoid concentrated impacts in some communities.

[5] GVIAP data sourced from ABARES, 2021. Murray-Darling Basin water market catchment dataset 2021, for the NSW Murray, Murrumbidgee, and Lower Darling.

- A reduction in on-farm production due to water recovery affects throughput in processing facilities. While water availability is a bigger driver of on-farm production, water recovery will reduce production (Parliament of Australia 2023a). Lower production on-farm translates to less hours of work in the rice mills, dairy processing facilities and cotton gins. This translates to less income for workers which affects local and regional expenditure.
    - Almost all of Australia's rice production occurs in the NSW Murray and Murrumbidgee regions of the southern MDB (Ashton and van Dijk 2017).
    - The biggest potential impact to downstream processing facilities is likely in Leeton and Deniliquin (rice), Finley (dairy) and the Murrumbidgee and Lower Murray for bulk wine processing.
- In the NSW northern MDB, the impacts will be more closely linked with where the water is recovered and are therefore harder to foreshadow. If the recovery is concentrated in some valleys, cotton growing and processing regions in the Gwydir and Namoi could be impacted. Cotton growing and processing towns in the northern MDB that could be affected include Gunnedah, Boggabri, Wee Waa, Narrabri, Moree and Mungindi).[6]

Broader economic impacts of water recovery

- Aside from on-farm impacts, the literature has broadly concluded that there are no negative distributional impacts of water recovery on regional employment and community economic outcomes.
- The econometric modelling used to draw this conclusion estimates different outcomes due to a range of factors including but not limited to differences in methodologies, underlying assumptions and the spatial and temporal scale of the modelling.
- Economic models are a useful input to policy decisions, but they cannot:
    - Forecast outcomes with 100 per cent accuracy.
    - Capture all the localised impacts on individuals, particularly those who might have their shifts reduced or lose their jobs because of a sustained reduction in rice, cotton or milk and dairy outputs being processed in local factories.
    - Capture the intangibles like the impact of uncertainty on investment and people's mental and physical health.
- While difficult to estimate the magnitude of impacts, our view is that the impact is unlikely to be zero, particularly as regional communities have faced interest rate, cost of living and other pressures like droughts and floods which create direct cash flow pressure which is critical for all businesses including agricultural businesses.

Most impacted and vulnerable townships/regions (southern MDB):

- The vulnerability assessment (Stenekes et al. 2012), as shown in Figure 3, found that local government authorities (LGAs) in the Lower southern MDB were relatively more vulnerable including Murrumbidgee, Balranald, Carrathol (Hillston), Edward River and Hay.
    - The analysis of downstream processing impacts from reductions to GVIAP also highlight Leeton (Murrumbidgee) and Deniliquin (Edward River), and the wine industries in the Murrumbidgee.

[6] This analysis is based on available information of cotton growing and processing regions in the northern MDB.

- This would indicate that these regions/townships are most vulnerable and likely to be impacted by water recovery.

Most impacted and vulnerable townships/regions (northern MDB):

- Cotton growing and processing towns in the northern MDB that could be affected include Gunnedah, Boggabri, Wee Waa, Narrabri, Moree and Mungindi.[7] Some of these locations are also relatively vulnerable based on the vulnerability mapping shown in Figure 3.

Purchase program design

- The key elements of purchase program design are water sought/purchased (i.e. type, volume, location); timing and sequencing; approach to market; conditions on participation; approach to pricing and accepting offers; contracting and registration considerations, and provision of information and links to adjustment assistance measures.
- The primary pathway to socio-economic impacts is by changing the extent of and location of irrigated agricultural production, which has direct and indirect or flow impacts. This is primarily influenced by the water purchased, including its type, volume (absolute and in terms of proportion) and location.
- Hence, the type and location of water entitlements purchased is the element of program design that is most material to socio-economic impacts and outcomes, and an area in which program design could be specifically designed or modified to manage socio-economic impacts or outcomes. Aither's view is that strategic targeting of specific entitlement types could materially reduce the socio-economic impacts outlined above.
- However, timing and sequencing, and provision of information, are also material to efficient long-term adaptation and adjustment and a high priority. These factors can make a significant difference to confidence and certainty and support more effective planning and investment decisions by those who remain, including those continuing to irrigate and the other businesses and industries that rely on irrigation continuing.
- Conditions on participation and other factors matter to a lesser extent but still should be considered. Conditions on participation can be used to manage or achieve other objectives including associated with the risk of stranded assets and remaining customers in districts or addressing equity and efficiency considerations including associated with competing programs or objectives (e.g. infrastructure and/or on farm efficiency vs purchasing programs).

Further work and suggested next steps

Aither recommends that the NSW Government:

- engage in any detailed design of a water purchasing program led by the Commonwealth
- undertake or seek further assessment by the Commonwealth on the possible socio-economic impacts of water purchases
- continue to engage with irrigation communities to identify opportunities for water recovery
- continue work on the design of adjustment assistance measures and integrate this with the design of any purchase program.

[7] This analysis is based on available information of cotton growing and processing regions in the northern MDB.

1. Introduction

1.1. Project drivers

To support full implementation of the Basin Plan, the Australian Government recently developed and passed legislative changes (*Water Amendment (Restoring Our Rivers) Act 2023*) to provide additional time and flexibility to achieve the Basin Plan's water recovery targets, including enabling water purchases as a means of recovery towards the 450 GL target for additional environmental water.

To address stakeholder concerns about the potential for negative socio-economic impacts associated with further water recovery, the Commonwealth made commitments in a 2023 Ministerial Agreement, and in the Act, to consider and minimise any negative socio-economic impacts associated with water purchases towards the 450 GL. Specifically, the Act requires that:

> *'before the Minister approves a program (however described) under which water access rights are proposed to be purchased for the purpose of increasing the volume of the Basin water resources that is available for environmental use by 450 gigalitres, the Minister must consider the social and economic impact of the program on communities in the Murray-Darling Basin'*

(*Water Amendment (Restoring Our Rivers) Act 2023,* s.86ADB).

The NSW Government has stated that it does not support water purchases but that it recognises the Commonwealth's obligation to deliver the Basin Plan. It is seeking to work with the Commonwealth to mitigate or manage any potential negative socio-economic impacts from water recovery.

1.2. Project objectives and scope

To support the objective of ensuring any purchase program minimises socio-economic impacts (i.e. is consistent with the Ministerial agreement and legislation), the NSW DCCEEW engaged Aither to:

1. examine, using desktop approaches, community vulnerability to socio-economic impacts of water recovery in NSW
2. analyse the potential extent of socio-economic impacts on vulnerable communities from water purchases in NSW
3. explore elements of proposed water purchase program design which influence socio-economic impacts or outcomes
4. recommend purchase program design options to minimise socio-economic impacts in NSW.

The purpose of the work NSW DCCEEW commissioned is to assist it in discussions with the Commonwealth related to purchase program design, and to help ensure the relevant parts of the Ministerial agreement and legislations are operationalised.

As part of Aither's work, it was necessary to make assumptions about how the 450 GL might be recovered through purchasing. NSW DCCEEW asked Aither to consider the following purchase-based water recovery scenario associated with the 450 GL:

- 300 GL of purchases in the southern MDB
  - of which 120 GL to 150 GL comes from NSW
- Up to 40 GL of purchases from the northern MDB in NSW

This scenario assumes that the difference would need to come from other states, but should not be interpreted as pre-empting or signalling any specific arrangements (targets or outcomes). Rather, it reflects a plausible scenario to test. Decisions on purchase volumes targeted will be the responsibility of the Commonwealth and as at the time of writing, no specific details have been provided in relation to their purchasing targets.

This scenario does not include additional water recovery that might be required via purchasing to meet any shortfall associated with the 605 GL. The above scenario implies that the remaining volume (difference between the NSW volumes and the overall target) would have to be met from other jurisdictions (but the analysis does not consider potential impacts associated with those volumes).

1.3. Approach and methods

The approach and methods used for this report included:

- A conceptual framework for understanding how water purchases influence economic and social outcomes and how they can best be analysed or assessed (see below).
- Synthesis of ABARES analysis from 2012 on community vulnerability, to help identify NSW communities most vulnerable to further water purchases.
- A review of literature and analysis of selected data sources to analyse the significance of potential impact, supported by a hypothetical water recovery scenario for NSW (i.e. indicative purchasing volumes for northern and southern NSW, based on scenario advised by NSW DCCEEW).
- Identification of purchase program design elements and analysis of their pathway to socio-economic impacts to assess how program design could be modified to mitigate such impacts.
- Supporting synthesis and summary of recent and historic purchase programs (including the 2023 'Bridging the Gap' program) and structural adjustment literature.
- An analysis and assessment of water entitlements in NSW including data analysis and criteria-based assessment to derive the relative socio-economic impact of removing each type from production.

Conceptual framework

To properly understand and manage socio-economic impacts it is necessary to understand how water recovery for the environment can influence socio-economic outcomes. A conceptual framework informed the analysis and insights provided in this report, which is based on understanding causal pathways, the impact of removing water from irrigated agricultural production, the role of water markets in transmitting impact, how water use supports economic activity directly and indirectly, and how that economic activity supports social outcomes.

The framework suggests that identifying and assessing potential impacts and thinking about how to mitigate or respond to them should start by considering where, how and to what extent water is recovered, and what impact that has on the economies and communities that rely (or relied) on that water.

The following figure provides an illustration of the conceptual framework, which is further described in Appendix A.

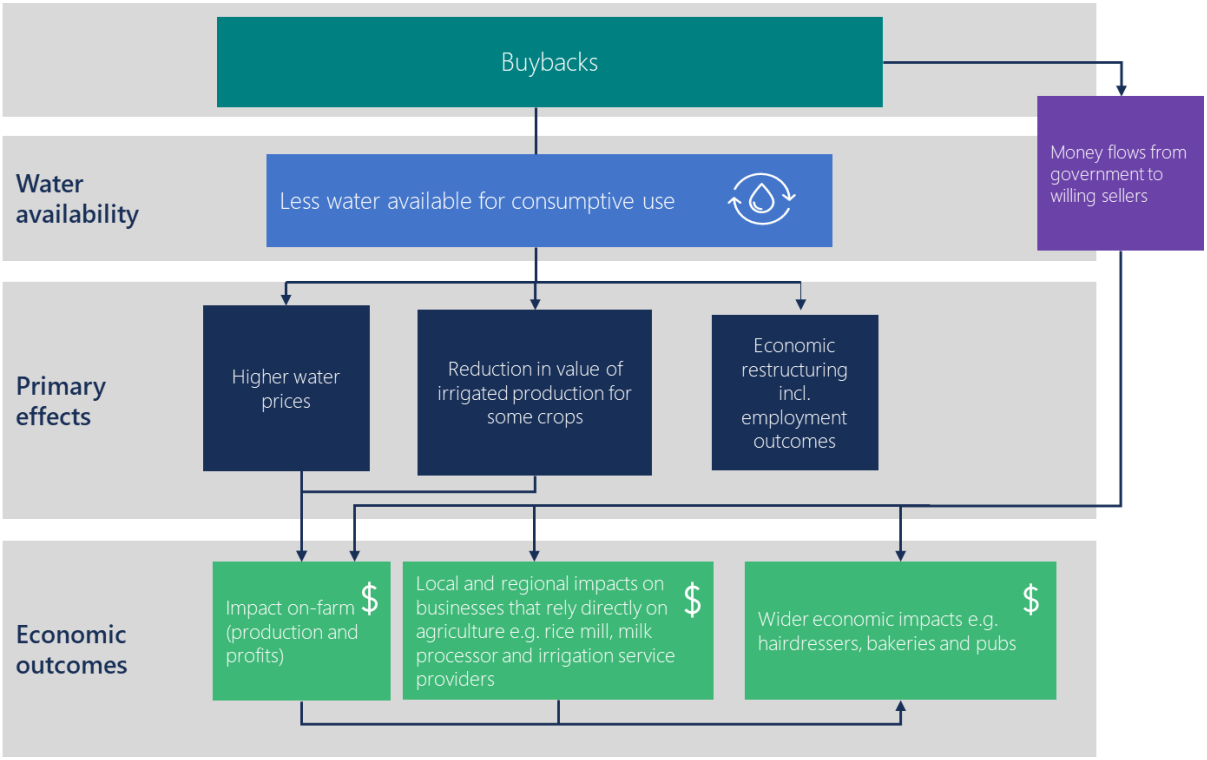


Figure 1 Conceptual map of the physical and socio-economic impacts of water purchase programs

1.4. Structure of this report

- Section 1 provides an introduction to the report
- Section 2 provides additional background on water recovery targets, the Ministerial agreement, and the Commonwealth legislation
- Sections 3 to 5 provide insights and analysis aligned with the first three objectives and scope elements outlined at Section 1.2 above
- Section 6 provides recommendations aligned with the fourth scope objective/element
- Appendix A - details the conceptual framework
- Appendix B - provides insights from recent and historic purchase programs and some background on relevant aspects of structural adjustment.

1.5. Limitations of this report

The following limitations apply to this report:

- This report was prepared in a short period of time. It is a rapid and preliminary assessment that has relied exclusively on desktop approaches and prior work or research.
- Given timeframes the reporting has had to focus on prior work of most relevance and utility to the questions put to Aither by NSW DCCEEW, hence it is not exhaustive.
- Aither did not review the validity of the methodology or analysis or the veracity of the findings from any existing literature referred to in this report. The purpose of this report was not to evaluate the robustness of previous studies, but rather such studies have been used for indicative purposes.
- Aither has not assessed whether there is a net benefit to society in recovering the additional water (i.e. whether the environmental and other benefits exceed the costs).
- Estimating the direct socio-economic impacts of additional water recovery is complex. Estimating the flow-on effects are even more complex. Aither has not sought to quantify or model socio-economic impacts using empirical economic analysis. Rather, Aither has relied on desktop analysis of existing literature and data.
- It was not within our scope to consider environmental benefits when advising on purchase program design options, however, analysis of entitlements in this report has considered the LTDLE of those entitlements and the contribution to the 450 GL LTAAY.
- It was not within our scope to analyse or make recommendations in relation to community or industry transition assistance, noting that Regional NSW is leading the NSW Government's work on the design and implementation of any transition assistance that may be provided by the Commonwealth. Aither's work focused on purchase program design elements.

2. Background

2.1. Achieving the Basin Plan 2012 targets

The Basin Plan was developed and implemented to address issues associated with water allocation, including historic levels of water extraction judged to be environmentally unsustainable. It contains objectives and water recovery targets which aim to improve environmental outcomes by returning some water to the environment. This has long term benefits for the Basin, not just for its environment, but for its economy and society, by ensuring the level of take for consumptive use can be sustained.

The Water Act 2007 (Cth) and Basin Plan set two water recovery targets:

- a target to 'bridge the gap' to long-term average Sustainable Diversion Limits (SDLs) and
- a target to recover 450 gigalitres a year of additional environmental water.

Water recovery targets in the Basin Plan were due for completion by 30 June 2024, however the target to recover the 450 GL had been at risk for some time, including due to a legislated cap on water purchasing towards that volume. During 2023, the Australian Minister for the Environment and Water, the Hon. Tanya Plibersek MP, asked for advice on Basin Plan implementation progress to date and the prospects of meeting water recovery targets by 30 June 2024, to which the Murray-Darling Basin Authority (MDBA) responded that full implementation would not be possible under the settings in place at that time.

Associated with the above, Basin State Ministers had been discussing (through the Minco forum) whether and how the Basin Plan can be implemented in full. In October 2022 they committed to working together to deliver the Basin Plan in full (MDBA 2022), and this commitment was reasserted when Ministers met in February 2023 (MDBA 2023), when officials from each of the respective Basin State Governments were tasked with developing options to effectively and efficiently implement the Basin Plan in full.

In August 2023 the Basin State Governments (excluding VIC) committed to the 'Intergovernmental Agreement to Deliver the Basin Plan in Full' (*Agreement of Murray Darling Basin Ministers to Deliver the Basin Plan in Full,* 2023). The agreement sets out the following key commitments:

- The Commonwealth will use its best endeavours to amend the Commonwealth's Water Act 2007 to implement the Basin Plan in full by:
  - extending time to deliver Sustainable Diversion Limit Adjustment Mechanism (SDLAM) supply and constraints projects until 31 December 2026
  - allowing for Basin states to bring forward new supply projects provided they can be achieved by no later than 31 December 2026
  - a reconciliation of SDLAM project outcomes by the MDBA to be completed by 31 December 2026
  - recovering 450 GL of water for enhanced environmental outcomes.

The August 2023 Ministerial agreement indicated Commonwealth support for working with communities on the design and delivery of water recovery programs towards the 450 GL target. The Commonwealth also indicated its approach to water recovery would be based on an overall

assessment of value for money informed by the following principles: (a) minimising the socio-economic impact on communities, (b) environmental utility, and (c) water market price.

In the agreement, commitments were made in relation to the potential negative socio-economic impacts of implementing the agreement. Where negative socio-economic impacts can be identified, the Commonwealth committed to supporting the minimization of such impacts on communities, including through:

- considering how the 450 GL of additional environmental water is recovered
- learning from the outcomes of previous water recovery and community adjustment programs
- in the case of water purchase towards the 450 GL for the environment, providing funding for community adjustment assistance and working with Basin governments and communities in delivering this assistance.

It was noted in the agreement that the NSW Government does not support water purchases but recognises that the Commonwealth has an obligation to deliver the Basin Plan in full.

2.2. Water Amendment (Restoring our Rivers) Bill 2023

The 'current settings' referred to by the MDBA in its response to the Minister (noted above) includes reference to a (now amended) legislative cap on water purchasing. The Ministerial agreement of August 2023 provided a degree of support from states (excluding VIC, and with conditions from others) for the Commonwealth to pursue removal of the constraint on purchasing to support it to achieve the 450 GL target (*Agreement of Murray Darling Basin Ministers to Deliver the Basin Plan in Full,* 2023). This was achieved by the preparation and passing of the *Water Amendment (Restoring our Rivers) Bill 2023 (Cth)*[8] which made necessary amendments to the *Water Act 2007 (Cth)* and the Basin Plan[9] to:

- Expand the measures (e.g. water recovery) that can deliver the Basin Plan target of 450 GL of additional environmental water.
- Remove the application of the socio-economic test in section 7.17 of the Basin Plan to water purchases towards the 450 GL (the test remains for efficiency measures projects).
- Extend the timeline to deliver the Basin Plan 450 GL target:
  - The MDBA would undertake a reconciliation of the Commonwealth's progress towards delivering the 450 GL by 31 December 2026, at which time the MDBA would also account for what has been achieved by the SDLAM projects towards the Bridging the Gap Target.
  - The last date contracts can be entered into to achieve additional water for the environment towards the 450 GL target would be 31 December 2027.
- Repeal the statutory 1,500 GL cap on Commonwealth water purchases, noting that 1,228.3 GL has been purchased by the Commonwealth.
- Provide additional time for Basin States to deliver SDLAM projects to 31 December 2026 (Parliament of Australia 2023b).

8 Noting information outlined is from the Bill that was proposed and not the Bill that was passed (see subsection below for material that was passed).

9 Basin Plan 2012 made under subparagraph 44(3)(b)(i) of the Water Act 2007

The Bill included additional powers for the Inspector-General of Water Compliance, delays to the Water Act 2007 review, amendments to implement the Water Market Reform Roadmap and other changes that are outside the scope of this report.

Passage of legislation and relevant amendments

The *Water Amendment (Restoring our Rivers) Act 2023* (Cth) was passed by the Parliament of Australia on 30 November 2023, legislating amendments to the *Water Act 2007* (Cth) and the *Basin Plan 2012*. The Bill passed based on amendments in the Senate agreed with the Government.

Relevant amendments made to the *Water Act 2007* (Cth) include:

1. Related to Part 1 Section 253, subsection 1, amending the deadline for the MDBA to review the Water Act (including the operation of the Act and extent to which the objects of the Act have been achieved) to 31 December 2027.
2. Related to Part 2A, Section 13A Division 4B, sub-section 85AC, extending the deadline for the Minister to increase water for environmental use to 450 GL per year (water recovery for environmental use), to 31 December 2027.
3. Related to Part 2A, Section 13B Division 4B, sub-section 86AA(3), requiring the Minister to take all reasonable steps to deliver the 450 GL for environmental use.
4. Related to Part 2 Paragraph 86 ADB, requiring the Minister to consider socio-economic impacts, when purchasing water entitlements for the purpose of increasing water resources available for environmental use by 450 gigalitres.
5. Related to Part 3 Section 14 Division 5, repealing the cap of 1,500 GL of water from the MDB permitted to be purchased by the Government.

Relevant amendments made to the *Basin Plan 2012* include:

6. Related to Division 3, Section 7.12 Subsection 2, amending the deadline for SDLAM supply projects to be proposed to 30 June 2025.
7. Related to Division 4, Section 7.11, Section 7.12 Subsection 3 or Section 7.21 amending the deadline for completion of Sustainable Diversion Limit adjustment Mechanism (SDLAM) supply projects for final determination to 31 December 2026.
8. Related to Part 1, Section 7.08B, providing a new framework for water recovery options to meet the 450 GL requirement, including the following criteria required for water to be categorised as an 'additional HEW entitlement':
    a. Take decreases the amount of water taken for consumptive use
    b. Take increases the volume of water available for environmental use
    c. Take contributes to enhancing environmental outcomes as set out in the Act, including the outcomes set out in schedule 5 of the Basin Plan.

3. Community vulnerability

3.1. Scope of community vulnerability assessment

This section of the report identifies which NSW communities (or regions) are likely most vulnerable to socio-economic impacts that could result from a Commonwealth water purchasing program towards the 450 GL recovery target.

3.2. Key findings

- Community vulnerability depends on the impact of a change or event, and the relevant region's adaptive capacity, where the level of adaptive capacity (where it exists) can potentially offset some of the impact, reducing vulnerability. Potential impact is a function of exposure and sensitivity to the change or event.
- Areas with relatively more reliable and/or greater volumes of surface water resources, and with established irrigation infrastructure and industries, tend to have relatively greater economic focus and concentration on irrigated agriculture (and associated activities). While not accounting for adaptive capacity, this suggests they are relatively more vulnerable to water recovery.
- Analysis published by ABARES in 2012 suggested the Gwydir, Lachlan, Murrumbidgee, and Upper Murray were all relatively more vulnerable to changes in water availability (towns such as Balranald, Hay, Griffith, Leeton, Coleambally, Conargo, and Hillston), with the Murrumbidgee and Upper Murray regions suggested to be most vulnerable *following* a modelled 2,800 GL water recovery scenario (Stenekes et al. 2012).
- Conditions are likely to have changed since 2012, with significant volumes of water recovery having already occurred, and significant adaptation also likely to have occurred. However, areas with relatively more intensive irrigated agriculture in 2023-24, including greater economic activity focused on or around this sector, are likely to be relatively more vulnerable to further purchasing.
- Based on the 2012 analysis, and the notional water recovery scenario considered in this report vulnerability in NSW is likely to be greatest in the southern connected MDB in NSW (including as this scenario means greater exposure there). This includes the Murrumbidgee and Upper Murray, but this will depend on which specific entitlements are purchased.

3.3. Supporting analysis

3.3.1. Definitions of community vulnerability

'Vulnerability' can be used to describe the socio-economic circumstances of communities undergoing change. It involves identifying the potential effects of a change and the ability for a community to respond or adapt. Inherent characteristics of the community are considered, such as income, education levels, age structure and housing, as well as the likely sensitivity to changes (in this case, changes in the availability of water).

Around the period the Basin Plan was being established, the MDBA commissioned ABARES to develop a framework to measure the vulnerability, resilience and adaptive capacity of Basin communities to changes in water availability (ABARES 2010; Stenekes et al. 2012).

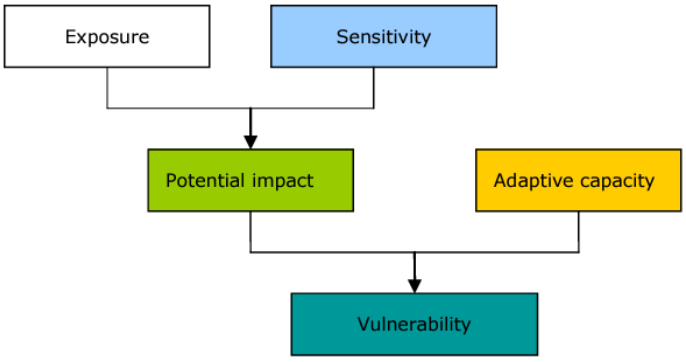
This work was used here to provide some context to vulnerability in NSW because it is an established methodology, viewed as appropriate to understand which communities in the MDB may be adversely affected by changes to water availability for consumptive use. The method has also been previously applied in the context of water purchasing in the Basin.

3.3.2. Definition of community vulnerability in the context of water in the MDB

Under the framework employed by ABARES, community vulnerability depends on the potential impact and the relevant region's adaptive capacity, where adaptive capacity can potentially offset some of the impact, reducing vulnerability. Impact is a function of both exposure and sensitivity to the impact.

Resilient communities are less vulnerable and have greater adaptive capacity, enabling them to better manage socio-economic change that may result from potential impacts. This is shown in the conceptual diagram (Figure 2) which has been applied in various adaptation contexts, including climate change adaptation. In the context of water recovery (Stenekes et al. 2012):

- **Exposure** is the amount of external stress or change a community is likely to be affected by (for example, the size of a reduction in water availability).
- **Sensitivity** is a measure of how dependent a community is upon the thing that is changing (for example, reliance on water for agriculture).
- Exposure and sensitivity determines the magnitude of the **potential impact**.
- The scale of the potential impact depends on the community's **adaptive capacity**, in terms of available built, human, natural, social or financial capital.



Source Stenekes et al. 2012, based on Allen Consulting Group 2005 and Schroter 2004.

Figure 2 Conceptual framework for understanding community vulnerability

3.3.3. NSW communities relatively more vulnerable to water purchasing programs

Approach and results from 2012 study

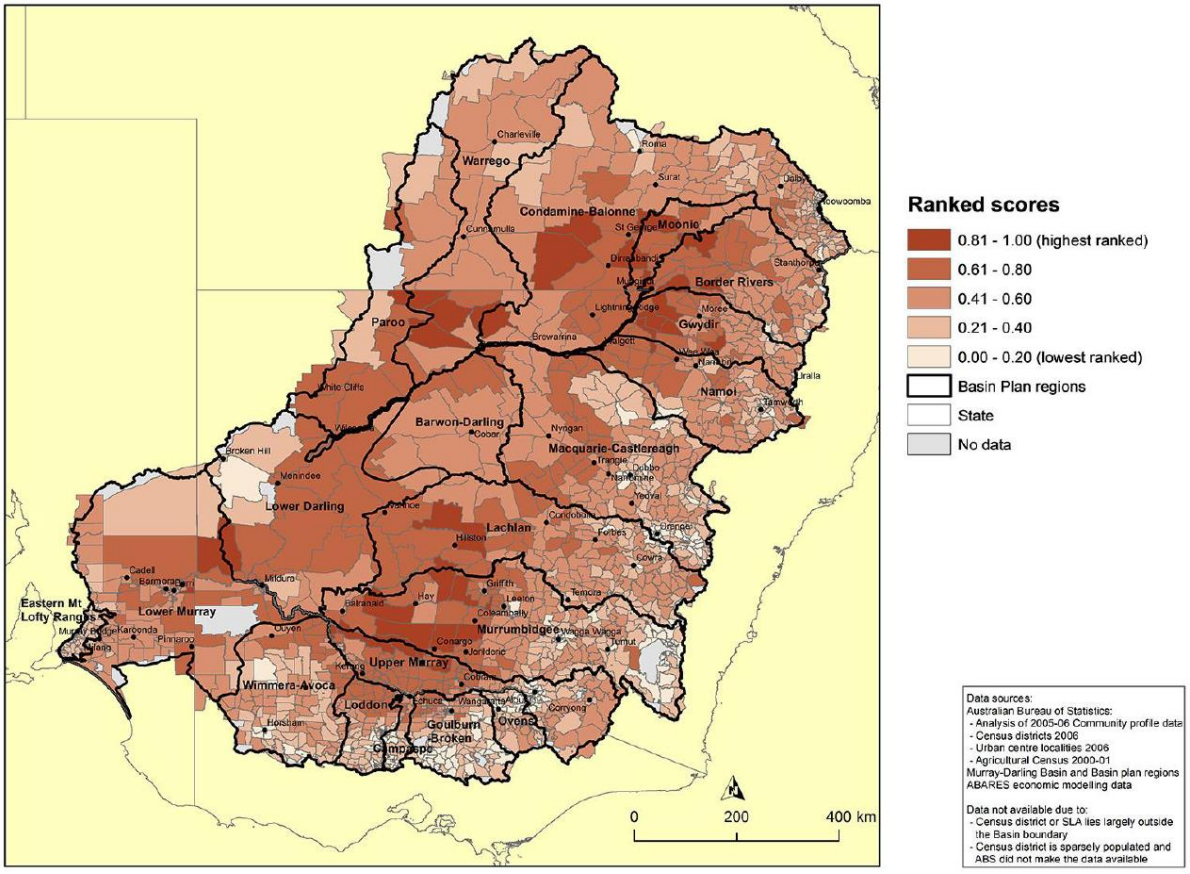
The most recent published results associated with ABARES' framework are from late 2012, which includes data inputs from different points in time (including Australian Bureau of Statistics (ABS)

census data, which is only undertaken every 5 years). The 2012 analysis presented vulnerability in terms of before, and after, exposure to implementation of the Basin Plan. To achieve this the analysis used different scenarios for water recovery volumes.

The work uses a range of indicators and associated data for different inputs in the framework (e.g. impact and adaptive capacity related variables) to derive an index of vulnerability to outline which areas are relatively more vulnerable than others. The analysis provides maps of vulnerability across the Basin.

Drawing on the 2012 analysis, the NSW regions with the highest rankings of relative vulnerability *before exposure* included irrigation regions in the southern MDB (including the Murrumbidgee, Lower Darling, Murray and Lachlan regions, which included regional towns such as Balranald, Hay, Conargo, Jerilderie, Coleambally, Griffith, Leeton and Hilston), and in the north-west of the Basin (Border Rivers and Gwydir regions).

The analysis of relatively greater vulnerability *after exposure* (assuming a 2,800 GL water recovery scenario) included a smaller and more focused cluster of areas in the Murrumbidgee and Upper Murray regions that displayed very high relative vulnerability rankings. These vulnerabilities were higher than before exposure because this was where proportionally more water recovery was expected to occur (i.e., greater exposure to a reduction due to SDLs). This included areas in between or adjacent to the same regional towns highlighted in the pre-exposure analysis (excluding Hilston), suggesting that the NSW southern MDB becomes relatively more vulnerable than the northern MDB.



Source Stenekes et al. 2012.

Figure 3 Index of relative community vulnerability to changes in water availability before exposure to the proposed Basin Plan

Implications for water purchasing in 2024 and beyond

If water purchasing proceeds (as it is likely to, given the Australian Government legislation), and based on the scenario Aither was asked to consider (120 GL to 150 GL purchased in southern MDB in NSW, and up to 40 GL in the northern MDB), the implications include that:

- The relative exposure means that the most irrigation intensive areas in the NSW southern MDB will still be relatively more vulnerable to further water purchasing than other parts of NSW, including intensive irrigation locations in the Murrumbidgee and Upper Murray.
- Vulnerability in these regions could have changed since the 2012 analysis based on changes to exposure – because some of the purchasing considered in the 2012 ABARES analysis has now occurred.
- However, these regions are still likely to be sensitive to further purchasing, and further work is required to better understand any changes in their adaptive capacity since 2012.
- Sensitivity could be heightened by conditions in some irrigated agricultural industries, including in communities with strong links to bulk wine grapes, due to low commodity prices.

Limitations of the vulnerability framework and analysis

Some important limitations include that:

- The ABARES framework and results provide a relative measure of vulnerability, not an absolute measure – i.e. they should not be used to say a specific area or community is, or is not, vulnerable.
- The 2012 published analysis is considerably dated now, and does not account for:
  - water that has been recovered to date and how it has been acquired (including whether by direct purchasing or other means such as infrastructure and efficiency), or
  - adaptation that has occurred over the last 10-15 years.
- The spatial scales for the inputs and outputs of the analysis can mask or hide very localised issues or impacts, and this should be considered when interpreting the results including the maps produced.
- An indicator-based approach to understanding community vulnerability risks reducing complex concepts to a simple index that can also mask local contextual differences which may be important in assessing vulnerability.

4. Socio-economic impacts on communities vulnerable from more water purchases

4.1. Scope of socio-economic analysis

The scope of this section is to present a rapid analysis, using desktop approaches only, on the potential socio-economic impacts on the communities identified in Section 3.

4.2. Key findings

These findings must be considered in the context of the limitations presented in Section 4.3.

Impacts of water recovery on Entitlement on Issue

- Based on the scenario provided by NSW DCCEEW, recovering 150 GL (LTDLE) within NSW from major entitlement types in the southern connected MDB would equate to approximately a 6.25 per cent reduction in consumptive EOI (LTDLE). When this recovery is expanded to 300 GL (LTDLE) across the entire southern MDB (NSW, VIC and SA), the reduction in consumptive EOI is slightly higher but similar at 6.56 per cent.
- Smaller volumes of EOI in the northern MDB mean that recovering 40 GL (LTDLE) from NSW in the northern MDB would equate to a 3.03 per cent reduction in consumptive EOI.

NSW MDB agricultural profile

- In the NSW southern MDB over a 15-year period (2006-20), the average GVIAP was $1,389 m, or approximately 41 per cent of NSW GVIAP in 2017-18. There is a mix of permanent and annual irrigated cropping in the NSW southern MDB:[10]
  - The annual average GVIAP of permanent crops, including grapes ($252 m), fruit ($239 m) and vegetables ($118 m) was relatively high in the NSW southern MDB and the value of output was relatively stable between 2006 and 2020.
  - Annual crops, rice ($179 m), dairy ($128 m) and cotton ($125 m) contributed considerably to the average annual GVIAP in the NSW southern MDB but the average annual value was considerably more variable than permanent crops between 2006 and 2020.
  - Grazing pasture ($146 m) and other cereals ($141 m) contribute considerably to the GVIAP in the NSW southern MDB.
- In the NSW northern MDB, over a 15-year period (2006-20), the average GVIAP was $874 m. Cotton accounted for approximately 76 per cent of this gross value each year on average. Annual cotton GVIAP varied considerably across the period (Walsh et al. 2021).

[10] GVIAP data sourced from Walsh et al. 2021 and Murray-Darling Basin water market catchment dataset 2021.

Expected on-farm (water price and GVIAP) impacts from water recovery (300 GL in the southern MDB, 40 GL in the northern MDB)

- The first causal link from a reduction in water availability for irrigation is impacts on irrigated farms. If less water is available from the consumptive pool:
  - Water prices will increase over the long-term (Gupta et al. 2020; MJA 2019).
  - Production volumes in some crops will fall over the long-term, which will reduce GVIAP for that crop.
- In the NSW southern MDB, the ABARES analysis estimates that on-farm impacts will be highest in relative terms in rice, cropping for dairy, hay and other pastures and broadacre crops.
  - Based on applying ABARES two water recovery scenarios (future market, and future market (dry)), **rice (-$24 m, -$54 m) and dairy (-$11 m, -$21 m) are likely to be the most impacted industries in NSW southern MDB.** Due to low current commodity prices not modelled within the ABARES scenarios, the bulk wine industry in the Murrumbidgee and Lower Murray is also expected to be impacted considerably.
- In the northern MDB, the water recovery scenario (40 GL) is most likely to come predominantly from irrigated cotton. **40 GL is approximately equivalent to 5 per cent of water applied on cotton each year in the northern MDB.**
  - The water recovery volume scenario in the northern MDB is less material in absolute and relative (compared to EOI) but could have material local impacts if recovery is concentrated in some valleys.

Industries, processing facilities and town most impacted by water recovery

- In the NSW southern MDB, impacts will be transmitted by the water market. Spreading purchases may not avoid concentrated impacts in some communities.
- A reduction in on-farm production due to water recovery affects throughput in processing facilities. While water availability is a bigger driver of on-farm production, water recovery will reduce production (Parliament of Australia 2023a). Lower production on-farm translates to less hours of work in the rice mills, dairy processing facilities and cotton gins. This translates to less income for workers which affects local and regional expenditure.
  - Almost all of Australia's rice production occurs in the NSW Murray and Murrumbidgee regions of the southern MDB (Ashton and van Dijk 2017).
  - The biggest potential impact to downstream processing facilities is likely in Leeton and Deniliquin (rice), Finley (dairy) and the Murrumbidgee and Lower Murray for bulk wine processing.
- In the NSW northern MDB, the impacts will be more closely linked with where the water is recovered and are therefore harder to foreshadow. If the recovery is concentrated in some valleys, cotton growing and processing regions in the Gwydir and Namoi could be impacted. Cotton growing and processing towns in the northern MDB that could be affected include Gunnedah, Boggabri, Wee Waa, Narrabri, Moree and Mungindi).[11]

[11] This analysis is based on available information of cotton growing and processing regions in the northern MDB.

Broader economic impacts of water recovery

- Aside from on-farm impacts, the literature has broadly concluded that there are no negative distributional impacts of water recovery on regional employment and community economic outcomes.
- The econometric modelling used to draw this conclusion estimates different outcomes due to a range of factors including but not limited to differences in methodologies, underlying assumptions and the spatial and temporal scale of the modelling.
- Economic models are a useful input to policy decisions, but they cannot:
  - Forecast outcomes with 100 per cent accuracy.
  - Capture all the localised impacts on individuals, particularly those who might have their shifts reduced or lose their jobs because of a sustained reduction in rice, cotton or milk and dairy outputs being processed in local factories.
  - Capture the intangibles like the impact of uncertainty on investment and people's mental and physical health.
- While difficult to estimate the magnitude of impacts, our view is that the impact is unlikely to be zero, particularly as regional communities have faced interest rate, cost of living and other pressures like droughts and floods which create direct cash flow pressure which is critical for all businesses including agricultural businesses.

Most impacted and vulnerable townships/regions (southern MDB):

- The vulnerability assessment (Stenekes et al. 2012), as shown in Figure 3, found that LGAs in the Lower southern MDB were relatively more vulnerable including Murrumbidgee, Balranald, Carrathol (Hillston), Edward River, Hay.
  - The analysis of downstream processing impacts from reductions to GVIAP also highlight Leeton (Murrumbidgee) and Deniliquin (Edward River), and the wine industries in the Murrumbidgee.
  - This would indicate that these regions/townships are most vulnerable and likely to be impacted by water recovery.

Most impacted and vulnerable townships/regions (northern MDB):

- Cotton growing and processing towns in the northern MDB that could be affected include Gunnedah, Boggabri, Wee Waa, Narrabri, Moree and Mungindi).[12] Some of these locations are also relatively vulnerable based on the vulnerability mapping shown in Figure 3.

4.3. Limitations of the socio-economic impact analysis

The socio-economic impact analysis needs to be interpreted in the context of the following limitations:

- This report was prepared in a short period of time, and has relied exclusively on desktop approaches and prior work or research.

[12] This analysis is based on available information of cotton growing and processing regions in the northern MDB.

- Given timeframes, the analysis has had to rely on previous published work most relevant to the questions put to Aither by DCCEEW, hence it is not exhaustive.
- Aither has not assessed whether there is a net benefit to society in recovering the additional water (i.e. whether the environmental and other benefits exceed the costs).
- Estimating the socio-economic impacts of additional water recovery is complex. Estimating the flow-on effects at a local, regional and NSW level is even more complex and is best done through Computable General Equilibrium (CGE) modelling which was not part of our scope. Rather, Aither has relied on desktop analysis of existing literature and data.
- CGE modelling, while useful, will not perfectly capture socio-economic impacts, particularly at the local level.
- We have not reviewed the validity of the methodology or analysis or the veracity of the findings from any existing literature referred to in this report.
- Due to a lack of data and modelled outputs to answer the questions in the scope, some of the studies we have relied on (e.g. Gupta et al. 2020) were not designed to assess the impact of buybacks in NSW per se. The analysis, although helpful to present a broad picture of potential impacts, is therefore limited in this regard. We have sought to make these limitations transparent.
- It was not within our scope to consider environmental benefits when advising on purchase program design options, however, analysis of entitlements in this report has considered the LTDLE of those entitlements and the contribution to the 450 GL LTAAY.

4.4. Supporting analysis and discussion

4.4.1. Section outline

The remainder of this section is structured using the conceptual overview presented in Figure 1. That is, the analysis presents:

- Estimated percentage reductions in the consumptive pool (LTDLE adjusted) to reach the revised water recovery target.
- A summary of the GVIAP in the southern connected and northern MDB – the baseline value of on-farm irrigated production.
- A summary of existing modelling that has estimated the on-farm impacts of water recovery (not exclusively buybacks) on GVIAP in the southern MDB.
- A description of the key processing facilities and the towns these facilities are in for the annual crops most likely to be affected by additional buybacks.
- A desktop review to describe how buybacks impact the wider economy and communities.

4.4.2. Water recovery impacts as a percentage of entitlement on issue

As a starting point in assessing the impact of water recovery in NSW, it is useful to estimate the potential reduction in the consumptive EOI. Reducing the volume in the consumptive pool means that there is less water available for productive use.

Table 1 presents the impact of the water recovery scenario outlined in Section 1.2 of this report on consumptive EOI (based on Aither's estimates of consumptive water entitlement on issue for major entitlement types). These results show that a recovery volume of 150 GL (LTDLE) within NSW from major entitlement types would equate to a 6.25 per cent reduction in consumptive EOI (LTDLE) in the NSW southern MDB. When this recovery is expanded to 300 GL (LTDLE) across the entire southern connected MDB (NSW, VIC and SA), the reduction in consumptive EOI is slightly higher but similar at 6.56 per cent.

Smaller volumes of EOI in the northern MDB mean that recovering 40 GL (LTDLE) from NSW in the northern MDB would equate to 3.03 per cent reduction in consumptive EOI.[13]

Table 1 Potential reduction in consumptive EOI

Recovery area	Consumptive EOI (LTDLE) (GL)	Recovery volume (LTDLE) (GL)	% of Consumptive EOI (LTDLE)
Southern connected MDB (NSW only)	2,401.51 GL	150.00 GL	6.25%
Southern connected MDB	4,574.50 GL	300.00 GL	6.56%
Northern MDB (NSW only)	1,318.76 GL	40.00 GL	3.03%

Note Aither data based on state water registers; recovery scenario provided by NSW DCCEEW.

4.4.3. On-farm impacts of water recovery

A reduction in water availability for irrigation will have impacts on irrigated farms. While the impacts are not linear (refer to box below), water availability is a direct driver of on-farm production and water recovery reduces the consumptive pool and will likely reduce production (Parliament of Australia 2023a). If less water is available from the consumptive pool, water prices will likely increase (Ashton and van Dijk 2017; MJA 2019), and production in some crops will fall over the long-term, which will reduce GVIAP in that industry all else being equal. GVIAP represents the gross value of irrigated production at the farm gate and is a function of commodity prices multiplied by yield.

[13] For the purposes of this analysis, northern MDB (NSW only) includes the Lachlan, it was excluded from the southern basin recovery as it is not part of the southern connected MDB.

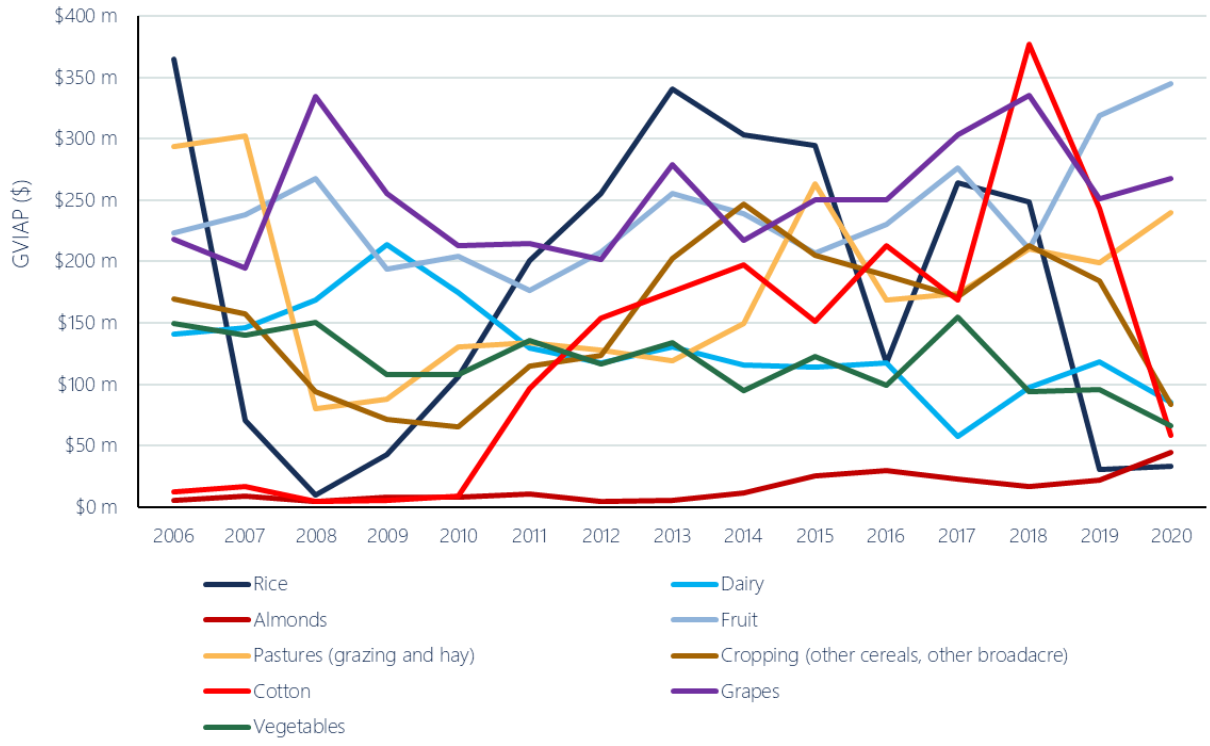
Regional impacts are not linear

A 10 per cent reduction in water available for irrigation will not, over the long-term, translate to a 10 per cent reduction in production and economic output due to:

- Irrigators receiving compensation for their water. The funds can be used to pay down debt without impacting production, particularly where excess entitlement is held. Where this is the case, irrigators will have more money to spend in local communities. A scenario where an irrigator sells and moves to the coast will have the opposite effect.
- Land, labour and capital mobility (e.g. partial or full transition to dryland agriculture is a good example of capital mobility).
- The water market will, over time, and subject to market constraints, redistribute water to higher value uses.
- Productivity and technological improvements.

Profile of NSW southern MDB GVIAP

Over a 15-year period (2006-20), the average annual GVIAP in the southern MDB was $1,389 m or approximately 41 per cent of NSW GVIAP in 2017-18. Figure 4 presents the GVIAP of the major irrigated crops in the NSW southern connected MDB between 2006 and 2020.



Source Aither analysis using Walsh et al. 2021. Murray-Darling Basin water market catchment dataset 2021

Figure 4 NSW Southern MDB industry GVIAP

In summary:

- The GVIAP of grapes, fruit and almonds (permanent horticulture) has steadily increased over time and remained relatively stable. Vegetables have not increased over the period but are also relatively stable.
- Cotton, rice and dairy are more variable over the 15-year period, as well as pastures and cropping. This is indicative of the crops being annual/temporary, meaning that during periods of reduced water availability, producers reduce production as water prices increase.

Table 2 presents NSW southern MDB GVIAP, volume of water applied, and area watered by crop types, as 15-year averages (2006-20). The main irrigated agriculture industries by value in the NSW southern MDB are horticulture (fruit, grapes, and vegetables), rice and pastures (grazing and hay).

Table 2 NSW southern MDB industry GVIAP, water use and area watered – 15-year averages (2006-20)

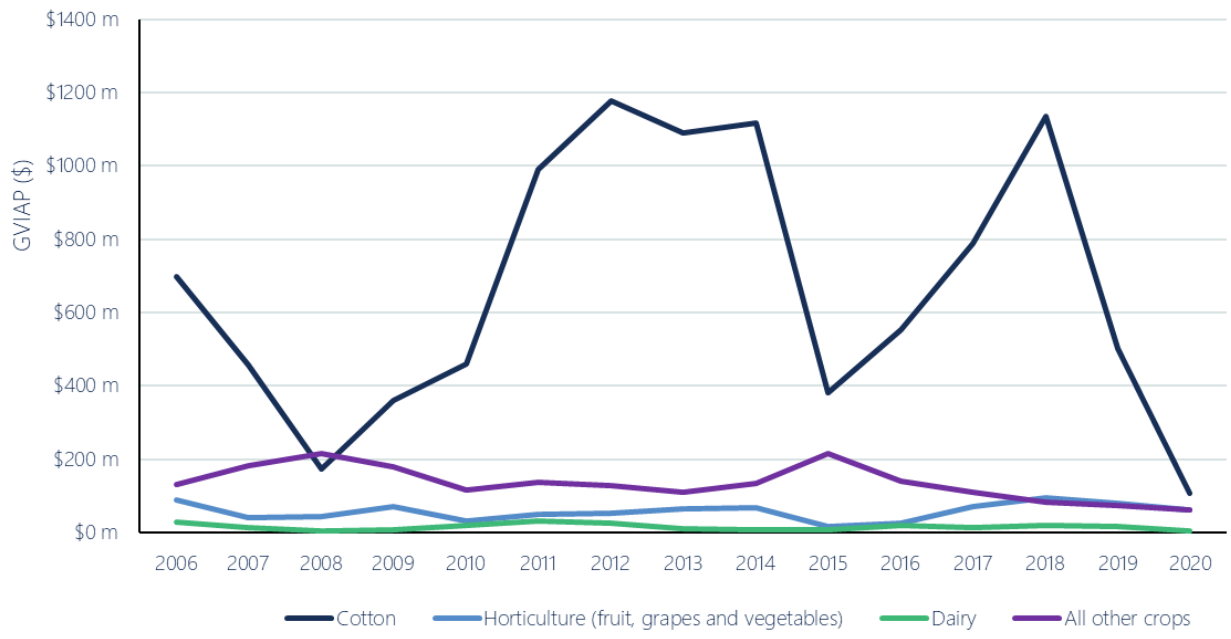
Crop types	GVIAP ($2019-20), millions)	Volume water applied (GL)	Area watered (ha)
Cotton	$125 m	207	24,242
Rice	$179 m	599	50,094
Dairy	$128 m	-	-
Almonds	$15 m	35	6,377
Fruit	$239 m	78	13,914
Grapevines	$252 m	129	25,758
Vegetables	$118 m	26	5,394
Pastures – grazing	$146 m	247	99,756
Pastures – hay	$29 m	85	28,408
Other broadacre	$16 m	N/A	N/A
Other cereals	$141 m	N/A	N/A
Total	**$1,389**	**1,395**	**249,520**

Note Subtotals may not round to totals due to rounding.

Source Aither analysis using Walsh et al. 2021. Murray-Darling Basin water market catchment dataset 2021

Profile of NSW northern MDB GVIAP

On average over the same 15-year period (2006-20), the NSW northern MDB contributed $874 m in GVIAP per annum, approximately equivalent to 36 per cent of NSW GVIAP in 2027-18. Figure 5 presents the GVIAP of cotton, horticulture, dairy and all other crops in the NSW northern MDB.



Source Aither analysis using Walsh et al. 2021 Murray-Darling Basin water market catchment dataset 2021

Figure 5 NSW Northern MDB industry GVIAP.

In summary:

- Cotton has the greatest GVIAP by a considerable margin, accounting for 76 per cent of NSW northern MDB annual average GVIAP ($666m/$874m).
- Cotton also has the great variation in GVIAP over the 15-year period. Cotton is an annual crop and as water availability reduces, producers reduce the area of irrigated cotton production, creating variation in GVIAP between years.

Desktop review of studies that have modelled on-farm impacts of water recovery

Two studies that have modelled or assessed the impacts of water recovery on GVIAP have been selected to demonstrate potential on-farm impacts of the water recovery scenarios. Neither study was designed to assess the impact of buybacks in NSW per se. The analysis, although helpful to present a broad picture of potential impacts, is therefore limited in this regard. We have sought to make these limitations transparent.

Frontier Economics assessment[14]

Frontier Economics (2022) modelled the on-farm impacts of a 450 GL buyback in the MDB and discussed off-farm/downstream economic impacts at a high level. Despite being 50 per cent larger than the 300 GL water recovery target tested in the scope of this analysis (Section 4.4.2), the analysis is indicative of the potential impacts to GVIAP. The focus of Frontier's analysis was on VIC, but included GVIAP impacts for NSW that are illustrative for this analysis.

[14] Given recent debate about economic studies on water recovery, Aither acknowledges Frontier's media release dated 15 November 2023 which clearly outlines the limitations and intent of Frontier's analysis. Given the limited modelling on the impact of the additional water to be recovered through buybacks to help meet the 450 GL target, Frontier's analysis is useful to contextualise potential impacts.

Consumptive water entitlements were assumed to reduce to achieve the average required volume (450 GL) in line with the current composition of the Commonwealth Environmental Water Holder (CEWH) portfolio. This equated to:

- 45.7 GL of SA Murray water entitlements
- 104.2 GL of NSW Murray General Security licences
- 80.7 GL of NSW Murrumbidgee General Security licences
- 120.8 GL of NSW Murrumbidgee Supplementary licences
- 102.1 GL of Victorian Murray high-reliability water shares (HRWS)
- 89.8 GL of Victorian Goulburn HRWS.

Frontier then estimated the volume of reduced water use by industry and location (Table 3).

Table 3 Expected reduction in volumes of annual water use due to a 450 GL buyback – Frontier Economics, 2022

Industry	Total GL reduction	Vic GMID[15]	Vic Mallee	NSW	SA
Horticulture	112	12	49	16	35
Dairy	137	125	0	10	2
Mixed grazing	40	20		20	0
Irrigated cropping	36	10		26	
Rice	83			83	
Cotton	42			42	
Total Reduction	**450**	**167**	**49**	**197**	**37**

Source Frontier Economics, 2022.

This estimated reduction in annual water use was applied to representative water application rates (in megalitres per hectare (ML/ha)) for each crop type and an estimated GVIAP reduction was calculated (Table 4).

[15] Goulburn Murray Irrigation District.

Table 4 Estimated GVIAP reduction associated with less irrigation from a 450 GL buyback in southern MDB – Frontier Economics

Lost GVIAP ($m/yr)	$/ML	Vic GMID ($m/yr)	Vic Mallee ($m/yr)	NSW ($m/yr)	SA ($m/yr)	Total ($m/yr)
Perennial horticulture	2,000	24	98	32	70	224
Dairy	1,350	169		14	3	185
Mixed grazing	360	7		7		14
Irrigated cropping	600	6		16		22
Rice	420			35		35
Cotton	800			34		34
All industries total		**206**	**98**	**137**	**73**	**513**

Source Frontier Economic, 2022

In summary, Frontier's analysis estimated that:

- Total annual GVIAP impacts in NSW of $137 m in 2022 dollars. This impact was assumed to be from water recovered from the NSW southern MDB (NSW Murrumbidgee, NSW Murray)[16].
- Rice ($35 m per annum), cotton ($34 m per annum), and perennial horticulture ($32 m per annum) would be the most affected industries in aggregate in the NSW southern MDB based on GVIAP foregone per annum.
- Based on the 2016 ABS observation of one job for every $300,000 of GVIAP, Frontier estimated that the GVIAP loss would correspond to approximately 457 farm jobs lost in NSW – not accounting for any dryland agriculture offsets. In addition to this, there would be associated job losses in up- and downstream industries, as well as in irrigation-dependent communities.

Applying Frontier's analysis to the reduced water recovery target (300 GL in the southern MDB rather than 450 GL)[17], and noting the limitations in Frontier's report and in the footnote, suggests that:

[16] Using Walsh et al. 2021 Murray-Darling Basin water market catchment dataset, this would represent approximately 9.1 per cent of average annual GVIAP in the NSW southern MDB, and 5.6 per cent of NSW MDB GVIAP (15-year average from 2006-2020).

[17] Frontier stated that some loss in irrigated production value (GVIAP) would be partially offset by the expansion of dryland agriculture, but this dryland offset was not estimated for NSW and not considered in this result. In VIC, the offset was approximately 10 per cent of GVIAP loss.

- Indicatively, this would equate to $91 m[18] under a 300 GL recovery target. (6.6 per cent of NSW southern MDB GVIAP and 3.7 per cent of NSW MDB GVIAP)
- GVIAP losses of $23 m (rice) and $22.5 m (cotton) under a 300 GL recovery target. This would equate to an 18 per cent and 13 per cent reduction in rice and cotton average annual GVIAP respectively in the southern MDB as described in Table 2 using ABARES 2021 MDB water market catchment dataset.
- Indicatively, this would be equivalent to 304 farm jobs lost under a 300 GL recovery target based on the 2016 ABS observation.

Limitations

Frontier noted in a media release (15 November 2023) that "the intent of this analysis was not to undertake detailed economic modelling to estimate the impact of further buybacks. Rather, we provide an indication of what is 'at risk' — in terms of the value of economic production and employment that is currently supported by the volumes of entitlements that could be recovered if the Commonwealth use buybacks to complete Basin Plan targets, for example the additional 450 GL. The report does not advocate for, or against, buybacks or alternative forms of water recovery."

ABARES modelling

Gupta et al. 2020 studied the economic impacts of Basin Plan water recovery in the southern connected MDB, leveraging their Water Trade Model to model the impacts of water recovery on irrigated crops. The model has been extensively documented in past reports (Hughes et al. 2017; Gupta et al. 2018; Gupta and Hughes 2018). This modelling considers changes in irrigated agriculture production-based water market dynamics, rather than assuming a direct proportional change between available irrigation water and agricultural output. The analysis was based around two future scenarios of water recovery:

- **Future market scenario**: In the future market scenario, water recovered under the Basin Plan is completed in full and 501.6 GL of water rights (in LTAAY terms) is recovered across the Basin. This future water recovery is assumed to occur via on-farm infrastructure upgrades. The scenario also considers an increase in farm productivity and water demand due to the effects of the assumed on-farm infrastructure upgrades.[19]
- **Future market (dry) scenario:** Similarly, the future market (dry) scenario recovers water under the Basin Plan in full and a further 501.6 GL of water rights (in LTAAY terms) is recovered across the Basin. The future market (dry) scenario uses the same historical climate sequence; however, rainfall and allocations are assumed to be 3 per cent and 11 per cent lower across the southern MDB.

Assumptions used in the ABARES analysis:

According to Gupta et al. 2020, there are several limitations and assumptions within the Water Trade Model used by ABARES to model the impacts of water recovery:

- Commodity prices are fixed to 2018-19 values for forward-looking simulations on all irrigation activities except hay. While hay prices vary in line with the climate sequence. Prices higher or lower

[18] These figures represent a basic extrapolation of GVIAP impacts from 450 GL to 300 GL (multiplying the results by 300/450). Based on Frontier's methodology, this assumption reasonably represents the GVIAP impacts of a 300 GL buyback where buybacks occur in line with the current composition of the CEWH portfolio.

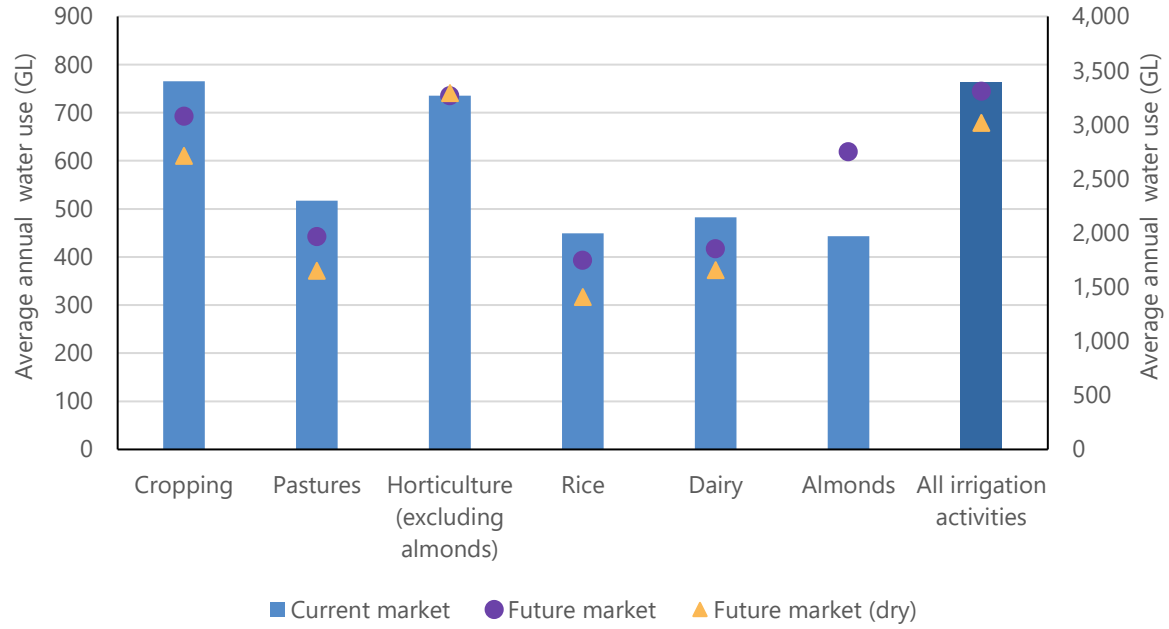
[19] "The future market scenario uses a historical climate sequence (2005–06 to 2018–19), which is particularly dry in the context of the longer historical record and may differ from average future climate conditions" (Gupta et al, 2020).

than assumed will alter the demand for water from farms producing that commodity, and hence their overall water use and production.

- On-farm infrastructure upgrades are assumed to have a positive effect on irrigation water demand and productivity, and all future water recovery is assumed to occur through these upgrades.
- Irrigation development and capital investment is fixed in the model, and future changes in productivity and technology advancements are not modelled. Incorporating these changes has the potential to moderate water price increases.
- A historical climate sequence (2005-06 to 2018-19) is used in the 'current market' and 'future market' scenarios. This period, within the longer historical record, is particularly dry, and may differ from average future climate conditions.
- Carryover volumes in the model are fixed. Changes in carryover behaviour has implications for water prices this can be induced by changes in water supply and demand.
- Due to the model operating on an annual financial year timescale, monthly or daily water prices could be significantly higher or lower than the annual averages predicted by the model.
- The inter-regional trade flows represented by the model are approximates, due to the model's annual timescale. Inter-regional trade limits apply at various times throughout the year however the model represents these limits using an approximated annual total trade limit from historical data and stakeholder input.
- The results are based on estimates of existing almond plantations and do not consider additional almond plantings in the future.
- The Water Trade Model relies on annual data and does not provide insights for day-to-day water trading and irrigation activity.

Key findings of the ABARES analysis:

Figure 6 presents the changes in average annual water use by crop types in the southern MDB. Rice, dairy, pastures and cropping are the main irrigated crops impacted. Almonds water use is assumed to increase as trees reach full maturity.



Source Gupta et al. 2020

Note No data point for Almonds - future market (dry) is not represented in the ABARES dataset.

Figure 6 Average water use by scenario - southern MDB.

Table 5 presents the Gupta et al. 2020 scenarios and the expected GVIAP impacts across the various crop types across the southern connected MDB The largest modelled negative impacts to GVIAP are for annual crops - rice, dairy, hay, other broadacre and other cereals under both scenarios.

Table 5 Expected change in annual GVIAP by scenario and irrigation activity southern MDB – ABARES, 2020 ($2019-20)

Crop type/scenario	Future market	Future market (dry)
Cotton	-2.8%	-10.4%
Rice	-13.5%	-30.3%
Dairy	-8.6%	-16.2%
Almonds	23.5%	22.8%
Fruit	2.1%	1.4%
Grapevines	-0.4%	-4.7%
Vegetables	3.8%	4.0%
Pastures – grazing	-6.7%	-18.0%
Pastures – hay	-15.4%	-32.2%
Other broadacre	-18.5%	-37.8%
Other cereals	-9.1%	-22.4%

Crop type/scenario	Future market	Future market (dry)
Total (southern MDB)	0.8%	-4.1%

Source Gupta et al. 2020.

Note The increase in total GVIAP across all activities under the future market scenario is largely driven by significantly higher almond production (Table 6). Around two-thirds of the increase in prices is attributed to the additional recovery of water through on-farm programs, while a third is attributed to greater water demand from the almonds sector. The greater water demand in almonds is driven by growth in water demand in the lower Murray due to maturing Almonds trees (particularly in NSW and SA Murray).

Estimating the impacts on GVIAP in the NSW southern connected MDB (using ABARES scenarios)

The scenarios modelled by ABARES have been applied to historical averages of GVIAP in NSW to assess the potential materiality of reductions in water available for irrigation. The percentage changes to GVIAP (under the two scenarios) in the southern connected MDB have been applied to average annual GVIAP in the NSW southern MDB (Table 2).

There are a few key differences between the scenarios that ABARES have modelled, and the scenario within this scope of work which limit the veracity of this analysis which is high-level only:

- The magnitude of water recovered is greater under the ABARES scenario (501.6 GL of water (in LTAAY terms) is recovered across the southern MDB in ABARES vis-a-vis 150 GL in Aither's scenario across the NSW southern MDB). The water recovery target used in the ABARES scenario therefore represents a 234 per cent increase in the water recovery target. As such, the results can be used to give an indication of impacted industries but should not be relied on to accurately represent a 340 GL water recovery target.
- The ABARES water recovery is assumed to occur via on-farm infrastructure upgrades, rather than via buybacks. The ABARES modelling also considers an increase in farm productivity and water demand due to the effects of these upgrades.
  - ABARES notes that "while the average annual GVIAP for most irrigation sectors (except horticulture) is estimated to decline, **this decrease would be greater if water was recovered solely through buybacks.**"
- This modelling captures the connected southern MDB whereas the scope of this analysis is the NSW southern MDB. The notable difference being the inclusion of the VIC Murray and SA Murray in the ABARES analysis.

Table 6 applies the ABARES percentage impacts under the two scenarios to the average annual GVIAP of crops in the NSW southern MDB, based on 15-year year averages (2006-20).

Table 6 NSW southern MDB industry GVIAP impacts from ABARES water recovery scenarios – 15-year averages (2006-20)

Crop types	Average annual GVIAP – (NSW southern MDB)[20]	Change in annual GVIAP [21]	% change in GVIAP relative to baseline	Average annual GVIAP change relative to NSW MDB GVIAP	Change in annual GVIAP[22]	% change in GVIAP relative to baseline	Average annual GVIAP change relative to NSW MDB GVIAP
Scenario	Baseline	Future market			Future market (dry)		
Cotton	$125 m	-$4 m	-2.8%	-0.2%	-$13 m	-10.4%	-0.6%
Rice	$179 m	-$24 m	-13.5%	-1.1%	-$54 m	-30.3%	-2.4%
Dairy	$128 m	-$11 m	-8.6%	-0.5%	-$21 m	-16.2%	-0.9%
Almonds	$15 m	$4 m	23.5%	0.2%	$3 m	22.8%	0.2%
Fruit	$239 m	$5 m	2.1%	0.2%	$3 m	1.4%	0.1%
Grapevines	$252 m	-$1 m	-0.4%	0.0%	-$12 m	-4.7%	-0.5%
Vegetables	$118 m	$4 m	3.8%	0.2%	$5 m	4.0%	0.2%
Pastures – grazing	$146 m	-$10 m	-6.7%	-0.4%	-$26 m	-18.0%	-1.2%
Pastures – hay	$29 m	-$4 m	-15.4%	-0.2%	-$9 m	-32.2%	-0.4%
Other broadacre	$16 m	-$3 m	-18.5%	-0.1%	-$6 m	-37.8%	-0.3%
Other cereals	$141 m	-$13 m	-9.1%	-0.6%	-$32 m	-22.4%	-1.4%
Total	**$1,389 m**	**-$57 m**	**-4.1%**	**-2.5%**	**-$162 m**	**-11.6%**	**-7.1%**

Source Aither analysis derived from Gupta et al. 2020 and Walsh et al 2021.

[20] Baseline data sourced from Walsh et al. 2021 Murray-Darling Basin water market catchment dataset.

[21] Percentage changes taken from Gupta et al. 2020, water recovery scenarios – Future market and used to derive change in annual GVIAP.

[22] Percentage changes taken from Gupta et al. 2020, water recovery scenarios – Future market (dry) and used to derive change in annual GVIAP.

In summary, and noting the limitations of the ABARES analysis:

- The GVIAP impacts of water recovery are material relative to the NSW MDB GVIAP[23] (-2.5 per cent and -7.1 per cent across the two scenarios).
- The impacts on the most affected industries are potentially amplified at a localised scale:
  - In NSW, rice (-$24 m, -$54 m) and dairy (-$11 m, -$21 m) are the most impacted industries based on GVIAP under the two scenarios.
  - Pastures – grazing (-$10 m, -$26 m) and other cereals (-$13 m, -$32 m) are also affected significantly based on GVIAP under the two scenarios.
  - ABARES also noted that GVIAP impacts may be amplified if water is recovered through buybacks. "While the average annual GVIAP for most irrigation sectors (except almonds and horticulture) is estimated to decline, **this decrease would be greater if water was recovered solely through buybacks**."
- The bulk winegrape industry is experiencing poor commodity prices and therefore lower financial returns per ML. It could be expected that the bulk wine industry in the Murrumbidgee and Lower Murray would also by impacted considerably by a 300 GL buyback and 6.56 per cent reduction in EOI in the southern MDB.

Estimating the impacts on GVIAP in the NSW northern MDB

Table 7 presents NSW northern MDB 15-year average GVIAP across the major crop types. Cotton has the greatest GVIAP, and water use by a considerable margin, accounting for 82 per cent of average annual water use.

Table 7 NSW northern MDB industry GVIAP and water use (15-year average – 2006-20) ($2019-20)

	GVIAP ($, millions)	Average volume water applied (GL)	Area watered (Ha)
Cotton	$666 m	762	114,515
Horticulture	$58 m	14	5,246
Dairy	$16 m	N/A	N/A
All other crops	$135 m	153	58,012
Total	**$874 m**	**929**	**177,773**

For the purposes of this analysis, 40 GL is assumed to be recovered from the consumptive pool in the northern MDB. The methodology used above cannot be applied to this volume as Gupta et al. (2020) did not model potential impacts in the northern MDB.

As the dominant annual crop by water use and value in the northern MDB, water recovery (40 GL) is assumed to be taken from cotton irrigation.

[23] For reference: NSW southern MDB GVIAP represents 61 per cent of total NSW MDB GVIAP (39 per cent GVIAP contribution from the northern MDB). NSW MDB GVIAP represented 72 per cent of NSW GVIAP in 2017-18 ($2,817 m out of $4,358 m).

An assessment of materiality can be made by comparing the recovery target to the average volume of water applied on cotton in the NSW northern MDB. 40 GL is approximately equivalent to 5 per cent of water[24] applied on cotton in the northern MDB (40/762).

4.4.4. Water recovery impacts: analysis of wider regional socio-economic impacts of water recovery

Overview

The impacts of changes to water availability, and the subsequent impacts on GVIAP, can result in downstream economic impacts on both local industries and on the broader region. Assessing the impacts requires an assessment at both the local and regional level over time as the impacts vary spatially and temporally.

The literature confirms that the largest relative on-farm impacts are in annual crops. In the NSW southern MDB, the ABARES analysis estimates that on-farm impacts will be highest in relative terms in rice, cropping for dairy, hay and other pastures and broadacre crops. In the NSW northern MDB, the biggest impact is expected to be in cotton.

Industries, processing facilities and towns most likely to be affected by water buybacks

A reduction in on-farm production due to water recovery affects throughput in processing facilities. Lower production on-farm translates to less hours of work in the rice mills, dairy processing facilities and cotton gins. This translates to less income for workers in the short-term which affects local and regional expenditure until the regional economy can adjust. The following section describes the industries and processing facilities most likely to be affected by water buybacks. The analysis is not intended to imply what could be lost as a result of the buybacks; rather, it presents a snapshot of the key industries that rely on irrigation water in the NSW MDB.

Rice

Most of Australia's rice production occurs in the NSW Murray and Murrumbidgee regions of the southern MDB (Gupta et al. 2020). The SunRice Group is the milling processor and value add manufacturer for nearly all the rice grown in these regions (MJA 2020). The SunRice Group's 2023 submission to the Inquiry into the Water Amendment (Restoring Our Rivers) Bill 2023 describes the contribution of the rice industry to the southern MDB economy:

> *"The SunRice Group is a significant economic contributor to the Southern Murray Darling Basin (Basin), and a major employer in the Riverina region of NSW where approximately 98 per cent of Australian rice is produced. In years of typical production (approximately 550,000 to 650,000 paddy tonnes), the SunRice Group employs over 650 skilled workers in the Riverina region and injects almost $500 million in direct payments into Basin communities through salaries and wages, and payments to growers, suppliers, and contractors.*

[24] 40 GL represents 3.03 per cent of northern MDB entitlement on issue (40/1318). Average annual cotton water use makes up approximately 58 per cent of entitlement on issue (762/1318).

Our operations in the Basin include three rice processing mills and associated value-add facilities in Deniliquin and Leeton, a network of more than 70 storage facilities across the Riverina, and the CopRice animal feed business which has facilities located at Leeton, Coleambally, Tongala and Wangaratta.

The vesting arrangements have supported SunRice to make over $2 billion in paddy payments to Riverina growers since the Millennium Drought, and invest approximately $1 million per annum in research and development of new rice varieties and improved farming techniques to increase yield and reduce water usage." (SunRice 2023)

The volume of rice processed at the Deniliquin and Leeton mills has historically flexed with changing water availability in the region. Rice is an 'interruptible' crop, meaning if water prices are higher due to reduced water availability, the crop may not be grown and can be deferred to another year for planting (Frontier Economics 2022). Throughout the Millennium drought, SunRice temporarily closed the Deniliquin mill for three years (MJA 2020). In 2019, off the back of a reduced 2018 rice crop, SunRice scaled back the daily operational hours of the Deniliquin plant. From November 2018 to March 2020, SunRice announced 230 job losses across their two mills, 100 of which were as a result of the low 2020 crop harvest (MJA 2020). SunRice is increasingly sourcing and milling rice overseas to meet increasing demand and offset variability of the supply of rice from the NSW Riverina (MJA 2020).

Dairy

Approximately one-fifth of Australia's total dairy farms are in the southern MDB (Gupta et al. 2020). The dairy industry is considered 'semi-interruptible'. When water is not readily available or is expensive, purchased feed can be used as a feedstock substitute (Frontier Economics 2022).

There are 42 milk processing facilities throughout the whole MDB (Australian Dairy Products Federation n.d.). This includes Wagga Wagga based dairy manufacturer and food service distribution business, Riverina Fresh. Riverina Fresh employs over 150 people across both NSW and VIC (Riverina Fresh n.d). Smaller dairy communities further to the south of NSW include Finley (Gupta et al. 2020).

Since the Millennium drought, milk processing facilities have continued to consolidate (Dairy Australia 2021). Saputo, one of Australia's largest dairy processors, with 10 manufacturing facilities across Australia, announced their intentions to consolidate their operations in 2022 (Saputo 2022). This process involved closing facilities and specific production processes across facilities in VIC and SA resulting in 75 job losses (Harvey 2022).

Bulk wine industry

The MDB contributes approximately 80 per cent of Australia's total irrigated grape production, with over 60 per cent of Australia's grapevine area situated within the Basin (Walsh et al. 2021). Grape production occurs across various regions within the MDB, with a concentration of production in the southern MDB areas. In NSW, grape production is concentrated in Murrumbidgee region and along the Murray River. The predominant use of grapes in this region is for wine production (Walsh et al. 2021). Wine processing and wine tourism generate income and employment opportunities across the regional economies within the MDB (Walsh et al. 2021).

A study conducted by the Australian Competition and Consumer Commission (ACCC) in 2019 on the wine grape market found bargaining power imbalances and information asymmetry in grower-winemaker relationships. Growers, particularly in warm climate regions like the southern MBD, often find themselves as price takers due to low levels of competition among winemakers acquiring grapes (ACCC 2019). The grape markets exhibit a high degree of concentration, with a few major winemakers acquiring the majority of grapes in each region. This concentration is notably pronounced in the Riverina region, where one or two dominant buyers control the grape market.

Dryland crops impacted

Other broadacre crops and hay also have considerable changes to GVIAP under the modelled scenarios in the southern MDB. The impacts of these changes are less likely to be felt by regional communities due to the crops having a lower application rate (ML/ha) and being spread out (refer to Table 2).

Cotton – North and South MDB

Cotton cultivation is predominantly concentrated in the northern MDB, with a primary focus on the Condamine–Balonne, Border Rivers, and Namoi. Cotton based systems are considered 'interruptible' as they are annual crops (Frontier Economics 2022). Cotton production returns a higher value product compared to other MDB industries such as cropping and dairy (Frontier Economics 2022). There are at least 31 cotton gins operating throughout NSW and QLD (MJA 2020). Auscott Limited is a producer, processor and marketer of cotton, operating six gins in the Gwydir, Macquarie, Namoi and Murrumbidgee valleys (Australian Cotton Shippers Association n.d.). Namoi Cotton operates cotton gins in several towns across northern NSW including Merah North Bourke and two in Wee Waa (Namoi Cotton n.d.).

Additionally, cotton is cultivated in the southern MDB in the Macquarie–Castlereagh and Murrumbidgee regions (Ashton 2019). Since 2011, cotton ginning operations in the southern MDB has increased as cotton production progresses southward, particularly into the Murrumbidgee region (MJA 2020). Out of the four cotton gins situated in the Murrumbidgee region, all have commenced operations after 2010, and two of them were constructed in the five years preceding 2020 (MJA 2020). Southern Cotton Gin operates in the Murrumbidgee irrigation area, in their first year of production they processed 166,234 bales (Southern Cotton n.d.). Between the 2011 and 2016 Censuses, employment in cotton ginning in the Riverina and Murray has increased significantly (MJA 2020).

Broader regional impacts of reduced water availability

The Sefton report (DCCEEW 2020) found that "many significant external influences change Basin communities' fortunes. Social and economic conditions in rural and regional communities are constantly changing in response to, or anticipation of, multiple pressures or events, and that lack of rainfall (drought) is the most significant factor influencing supply and water market prices. It is difficult to unpick and separate out drivers (such as policy changes and government responses) and their consequences."

Key drivers shaping social and economic conditions in regional towns and communities where irrigation occurs include commodity prices, exchange rates, structural changes to the Australian economy, technology and innovation, farm consolidation and commercialisation, and climate change. (DCCEEW 2020). Interest rates are also a key driver of investment and business profitability.

There are challenges disentangling these impacts and establishing a causal link between water recovery and social and economic outcomes. The ABS noted in their 2020-21 agriculture census that consultation with data users highlighted a strong requirement for supply chain data, such as labour and non-labour inputs and markets for output (ABS 2021). As such, it is difficult to estimate downstream economic impacts.

This section presents a desktop review of studies that estimate or describe wider regional economic impacts of water recovery based on three different methodologies.

Input-output modelling of downstream impacts can show considerable downstream economic impacts from changes to irrigation water availability but the methodology has significant limitations

Using multipliers to model economic impact of water availability reductions:

In Australia, the evidence of the impact of irrigation activity on wider regional communities is ambiguous, and the literature on economic multipliers for irrigated agriculture is varied, relatively dated, and contentious:

- The NSW Irrigators' Council (2023) reported that irrigation in the MDB has an economic multiplier of 3.5 – meaning that for every $1,000 of farm gate revenue generated, there is an additional $3,500 of dependent economic activity.
- Faurès et al. (2007) argue that the multiplier effect of irrigation on the economy is somewhere between 2.5 and 4.0.

This analysis hasn't applied such multipliers to GVIAP impacts to estimate downstream economic impacts. Using multipliers for this purpose is highly flawed for several reasons discussed below.

Limitations of using economic multipliers and why they should be avoided

The ABS (2021) stated in relation to Input-Output (I-O) multipliers that:

- "Input-output (I-O) multipliers may be useful as summary statistics to assist in understanding the degree to which an industry is integrated into the economy, their inherent shortcomings make them inappropriate for economic impact analysis. Shortcomings include a lack of supply-side constraints (overstates impact); fixed prices; fixed ratios for intermediate inputs and production; **no allowance for people to adapt and respond to changes**; absence of any budgetary constraints; not applicable for small regions. These shortcomings mean that input-output multipliers are likely to significantly overstate the impacts of projects or events. More complex methodologies, such as those inherent in Computable General Equilibrium models, are required to overcome these shortcomings" (ABS 2021).
- In the context of water recovery, multipliers and I-O modelling do not consider adjustments that water users make after an allocation reduction to recover economic loss. For example, where water users trade water from low value to high value uses to recover losses (water market trades). The other effect that I-O models fail to capture is through changes to farm factor mobility (land, labour and capital shifts) to adjust to changes to the quantum of water available for productive uses. The water market and farm factor mobility are capable of redistributing and recovering some of this loss, but a dynamic regional economic model is required to model these changes over time.

More advanced techniques of modelling downstream impacts find little to no economy wide impacts from changes to irrigation water availability at a regional level

Econometric modelling

There are several time series regressions that attempt to study water recovery targets with broader economic outcomes, with varying statistical robustness. Davidson and Hellegers (2023) used econometric modelling to assess the impacts of irrigation on regional economic indicators across natural resource management regions in Eastern Australia, and how they have changed over time. In summary:

- The main finding of this study is that while a statistical association can be found between the production levels and the incomes of irrigators, any further statistical associations between water applied and the incomes, employment and well-being of others in the regions are not strong.
- The result of the associative relationships between water applied and employment in a region was not strong. Australian agriculture is highly mechanised and in total accounts for less than 3 per cent of the total workforce.
    - This finding represents the whole of Eastern Australia and represents regions and communities outside of regional NSW that don't rely as much on agricultural employment.

CGE modelling

A CGE model is the best approach to quantify the timing and quantum of impacts. CGE models are large, dynamic numerical models which combine economic theory with economic data to derive computationally, the impacts of policies or shocks in the economy. The most prevalent CGE model that has been used to assess the impacts of water recovery in the MDB is the TERM-H2O model (Dixon et al. 2009). This model has been updated over the past decade for applications in the MDB. In summary, outputs from the TERM-H2O model indicate that:

- If water holders are fully compensated for voluntary sales of water at market prices, they should be no worse off.
- TERM-H2O's application in the MDB has consistently shown that buybacks leave communities no worse off. In fact, TERM-H2O's application showed that regional economies were slightly better off as irrigators' terms of trade and spending power increased because of buybacks.
- The reason why water buybacks have a much smaller impact than equivalent declines in diversions due to drought is because farmers are: (1) directly compensated for the loss of water and (2) the reduced diversions with a buyback are accounted for in the planning and planting decisions of farmers (Grafton and Jiang 2009).

What could all this mean for NSW communities?

Aside from on-farm impacts, at the Basin scale, CGE modelling has broadly concluded that the impacts of water recovery (with respect to regional employment and community economic outcomes) are negligible. However, these economic models cannot capture all the localised socio-economic impacts, and the impacts on individual businesses and people as well as the potential intangible impacts of uncertainty on investment and people's mental and physical health. Moreover, Aither is not aware of CGE modelling that has attempted to model the impact of additional buybacks. This is a gap and further underscores the importance of the recommendations contained in this report.

While difficult to estimate the magnitude of impacts and further work is recommended, there will be impacts and our view is that they will likely be concentrated in the NSW Murrumbidgee and Upper Murray in the southern MDB. In the northern MDB, valleys where significant volumes of water are purchased and where the cotton gins are located (e.g. the Namoi and Gwydir catchments) are more likely to be affected.

5. Purchase program design considerations

5.1. Scope of purchase program design considerations

The scope of this section is to explore elements of water entitlement purchase program design which would affect the socio-economic welfare of affected industries and communities identified in Section 3. As part of this Aither was asked to consider information on the strategic water purchase framework[25] established by the Commonwealth during 2023 to Bridge the Gap (see Appendix B - for more detailed treatment of this).

5.2. Key findings

- The key elements of purchase program design are water sought/purchased (i.e. type, volume, location); timing and sequencing; approach to market; conditions on participation; approach to pricing and accepting offers; contracting and registration considerations, and provision of information and links to adjustment assistance measures.
- The primary pathway to socio-economic impacts is by changing the extent of and location of irrigated agricultural production, which has direct and indirect or flow impacts. This is primarily influenced by the water purchased, including its type, volume (absolute and in terms of proportion) and location.
- Hence, the type and location of water entitlements purchased is the element of program design that is most material to socio-economic impacts and outcomes, and an area in which program design could be specifically designed or modified to manage socio-economic impacts or outcomes.
- However, timing and sequencing, and provision of information, are also material to efficient long-term adaptation and adjustment and a high priority, as they can make a significant difference to confidence and certainty and support more effective planning and investment decisions by those who remain, including those continuing to irrigate and the other businesses and industries that rely on irrigation continuing.
- Conditions on participation and other factors matter to a lesser extent but should still be taken into consideration. Conditions on participation can be used to manage or achieve other objectives including associated with the risk of stranded assets and remaining customers in districts or addressing equity and efficiency considerations including associated with competing programs or objectives (e.g. infrastructure and/or on farm efficiency vs purchasing programs).

[25] The Commonwealth's Strategic Water Purchasing Framework is described here: https://www.dcceew.gov.au/water/publications/strategic-water-purchasing-framework-and-factsheet

5.3. Supporting analysis and discussion

5.3.1. Key elements of purchase program design

To understand how purchase program design might influence socio-economic outcomes it's necessary to understand what elements are involved in the design and implementation of a water purchasing program. Key elements of water recovery purchase programs are likely to include (but may not necessarily be limited to) those outlined in Table 8. Not all of these will have direct implications for socio-economic outcomes (and some may have little or no influence). Some may affect the value for money outcomes of a buyback program, and they may also affect entitlement holders' levels of trust and confidence in the program.

Table 8 Key elements of purchase program design

Element	Specific examples
Water sought for purchase	• Location(s) being targeted; resource type (e.g. surface vs groundwater, regulated or unregulated); entitlement type(s) sought including reliability/yield/LTAAY; volumes sought or required, including aggregate totals and any location, valley or product specific targets; geographic targeting vs spreading.
Timing and sequencing	• The program's total duration; how much notice is given ahead of a purchase round; when the program occurs (e.g. within or over multiple seasons); whether it occurs in one or multiple rounds or tranches, and potential changes made between rounds; extent of prior notice and signalling of intent.
Approach to market	• Limited tenders; open tenders; auctions; non-specific or 'on market' approaches; requirement to use or not use brokers or intermediaries; direct negotiation and targeted approaches (e.g. buyer seeks out and approaches potential sellers directly).
Conditions on participation	• Minimum or maximum parcel sizes (volume of water per transaction); whether participants have been involved in previous purchasing rounds or not; whether participants have received efficiency grants or might be involved in such programs; requirement for water within specific areas (e.g. within or not within certain irrigation districts); requirement to exit irrigation (or stay involved); requirement to not re-enter the market to buy water later; water is or isn't leased out; conditions based on current or potential use of the water; whether water is held by an active user or not (e.g. an investor or non-water using manager/owner).
Approach to pricing and sorting or accepting offers	• Whether price guidance is provided (e.g. a range) or acceptable prices or levels are set by the buyer; whether and how bids or offers are ranked and selected (e.g. volume weighted prices are calculated for offers which are then ranked according to that price); any other criteria used to rank offers, or to accept or deny offers made.

Element	Specific examples
Contracting and registration considerations	• Conditions placed on minimum or maximum validity period for offers; time for exchanging contracts; or to finalise transactions, and register the exchange of ownership.
Information requirements and provision	• Information requirements imposed on sellers such as disclosure of caveats or encumbrances on the entitlements being offered; the degree of transparency the buyer provides to potential sellers to inform their offers (e.g. price information, including advising of prices accepted under previous rounds); information provided on objectives for the purchases, or in relation to adjustment support, or the future of water systems, markets and regions which may be the target of purchases.

Source Aither, based on prior work.

5.3.2. How design may influence socio-economic outcomes

Based on Aither's experience and knowledge, the following table provides an indication of how different elements of program design may have a bearing on socio-economic outcomes or are otherwise important to consider in this context.

Table 9 Purchase program design elements

Design element	Potential influence on socio-economic outcomes and participants
Water sought for purchase	• Volume sought/purchased and the proportion of volume of water in use this represents in a connected market, will influence the magnitude of impact (noting there may be non-linear responses including thresholds, as well as adaptation). • Different types and reliability of entitlement will have different significance and value to different industries or users, and entitlements with greater value and importance will likely have greater impact when removed from use. • Location of change in use will determine where the production impact is felt, and where direct and indirect or flow on effects will originate from.

Design element	Potential influence on socio-economic outcomes and participants
Timing and sequencing	• The duration and speed of programs can influence planning and investment decisions of those participating or those that might experience flow on impacts. • Going slow or going fast could have different impacts on confidence and certainty. • Providing more notice in cases where major change is required may provide more time to plan and adapt leading to better decisions and less impacts, while drawn out processes can contribute to uncertainty and maladaptation (particularly if there is a long duration between offers being submitted and accepted or rejected). • Long run impacts will likely be similar (influenced by volume and location of recovery), but short run impacts could differ depending on sequencing and staging (e.g. potential for more concentrated short run impacts as those affected seek to adjust).
Approach to market	• Different approaches may influence the degree of participation or the amount of recovery obtained, which could influence the volumes recovered (however impacts would likely be transmitted in the same way as 'water sought' above).
Conditions on participation	• Could have material influence (positive or negative) depending on the condition. • Conditions could be used to target or control certain outcomes – e.g. encouraging exit or transition in a particular area or sector / sub sector, managing impacts on remaining irrigators in irrigation districts.
Pricing and sorting / accepting offers	• Could have implications for speed at which the recovery occurs by influencing the extent or quality of offers received which could influence volumes recovered (effects transmitted in same way as 'water sought'). Overall, this element is not expected to be highly material to socio-economic impacts.
Contracting and registration	• Has potential to influence speed of recovery, or impact on confidence and certainty, if contracting or registration doesn't proceed or does so slowly. • Broader impacts could occur if Commonwealth forced to re-enter market if / as sales fail to proceed.

Design element	Potential influence on socio-economic outcomes and participants
Information requirements and provision	• Information about objectives and intent of recovery (beyond addressing environmental needs) has significant bearing on confidence, and planning and investment decisions. • Information about adjustment support and how it is targeted or delivered may provide increased confidence to regions, communities or industries which may be affected and could influence broader socio-economic outcomes. • Information about the target level of recovery and implications for water availability, market prices and overall production will be important to enable participants and those in irrigation industries and communities to make decisions that help mitigate the impacts.

Source Aither

Note Examples are indicative, not exhaustive.

5.3.3. Elements most relevant to socio-economic outcomes

The elements that have the greatest potential to influence socio economic outcomes are:

- Water entitlement types and locations purchased.
- Conditions on participation (which can also be designed to influence where and when water is recovered and can have direct and indirect influence on socio-economic outcomes).
- Timing and sequencing, including timeframes and intensity of recovery.
- Information provision.

Each of these is discussed further below.

Water entitlements sought and associated considerations

The entitlements that are purchased under any program are likely to have the most direct and significant impact on socio-economic outcomes, including the entitlement type and the location. In this context it is important to consider:

- **Use and the value of the use** – different entitlement types have different reliabilities, and different uses and values to individual businesses, and have different levels of flow on implications for different industries or locations (including towns). Some entitlement types may be less utilised or only available and used in wet conditions when the incremental value of irrigation water is lower. Some entitlements act more as insurance and are used infrequently, others are in constant use and highly relied upon. Carryover characteristics are also important and can provide good carryover ability which can increase the value of the entitlement (see further in box below, and Section 6.3).
- **Proportionality** – the proportion of the consumptively held entitlement on issue that is removed from the total. If most of the entitlement in consumptive use is taken out of the consumptive pool in a particular water system (and there is little connectivity or ability to adjust through the water market), this could have more significant impacts than if a more modest proportion is recovered.
- **Geographic concentration** – recovery could be more concentrated on specific entitlements or locations which could also concentrate socio-economic impacts, alternatively the recovery effort could be spread in an attempt to reduce the significance of impact in individual areas. There is a

likely trade-off between the 'vegemite spread effect' of smaller impacts across many areas versus larger impacts in fewer areas and complementing this with a significant adjustment support effort.

- **Thresholds and tipping points** – industry viability or viability of certain activities or employers within regions could be harmed if enough water is taken out of a particular entitlement type or location, and some locations or industries may be more sensitive than others.
  - For example, reductions in cotton and rice production that make local production facilities non-viable which could lead to off farm employment and economic activity being wound back.
  - Similarly, if purchasing water below the choke and keeping existing Inter Valley Trade rules, this may increase risks to sector in dry years due to lack of water availability for horticulture, which could have significant economic impacts due to capital intensity of the sector with long lived assets that require water every year.
  - However, this dynamic will be more complicated in reality as cotton is currently relatively profitable, while some horticulture (and particularly viticulture) is not currently profitable. Cotton and rice may also be more labour intensive so the flow on impacts may be more significant. Further research and analysis would be required on these dynamics.
- **Change in location of use** – in connected markets particularly in the southern MDB, where the reduction in use occurs will drive the socio-economic impact associated with purchases. The reduction in use will be transmitted by the water market across the southern connected MDB. It may be difficult to determine exactly where the impacts will occur or be most felt but will most likely be at the locations of lowest value use.

Insights on linking different entitlement types to impact

Analysis of the EOI in NSW that are used in irrigated agricultural production suggests these can be characterised in a way that helps understand their relative impact on socio-economic outcomes, and therefore assessed for their potential economic impact and targeted to manage or mitigate such impacts. Detailed analysis is provided at Section 6.3.

Conditions on participation

An important consideration in managing impact is the water demand response linked to buyback – i.e. whether demand is taken out (production exits with the water), or if irrigation businesses are left competing for less water in the consumptive pool (same demand). Purchase programs could be modified, through conditions on participation, to manage issues related to this, for example an exit program with shut down – linking purchase to irrigator exit and reduction in use by the buyback participant, versus taking the water and leaving IIOs, communities and industries to work out how best to respond.

Other considerations for conditions (or targeting) could include:

- Purchasing from non-water users who might be leasing out water – if water is purchased which has associated leases in place, there may be a case for those leases continuing for a period so that there is time to adjust. However, ultimately, purchasing water entitlements from those who lease out the water will still reduce the consumptive pool and is not necessarily a means of reducing long term socio-economic impacts.

- If only purchasing water out of the southern MDB, the dispersion of the impact (through the market, due to changes in location in use) will make it very hard to pre-emptively target areas for community adjustment, as the location of impact will not be easily identified.

Further, a purchasing program could require that only private divertors outside irrigation districts can participate, or that only those within a certain district or part of a district, can. There may also be conditions that favour purchase in particular districts. The objectives of this could include trying to ensure the viability of the irrigation district, or conversely, supporting its exit (or parts thereof, such as achieving system rationalising through purchasing programs). Another could be that participants in purchase programs cannot participate in (or have not previously participated in) water efficiency programs and ensuring on farm grants programs and buyback are not mixed.

Consistent with the above, conditions on participation could be used to manage or mitigate certain outcomes or achieve other objectives (e.g. where an area is known to be marginal, the purchasing could seek to speed up exit or rationalisation, or vice versa). In this way, conditions can be implemented to target certain objectives and manage economic considerations.

Timing considerations

Timing considerations relate to the ability of those directly or indirectly affected to adapt, more so than influencing the overall impact. For example, the short run impacts could differ depending on how the process is managed, but over longer timeframes (and at state or national scales) the total impact is likely similar (and linked to how much water is no longer used in production).

However, timing can also be linked to better information and better decisions so those that do need to exit and adjust make the right decision to do so, and those that should stay make the decision to stay and not sell out quickly.

Strategies around timing could include providing sufficient notice and signalling of intent of the timing and scale of a program in a particular region, which could provide more (or less) opportunity for business and succession planning and adjustment decisions to occur. These are important decisions for irrigation businesses and supporting them to make informed good decisions could have a material impact on their wellbeing and business health. Having individual irrigation businesses make good decisions will also likely be correlated with reduced broader community impacts.

Conversely, there is an argument that completing purchasing programs quickly could be better if it provides clarity or certainty and gets to a new set of operating arrangements more quickly (rather than dragging the process, and period of adjustment out unduly) but in such cases some could be caught out by the pace of change, particularly if there is inadequate signalling and information, or support where warranted. Alternatively, proceeding on a region-by-region basis, and then never coming back could be appropriate. Coming back into the market in multiple tranches would likely be disruptive to the market and to the confidence of people and might be better avoided.

There may also be merit in providing individuals or communities with an understanding of what exit packages might look like in particular areas – for example, signalling of intent to purchase in, for example, 12 months' time – with the suggestion that individuals and communities work out whether and to what extent they want to participate and organise themselves for the outcome that follows.

Information provision

Information provision will be critical to confidence and is closely related to the timing consideration. For example, whether programs are designed to support (or require exit), whether they are

ambivalent, or whether they are structured to help ensure dependent businesses and communities remain, will all inform the planning and investment, or other decisions made by those whose economic activity is dependent on the water being purchased.

In this way, purchasing programs can do more than simply signalling the intent purchase water for the environment, and do and say more to inform communities in affected areas about broader intent. Irrigators and communities will want information or guidance on what should be expected after the purchasing – making decisions using bad information about what the future might look like could result in worse adjustment outcomes. This could extend to providing information on what it looks like to either sell, or not sell, which may support impacts being lessened.

A further critical point is for Government to not send conflicting signals. Examples include modernising infrastructure or providing on farm grants in a particular location and then government comes in purchasing water for the environment in the same location. Ideally demand should shift out of irrigation, but there is a risk that individuals sell part of their water and don't invest in becoming more water efficient, but don't exit either.

Other socio-economic considerations

Other considerations include those of procedural fairness, that have an impact on trust in government, and the potential for gaming of purchase programs, that could lead to frustration of participating or non-participating irrigators. These include:

- the potential for participants to sell to the Commonwealth but who buy water back later
- people that miss out may feel pressure
- those that remain might observe others profit from it
- community perceptions and culture issues, including the effects of a perception of 'sell outs' which may negatively affect communities.

These issues can contribute to breakdowns in relationships and trust within irrigation communities, as well as between these communities and governments, and their significance should not be underestimated.

5.3.4. Past programs and structural adjustment literature

A synthesis and summary of past purchasing programs and select structural adjustment literature is provided in Appendix B, and re stated in brief below.

Bridging the gap purchase program in 2023

- The program clearly indicated volumes sought from different catchments but did not specify entitlement types or volume targets specific to certain types of entitlement.
- There was a notice period for the program, but the Commonwealth was criticised by irrigation stakeholders for the limited notice period. The official approach to the program was announced in February 2023, which provided approximately one month lead time for prospective Tenderers.
- A voluntary open tender was used. Conditions on participation related to parcel size (minimum 10 ML), current entitlement availability, and the catchment/location of entitlement.
- No price guidance was provided.

- The approach to evaluating tenders was based on a value for money assessment defined as ability to meet the SDLs, prices offered and other financial factors, and environmental utility.
- The Commonwealth has indicated the tender was oversubscribed (noting purchasing was not solely undertaken in NSW), suggesting there may be latent demand in the catchments specified.

Earlier Commonwealth purchase programs

- Earlier tenders were well subscribed, however the Commonwealth often paid at or above market prices, and there are now significant differences in market dynamics which need to be considered.
- There were perceptions that some prior programs were not sufficiently strategically targeted.
- There was limited information available to irrigators to aid decisions about future implications of selling entitlements and/or remaining as an irrigation business.
- Some participants may have made less than optimal decisions about participation including given limited information. Consequences have included greater reliance on water allocation markets, which exposed many to high allocation prices during drought.
- There was some 'gaming' of previous programs, with strategic participation and market re entry.
- There has been limited ongoing monitoring or subsequent evaluation of the direct and flow on impacts of previous purchase programs. This has contributed to highly polarised debate about the significance of the impacts of buybacks.
- Buybacks have not been well supported beyond those who participated, and negative sentiment has made water policy and reform more contested and difficult to implement.
- Strategic purchases of land and water may have had comparatively less broader water market and socio-economic concerns about flow on impacts, notwithstanding some transactions may have had impacts.
- Some issues occurred with irrigation districts such as those who remained shouldering a greater burden for costs, and some who may have wished to continue irrigating found themselves the focus of localised exit programs.

Structural adjustment literature

- Government water purchasing for the environment can be characterised a policy driven adjustment event (a reform), for which government may be viewed as being responsible for managing or assisting any necessary transition that results from the event.
- Government may have a stronger case to intervene in these cases and can do so through reform modification (e.g. purchase program design), direct compensation (e.g. water purchases), special adjustment assistance (e.g. assistance to affected communities who weren't paid for water entitlements), capacity building and information provision, or indirect assistance (or combinations).
- Reform modification (see Appendix B -) can involve ex-post modification (changing the reform following initial implementation to achieve better adjustment outcomes), signalling and phasing (to allow for preparation and time to adjust), dilution (limiting the extent or reach of the reform), or broad-based reform (combining the reform with a range of other policy changes to the impacts are more manageable).
- Modifying the design and implementation of a water recovery purchase program, such as targeting entitlement types to manage socio-economic impacts, is a form of reform modification, and

potentially a way of assuring successful reform implementation. Previous programs have been modified at times, although not necessarily in the same specific way.

- Evidence suggests that delaying or preventing necessary change can have worse outcomes than engaging with and supporting and facilitating it, and support can be warranted and beneficial where it facilitates change consistent with clear and agreed objectives (rather than avoiding it).
- While extending timeframes can have negative effects (such as increased uncertainty) there are benefits in ensuring those affected have sufficient time to understand the implications of the reforms, and plan and act effectively in response.

6. Recommendations on program design

6.1. Scope of recommendations on program design

The scope of this section is to recommend water purchase program design options that would minimise the socio-economic impact on communities identified in Section 3.

6.2. Recommendations

Aither makes the following recommendations in response to the questions put to us by NSW DCCEEW, reflecting on the analysis in this report and prior work:

1. **Target entitlement purchases.** Focus purchasing on entitlements that generate the least negative socio-economic impacts. Avoid purchasing entitlements that have the highest relative socio-economic impact (including based on their reliability and drought resilience characteristics). Undertake some recovery in the northern MDB.

This is the most material and direct way to minimise socio economic impact. There is clear potential to select entitlements based on type and location that will be relatively less impactful on production and hence on economic and social outcomes. Strategies may be available to acquire large volumes of some targeted entitlement types. Conversely some entitlements should be avoided to mitigate socio-economic impacts (see further detail in Section 6.3).

2. **Clearly communicate strategy and intent**. High quality information on targeted entitlements, overall approach to purchase rounds, and the implications for water markets will help entitlement holders consider their options, and the implications of participating or not participating in programs.

When individual entitlement holders make decisions based on good information, the longer-term socio-economic outcomes are likely to be better than they otherwise would be. It will be beneficial to provide the time and information for entitlement holders and other people in irrigation communities to make informed decisions.

3. **Design the program to manage timing and sequencing concerns.** Any purchase program should provide sufficient notice for potential participants to carefully consider their options and give careful consideration to the possible impacts of achieving program targets quickly versus more slowly. If staging programs, this should be clearly signalled in advance and the rationale provided, and plans maintained once signalled.

The duration and speed of programs can influence planning and investment decisions of those participating and those that might experience flow on impacts. Providing more notice may provide more time to plan and adapt leading to better decisions and less impacts, while drawn out or uncertain processes (including those which change unexpectedly) can contribute to uncertainty and maladaptation, including shocks and uncertainty which destabilise communities and industries, and undermine confidence.

4. **Execute the program effectively and efficiently**. The approach to market should be clearly signalled in advance with sufficient detail. The execution of transactions (after closing periods) should also be as fast as possible, with implications made clear for future rounds of buyback based

on results. Targeting specific entitlements first, then moving to other entitlements is likely to be beneficial.

An uncoordinated and ad hoc approach to market risks entitlement holders making poor decisions that increase negative socio-economic impacts. It would also adversely affect trust in government and water policy.

5. **Consider exit grants in combination with buyback**. Whilst not recommended due to high irrigation reliance, if pursuing High Security entitlement in the southern connected MDB, consider combining buyback with exit grants particularly for small block permanent plantings.

Reducing High Security entitlement will increase water availability risks to remaining permanent plantings during dry periods. One approach to offset these risks is to combine buyback with an exit grant program. This would ameliorate the impacts on remaining irrigators and may be beneficial given current economic challenges facing many viticulturalists particularly.

6. **Target industry and community assistance**. If concentrating purchases in the southern MDB, consider targeted industry and community assistance in other areas likely to be most affected (e.g. Upper Murray and Murrumbidgee – broadacre irrigation and rice growing industry and communities).

Evidence suggests that a large volume of water recovered in the southern MDB could result in material reductions in water used in these regions, which would likely have flow on impacts to vulnerable irrigation dependent communities. Assisting adjustment has the potential to reduce the socio-economic costs but needs careful design.

7. **Consider system rationalisation opportunities**. If purchasing from entitlement holders within irrigation districts, consider potential system rationalisation.

This will reduce the impacts on the viability of IIOs and remaining customers and potentially deliver enhanced water savings.

6.3. Supporting rationale and discussion

6.3.1. Preliminary assessment of the type of entitlements that have the biggest influence on socio-economic impacts

Entitlements purchased, including their type, location, volume, and proportion of water in use, are the most direct pathway to economic, and consequently social, impact. Other elements of purchase program design may have influence on these outcomes but are likely to be less material. As a result, careful selection and targeting of entitlement type is the most material way of managing or minimising economic and social impacts that may result from purchasing programs.

Analysis of the EOI in NSW that are used in irrigated agricultural production suggests these can be characterised in a way that helps understand their relative impact on socio-economic outcomes (and potential targeting to manage impact or outcomes). Detailed analysis is provided in Table 12 with relevant insights of this analysis provided below.

Aither has outlined the major EOI in NSW across the MDB and detailed the consumptive entitlement on issue that could be targeted in the northern and southern MDB in NSW. We have adjusted the consumptive entitlement on issue to consider the LTDLE factor for each entitlement type so that the potential contribution to the 450 GL target is clear.

We considered the following factors to establish a preliminary relative assessment of the socio-economic impacts of water recovery of LTDLE across each of the entitlement types:

- average annual total use (2012-14 to 2022-23)
- utilisation as measured by average annual total use as a percentage of average annual allocation
- take and use conditions and restrictions that limit value in production
- productive reliance
- contribution to drought resilience through provision of high security water allocation and carryover.

In undertaking the assessment, we have also reported on the major crop type or productive use linked to the entitlement type and the industries and towns most likely affected by a reduction in each entitlement type.

A preliminary assessment framework is detailed in Table 10. Some of the assessment criteria are informed by Aither's water system and market knowledge. Further testing and refinement of the assessment framework is warranted if this were to be used in program design however, we believe the general findings will be robust.

Using the criteria, we have categorised the relative socio-economic impact. This approach provides a possible foundation for a method to achieve NSW based contribution targets to the 450 GL in a way that is relatively less damaging to socio-economic outcomes.

Table 10 Relative socio-economic impact assessment criteria

Relative socio-economic impact assessment	Assessment criteria
Higher	• High annual utilisation. • Critical to drought resilience (highly reliable) or supports drought resilience through carryover provisions. • Water users within IIO areas and Private Irrigation Districts (PID) are highly reliant on this entitlement. • High productive reliance (permanent horticultural and/or high-value annual cropping)
Medium-higher	• High annual utilisation. • Supports drought resilience through carryover provisions. • Water users within IIO areas and PID are highly reliant on this entitlement. • High productive reliance (high value annual crops and/or permanent horticulture)
Medium	• Moderate to high annual utilisation • Localised use due to take restrictions (supplementary or unregulated entitlements).

Relative socio-economic impact assessment	Assessment criteria
Lower	• Lower annual utilisation. • Lower reliability. • Localised use due to take restrictions (supplementary or unregulated entitlements). • Lower productive reliance

Average annual use analysis in the following tables references data from 2013-14 to 2022-23, sourced from the NSW water register and NSW DCCEEW publications.

Table 11 NSW southern MDB – relative socio-economic impact assessment

Entitlement	% of total EOI currently held for the environment	LTDLE factor	Consumptive EOI (LTDLE)	Consumptive EOI (nominal)	Average annual total use as a % of average annual volume allocated	Relative socio-economic impact assessment	Region	Major associated regional towns
NSW 10 Murray HS	20%	0.873	16.15 GL	19 GL	59%	Higher	Above Choke Murray	Deniliquin, Jerilderie, Moulamein, Balranald
NSW 10 Murray GS	28%	0.699	654.43 GL	936 GL	55%	Medium-higher	Above Choke Murray	Deniliquin, Jerilderie, Moulamein, Balranald
NSW 11 Murray HS	12%	0.873	127.89 GL	146 GL	59%	Higher	Sunraysia	Wentworth, Balranald
NSW 11 Murray GS	32%	0.699	176.91 GL	253 GL	55%	Higher	Sunraysia	Wentworth, Balranald
NSW Murray Supplementary Water	40%	0.703	107.11 GL	152 GL	27%	Lower	Sunraysia – Riverina	Wentworth, Balranald
NSW Lower Darling HS	61%	0.931	2.83 GL	3 GL	32%	Higher	Sunraysia – Darling	Wentworth, Menindee
NSW Lower Darling GS	87%	0.734	7.45 GL	10 GL	98%	Medium-higher	Sunraysia – Darling	Wentworth, Menindee
NSW Lower Darling Supplementary Water	100%	-	0 GL	0 GL	0%	n/a	Sunraysia – Darling	Wentworth, Menindee

Entitlement	% of total EOI currently held for the environment	LTDLE factor	Consumptive EOI (LTDLE)	Consumptive EOI (nominal)	Average annual total use as a % of average annual volume allocated	Relative socio-economic impact assessment	Region	Major associated regional towns
NSW Murrumbidgee HS	4%	0.977	340.20 GL	348 GL	84%	Higher	Riverina	Balranald, Hay, Griffith, Leeton, Narrandera, Wagga Wagga, Jerilderie
NSW Murrumbidgee GS	25%	0.591	835.44 GL	1,414 GL	66%	Higher	Riverina	Balranald, Hay, Griffith, Leeton, Narrandera, Wagga Wagga, Jerilderie
NSW Murrumbidgee Supplementary Water	14%	0.377	64.13 GL	170 GL	46%	Medium	Riverina	Hay, Griffith, Leeton, Narrandera, Wagga Wagga, Jerilderie
NSW Murrumbidgee Supplementary Water (Lowbidgee)	74%	0.359	68.97 GL	192 GL	8%	Lower	Riverina	Balranald
NSW Lachlan GS	21%	0.396	185.44 GL	468 GL	47%	Higher	Riverina	Hilston, Condobolin
NSW Lachlan HS	10%	0.927	23.13 GL	25 GL	47%	Higher	Riverina	Hilston, Condobolin
TOTAL CONSUMPTIVE EOI (LTDLE) NSW southern MDB			2,959 GL					

Table 12 NSW northern MDB - relative socio-economic impact assessment

Entitlement	% of total EOI currently held for the environment	LTDLE factor	Consumptive EOI (LTDLE)	Consumptive EOI (nominal)	Average annual total use as a % of average annual volume allocated	Relative socio-economic impact assessment	Region	Major associated regional towns
NSW Macquarie And Cudgegong HS	0%	0.668	9 GL	14 GL	44%	Higher	Central West	Dubbo, Narromine
NSW Macquarie And Cudgegong GS	28%	0.516	236 GL	458 GL	46%	Higher	Central West	Dubbo, Narromine
NSW Macquarie And Cudgegong Supplementary Water	19%	0.588	24 GL	40 GL	30%	Lower	Central West	Dubbo, Narromine
NSW Peel HS	0%	0.393	0.3 GL	1 GL	35%	Higher	Namoi	Tamworth
NSW Peel GS	4%	0.209	6 GL	28 GL	35%	Medium-higher	Namoi	Tamworth
NSW Upper Namoi HS	0%	0.723	0.06 GL	0 GL	31%	Higher	Namoi	Narrabri, Walgett, Wee-Waa
NSW Upper Namoi GS	1%	0.753	9 GL	12 GL	32%	Medium-higher	Namoi	Narrabri, Walgett, Wee-Waa

Entitlement	% of total EOI currently held for the environment	LTDLE factor	Consumptive EOI (LTDLE)	Consumptive EOI (nominal)	Average annual total use as a % of average annual volume allocated	Relative socio-economic impact assessment	Region	Major associated regional towns
NSW Lower Namoi HS	0%	0.723	2.5 GL	3 GL	30%	Higher	Namoi	Narrabri, Walgett, Wee-Waa
NSW Lower Namoi GS	6%	0.753	174 GL	231 GL	69%	Higher	Namoi	Narrabri, Walgett, Wee-Waa
NSW Lower Namoi Supplementary Water	0%	0.279	32 GL	115 GL	28%	Lower	Namoi	Narrabri, Walgett, Wee-Waa
NSW Gwydir HS	29%	0.886	13 GL	14 GL	51%	Higher	Border Rivers / Gwydir	Moree, Boggabilla, Bingara
NSW Gwydir GS	21%	0.380	153 GL	403 GL	70%	Higher	Border Rivers / Gwydir	Moree, Boggabilla, Bingara
NSW Border Rivers (GS A)	0%	0.976	21 GL	22 GL	46%	Higher	Border Rivers / Gwydir	Moree, Boggabilla, Bingara
NSW Border Rivers (GS B)	1%	0.337	80 GL	238 GL	46%	Higher	Border Rivers / Gwydir	Moree, Boggabilla, Bingara
NSW Border Rivers Supplementary Water	1%	0.697	83 GL	119 GL	29%	Lower	Border Rivers / Gwydir	Moree, Boggabilla, Bingara

Entitlement	% of total EOI currently held for the environment	LTDLE factor	Consumptive EOI (LTDLE)	Consumptive EOI (nominal)	Average annual total use as a % of average annual volume allocated	Relative socio-economic impact assessment	Region	Major associated regional towns
NSW Gwydir Supplementary Water	13%	0.485	77 GL	158 GL	27%	Lower	Border Rivers / Gwydir	Moree, Boggabilla, Bingara
NSW Barwon Darling Unregulated River	0%	1	1.5 GL	1.5 GL	10%	Lower	Far West	Walgett, Brewarrina, Bourke, Tilpa, Wilcannia
NSW Barwon Darling Unregulated A Class	0.7%	1	9.9 GL	9.9 GL	75%	Higher	Far West	Walgett, Brewarrina, Bourke, Tilpa, Wilcannia
NSW Barwon Darling Unregulated B Class	12.1%	1	133 GL	133 GL	81%	Higher	Far West	Walgett, Brewarrina, Bourke, Tilpa, Wilcannia
NSW Barwon Darling Unregulated C Class	27.3%	1	46 GL	46 GL	52%	Medium-higher	Far West	Walgett, Brewarrina, Bourke, Tilpa, Wilcannia
TOTAL CONSUMPTIVE EOI (LTDLE) NSW northern MDB			1,110 GL					

Table 13 NSW Intersecting Streams Unregulated – relative socio-economic impact assessment

Entitlement	% of total EOI currently held for the environment	LTDLE factor	Consumptive EOI (LTDLE)	Consumptive EOI (nominal)	Average annual total use as a % of average annual volume allocated	Relative socio-economic impact assessment	Region	Major associated regional towns
Barwon River	-	1.0	3.24 GL	3.24 GL	n/a	Low	North-West	Brewarrina
Mooni River	-	1.0	1.05 GL	1.05 GL	n/a	Low	North-West	Brewarrina
Narran River	-	1.0	8.83 GL	8.83 GL	n/a	Low	North-West	Brewarrina
Culgoa and Bokhara River	-	1.0	2.98 GL	2.98 GL	n/a	Low	North-West	Brewarrina
Warrego River	82%	0.167	3 GL	18 GL	17%	Medium	North-West	Bourke, Louth
TOTAL CONSUMPTIVE EOI (LTDLE) **NSW northern MDB – Intersecting streams**			19 GL					

6.3.2. Further explanation of the assessment

Water-use analysis

Based on water-use data from 2013-14 to 2022-23 from NSW DCCEEW, the average annual use as a percentage of regulated EOI across the NSW MDB is 51 per cent. Regulated entitlements in NSW's southern connected MDB on average have a higher utilisation at 66 per cent. However, there is significant variation in average use for individual entitlement types across NSW – i.e. some have much greater use, on average, than others.

Where entitlements have high utilisation, especially high security, further reduction in the consumptive pool is more likely to have adverse impacts on productive capacity in regional areas. Conversely, less utilised entitlements are likely to have less impacts.

Reliability, resilience and productive reliance

High security water entitlements are by their very nature highly reliable and provide an important foundation of water supply on an annual basis for high value production, including permanent horticulture. These entitlements are a critical source of water allocations through dry periods and play a key role in drought resilience.

General security water entitlements have lower reliability. However, they are generally highly utilised, in some instances even higher than high security entitlements. Allocations to these entitlements are vital for annual opportunistic crops which are important to regional GVIAP. General security entitlements are also a critical tool to manage drought resilience through the provision of carryover.

Any reduction in the volume of high security or general security entitlements is likely to affect productivity within the associated regions.

Supplementary water entitlements are very low reliability, take against these entitlements is opportunistic and therefore is unlikely to provide foundational supply for production. It is noted however that in some instances, on-farm storage could enable water stored from supplementary flows to play a material role in annual production. It is likely that recovery of these types of entitlements will have a lower impact compared with high security and general security water entitlements.

In unregulated systems, where the ability to take and use water is reliant upon predetermined flow rates, reliability can be highly variable. This depends on the location of the unregulated system and relative rainfall that contributes to inflows for the system.

In NSW average rainfall decreases the further west you are from the Great Dividing Range. According to the MDBA, the Barwon-Darling catchment in the far west of the state only uses 3 per cent of total surface water for irrigation. However, considering this, data from the NSW DCCEEW shows utilisation against entitlements is very high, suggesting that water users can respond relatively quickly to forecast conditions. This suggests that that any reduction in the consumptive pool in this system could have a higher impact on productive capacity.

The Warrego system however has low utilisation (16.7 per cent), and a high proportion of this system is already held for the environment (82 per cent). With low annual reliability, the impact of further recovery on is likely to be lower.

Connectivity

Connectivity across the southern MDB means that a reduction in the consumptive pool has the potential to impact at-risk irrigators across the connected system. Those who can least afford to pay for allocation water will experience the biggest impacts.

6.3.3. Implications for a targeted approach

Based on the assessment, a targeted approach is recommended to best manage the socio-economic impacts of further water recovery throughout the NSW MDB. The assessment shows that there are several entitlement types where the socio-economic impact is likely to be higher, and some where the impacts are likely to be comparatively less. Aither is not suggesting the impacts will be immaterial; it is merely a comparative and preliminary assessment based on our knowledge.

An example of higher socio-economic impact is the Murray system, in particular - below the Barmah Choke, where productive reliance and utilisation is high. Unfortunately, the NSW water register does not separate water use between the zones 10 and 11, however the concentration of permanent horticulture below the Barmah Choke would suggest that use is likely to be higher in this zone. Whilst high security entitlements are likely to be favoured by permanent horticulture for their high annual reliability, general security entitlements are critical for managing water security between years, especially through drought periods. In the northern MDB, where general security entitlements operate on continuous accounting, the productive reliance and utilisation on these entitlements is very high.

However, the data also shows entitlement types where material water recovery could occur with lower socio-economic impacts or where impacts are contained to a small area which could then be mitigated through structural adjustment programs. For example, supplementary water entitlements by their nature have a relatively low annual reliability, and thus are opportunistic entitlements that in most instances require perfect timing or on-farm storage to be useful – and so have a lower productive reliance.

For example, there are two supplementary entitlement types in the Murrumbidgee:

- Murrumbidgee Supplementary Water
- Murrumbidgee Supplementary Water (Lowbidgee)

Murrumbidgee supplementary water entitlements are relatively highly utilised at 46 per cent. Anecdotally, many irrigators use supplementary events in the Murrumbidgee to fill on-farm storage, making it an important tool for production and managing water costs. On the other hand, Lowbidgee supplementary entitlements exhibit a utilisation factor of 8 per cent, the lowest in the data set – except Lower-Darling supplementary which is entirely held for the environment.

On this basis there could be a comparatively lower impact opportunity in acquiring supplementary water in the Murrumbidgee (Lowbidgee) and Murray - which had the equal third lowest utilisation factor of 27 per cent. Acquiring all these entitlements could return up to 176 GL (LTDLE) from the consumptive pool in NSW southern MDB.

Take conditions mean that supplementary entitlements can only be traded within designated zones, meaning socio-economic impact from water recovery is also likely to be localised.

Table 13 assesses the impact of recovery in the far north-west of NSW, where there has been Commonwealth purchases and programs related to Narran Lakes and Toorale Station. The nature of these unregulated systems is high variability and low reliability. As such, the impact of further water

recovery in these areas is likely to be lower. Anecdotal evidence suggests that water holders in the area could be willing sellers. Socio-economic factors could be mitigated with targeted support.

Other lower impact options could include zones where the majority of water is already held by environmental water holders, for example the Lower-Darling where the environmental already owns 100 per cent of supplementary entitlements, 87 per cent of general security and 61 per cent of high security entitlements.

Here the impacts are contained to a relatively small area and targeted support could be deployed to assist the producers and their communities to adapt.

6.4. Further work and suggested next steps

Aither recommends that the NSW Government:

- engage in any detailed design of a water purchasing program led by the Commonwealth
- undertake or seek further assessment by the Commonwealth on the possible socio-economic impacts of water purchases
- continue to engage with irrigation communities to identify opportunities for water recovery
- continue current work on the design of adjustment assistance measures and integrate this with the design of any purchase program.

Appendix A - Conceptual framework

To properly understand and manage socio-economic impacts in this context, it is necessary to explain how water recovery for the environment can influence socio-economic outcomes. With this in mind, it is important to consider:

- Causal pathways, which in the case of water purchasing generally means taking water out of consumptive use, in different locations and extents, and returning it to the environment. It also means paying money to recipients which could be spent in a range of ways, saved, or used to reduce debt.
- Water sought through recovery programs is most likely used in production and is primarily being put to economic use in irrigated agriculture. In some cases, buying certain entitlements from some holders would prevent those entitlements being activated for use in the future.
- Water markets mean that the reductions in water use can be transmitted to other locations.
- Water use and associated economic activity directly supports profits and incomes, and broader economic outcomes, at individual, industry and community levels (including local or regional businesses, or services, linked to irrigated agriculture).
- That economic activity supports a range of social outcomes at different scales (e.g. local public and private services). Some social outcomes may be independent of the economic situation (but still linked to the productive use of water), but in considering modification to purchasing programs, it helps to contain the view of social outcomes to those which can be directly or strongly linked to water in production that is lost. Most social outcomes link to or follow from economic ones.
- Identifying and assessing potential impacts and thinking about how to mitigate or respond to them, should start by considering where, how, and to what extent water is recovered, and what impact that has on the economies and communities that rely (or relied) on that water.

Analysis of economic and social impacts or issues

Given the above, analysis of economic and social impacts or issues associated with water recovery should consider:

- Volumes, distributions, locations, and timing of water recovery.
- Methods of water recovery (e.g. purchasing vs on farm or off farm infrastructure, other efficiency projects).
- Use(s) of the water being recovered from the different locations (including the potential for redistribution via trade).
- Proportionality of the reductions (how much of the total water in use in a particular location is being recovered)
- Direct, and downstream, economic activity and interactions associated with the primary water uses or water users being impacted, including degree of dependence, and interactions within and across regions.
- Social outcomes or impacts that result from the altered or reduced economic activity, or any social impacts which may result from water recovery but are independent of the economic impacts.

- Potential or likely responses, or adaptations, that might autonomously occur in response – including but not limited to water trade, water use efficiency, and leveraging of economic diversity or strength, or resilience and adaptive capacity.

This report does not attempt to provide a comprehensive economic and social impact assessment of water recovery in NSW – hence it does not address all the above points in detail, however, Section 4 does explore several of the above elements in the context of potential water recovery scenarios in NSW towards the 450 GL target.

The following diagram provides a conceptual illustration of the points made above.

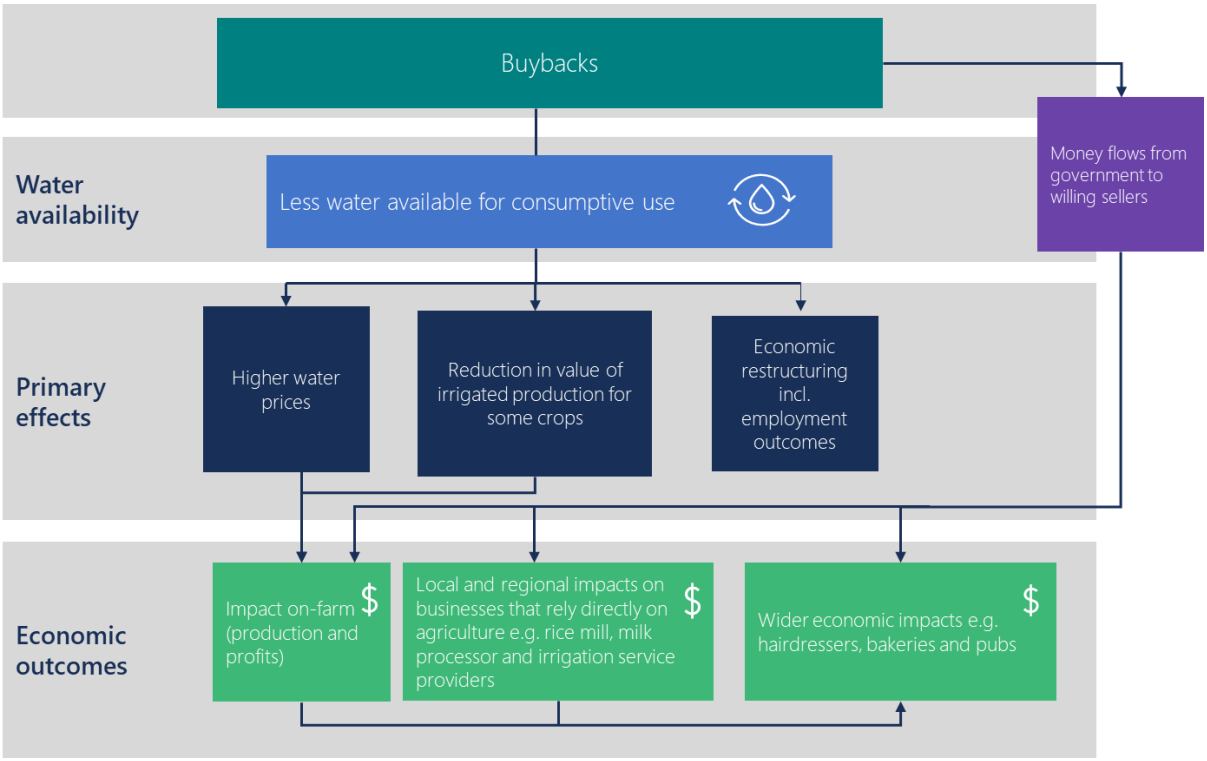


Figure 7 Conceptual map of the physical and socio-economic impacts of water purchase programs

Appendix B - Insights from past programs and structural adjustment

Approach to 'Bridging the Gap' program in 2023

The Australian Government ran a 'Bridging the Gap' water right purchase program in 2023 (the program), which applied the following approach to the elements of program design outlined earlier in this report. The program received approximately 205 tender responses. The following table provides more information on the purchase program according to the key elements of purchase program design identified in this report.

At the time of writing detailed results of the 2023 program (i.e. actual entitlement types and volumes acquired) were not known, and hence are not documented here.

Design element	Sub-element	Bridging the Gap
Water sought (scope of purchase)	Location	The program targeted water right purchases in 6 MDB catchments across NSW and QLD (Condamine-Balone, NSW Murray, Namoi, Border Rivers, Barwon-Darling and Lachlan)).
	Volume	The volume sought was 44.3 GL aggregate total with recovery targets set specifically for each catchment (e.g. 14 GL of surface water and 3.2 GL of groundwater specified as the target for the Condamine-Balonne).
	Type/reliability of entitlement	No specification was made about the type and/or reliability of entitlement to be purchased.
	Resource type	A distinction was made between surface water and groundwater for water entitlement purchases from the Condamine – Balone catchment.
	Specific targeting	Beyond the designated target catchment areas, and the 8 associated SDL units, as well as the Mandatory Requirements (see Contracting and Registration) no further specific requirements were set out.
Timing and sequencing	The program's total duration	Community engagement began in February 2023, with the release of the Strategic water purchasing framework – Bridging the Gap and supporting Factsheet, providing 1 month lead time to the tender process. The tender period was open for 77 days – from 23 March to 19 May 2023. Indicative period for offers being made to Tenderers was specified as July 2023 to August 2023.
	When the program occurs	The program was conducted within a single irrigation year, generally around the 'peak' irrigation period for crop types typically irrigated in the targeted catchments.
	Multiple rounds/tranches	The program had one round of tender.

Design element	Sub-element	Bridging the Gap
	Prior notice/signalling of intent	The Government announced the official approach to the program in February 2023 with the release of the Strategic purchasing framework – Bridging the Gap. Throughout March 2023, 9 information sessions in 8 locations with key stakeholders in the 6 catchments were conducted. Invitations were sent to key stakeholders who could provide a strong representation of community views and were able to share information with their communities. There was some inconsistency in the information specified in the documentation provided and what was implemented. See Information provision below.
Approach to market	Type of market approach	Voluntary open tender process conditional on a range of requirements from suppliers outlined in this Table including minimum parcel size, current entitlement availability, catchment/location of entitlement (see Conditions on participation).
	Broker or intermediary requirements	Brokers or intermediaries were not required to be engaged, nor excluded from the program.
Conditions on participation	Parcel sizes.	A minimum 10 ML parcel size tendered was required for consideration.
	Specific areas conditions	The program targeted water right purchases in 6 MDB catchments across NSW and QLD (Condamine-Balone, NSW Murray, Namoi, Border Rivers, Barwon-Darling and Lachlan). Tender offers for groundwater entitlement types were accepted in the Condamine-Balonne catchment.
	Requirement to exit irrigation	No requirements/conditions.

Design element	Sub-element	Bridging the Gap
	Water is or isn't leased out	Any existing encumbrances on the water entitlement were released at the point of transfer (i.e. mortgages). Water entitlement leases (while not strictly an encumbrance) were respected by the Commonwealth for the under the pre-existing existing leasing arrangements.
	Current or potential use	Tendered water rights needed to be: • available for sale the day the Tender was lodged • capable of assessment and potentially competitive in the context of an open market process • able to provide environmental utility and/or ability to support basin outcomes.
Pricing and sorting / accepting offers	Price guidance or acceptable prices	No price guidance was specified in the tender or supporting documentation. Tender offers were considered using the principles that a value for money assessment of purchasing a water entitlement could include: • achieving the Sustainable Diversion Limits (eligibility threshold) • water market price and other financial factors • environmental utility.
	Information provided on objectives adjustment support, or future viability of targeted regions.	The objective of the water recovery purchase program was to recover water entitlements to help achieve MDB outcomes, namely reduce the volume of water extracted for consumptive use to achieve the SDL. This objective was clearly communicated in the tender documentation and supporting factsheets and frameworks provided prior to implementation. No further information was provided regarding industry or community adjustment or socio-economic support, or about the future viability of targeted regions.

Design element	Sub-element	Bridging the Gap
Contracting and registration		The tender was managed through the AusTender procurement information system. Tenderers were required to provide their Tender offer consistent with the instructions, processes, procedures and recommendations outlined in the Approach to market documentation. Tender offers were evaluated on the basis of securing the best value for money, consistent with the Commonwealth Procurement Rules and contracts (sales agreements) were engaged on this basis. The process was conducted using a three-stage approach. 1. Initial screening, 2. Value for Money Assessment and 3. Value for Money Prioritisation. The mandatory requirements included: • Tenders must be submitted by the Water Right owner or their representative(s). • Tenderers must exist as a legal entity. • The total volume of the Water Right offered must not exceed the total nominal volume on the Water Right. • The volume of the Water Right offered must not be less than ten megalitres.
Information provision		There was some inconsistency between the target aggregate volume specified in the documentation provided prior to implementation (49.2 GL) compared to the Approach to Market (44.3 GL). This was due to water entitlements from the ACT catchment being specified as target entitlements (4.9 GL) in the prior documentation but not targeted in the program implementation. The objective of the program was clearly communicated in the tender documentation and supporting factsheets and frameworks provided prior to implementation (see Information provided on objectives adjustment support, or future viability of targeted regions). No further information was provided regarding adjustment or socio-economic support or about the future viability of targeted regions (noting this may not have been necessary or justified for this program).

Earlier Commonwealth purchase programs

Many of the published reports assessing previous water purchase programs focus on whether value for money was achieved by the Commonwealth. Given this Aither has sought to provide insights on implications of previous buyback design throughout this report, based on our knowledge and limited desktop review.

Additional specific insights from the previous buyback programs – when thinking about this from the perspective of market participants and irrigation communities – include:

- Previous open tender processes were well subscribed although the Commonwealth often paid at or above prevailing market prices. However, there are significant differences in the market dynamics that need to be considered for future buyback programs.
- There were perceptions that the open tender programs were not (sufficiently) strategically targeted to specific types of entitlements that would deliver the best outcomes. Previous programs appeared rushed with multiple rounds of purchases completed without clarity around the overall strategy, noting that this may have been driven by the desire to acquire water quickly following the millennium drought.
- There was limited information available to irrigators to aid decisions about future implications of selling entitlements and/or remaining as an irrigation business.
- Participants of buyback programs have benefited from funds to improve farm efficiency, pay down debt, transition from a sector, exit or retire. However, some of these irrigators likely made the decision to sell entitlements under financial duress or with limited information about future water availability.
- Greater reliance on the allocation market to substitute water shortfalls for those who kept irrigating led to a new business risk. Many farmers are now more vulnerable to the higher water prices during drier conditions because they no longer have access to their water entitlements, and these effects have been magnified during periods of low water availability and high prices.
- The angst about high water allocation prices during drought periods has had negative impacts for water policy and management in the Basin.
- Some irrigators that participated in buyback programs did so strategically and were subsequently able to re-enter the entitlement market later.
- Whilst there have been some surveys of buyback participants, these were at a point in time and there has been limited ongoing monitoring or subsequent evaluation of the direct and flow on impacts of previous purchase programs. This lack of evidence has contributed to a highly polarised debate about the significance of the impacts of buybacks.
- Buybacks have not been well supported by the wider community in irrigation regions (i.e. beyond those who participated). Negative sentiment has made water policy and reform more contested and difficult to implement. Future buyback programs and other water recovery efforts would benefit from improved community engagement supported by evidence on the benefits of water recovery to date and the intended outcomes of further water recovery.
- Historically, strategic purchases of land and water focused on large properties with significant water holdings, often outside the southern MDB. There have been questions about the processes and cost-effectiveness of these purchases, and certain purchases were suggested to have led to

negative socio-economic impacts, there have been comparatively less broader water market and socio-economic concerns about the flow on impacts of these purchases.

- Arguments have been made that different forms of water recovery have altered competitive advantage, including those who participate in a buyback program being worse off relative to farmers in regions where irrigation infrastructure upgrades were used to achieve water recovery.
- The purchasing of water entitlements has been suggested to have a greater impact on irrigators during droughts as buybacks exacerbated water reductions in drier years and increased water prices.
- Concerns were often raised that irrigators selling water entitlements would impact those providing services to those irrigators and people living in irrigation dependent communities. Flow on impacts including to service industries and businesses negatively affected by flow-on changes in supply chain demand, and the loss of community resources where there is a loss of human capital.
- Concerns have been expressed about third party impacts on those in irrigation districts including:
  - those remaining shouldering a greater burden for the costs for infrastructure maintenance and renewal
  - some wishing to continue irrigating in certain locations, but through circumstance have found they are the focus of localised targeted exit programs.

Structural adjustment considerations

The following provides a summary of structural adjustment and considerations to be made in the context of water purchasing programs. The summary draws upon the Aither (2014) report *Structural Adjustment in Regional Australia - Learning from experience, improving future responses*.

About adjustment and its drivers

Structural adjustment refers to changes in the size, composition and characteristics of industries which occur in response to a range of market, technological and environmental factors, as well as in response to government policy and reform. Changes may include the size of industries, the characteristics of the workforce and the size and mix of activities within regions.

Drivers for structural adjustment can be broadly categorised as:

1. Processes driven by non-policy related drivers; or
2. Processes driven by government policy initiatives.

Non-policy related drivers of structural adjustments are usually outside the control of individuals, industries, or governments, and often reflect aggregate changes in consumer preferences and broader changes in national and global economics. These include changes in commodity markets, droughts and floods, changing demand for Australian products, changes in manufacturing, population shifts, the value of the Australian dollar, and changes in the terms of trade.

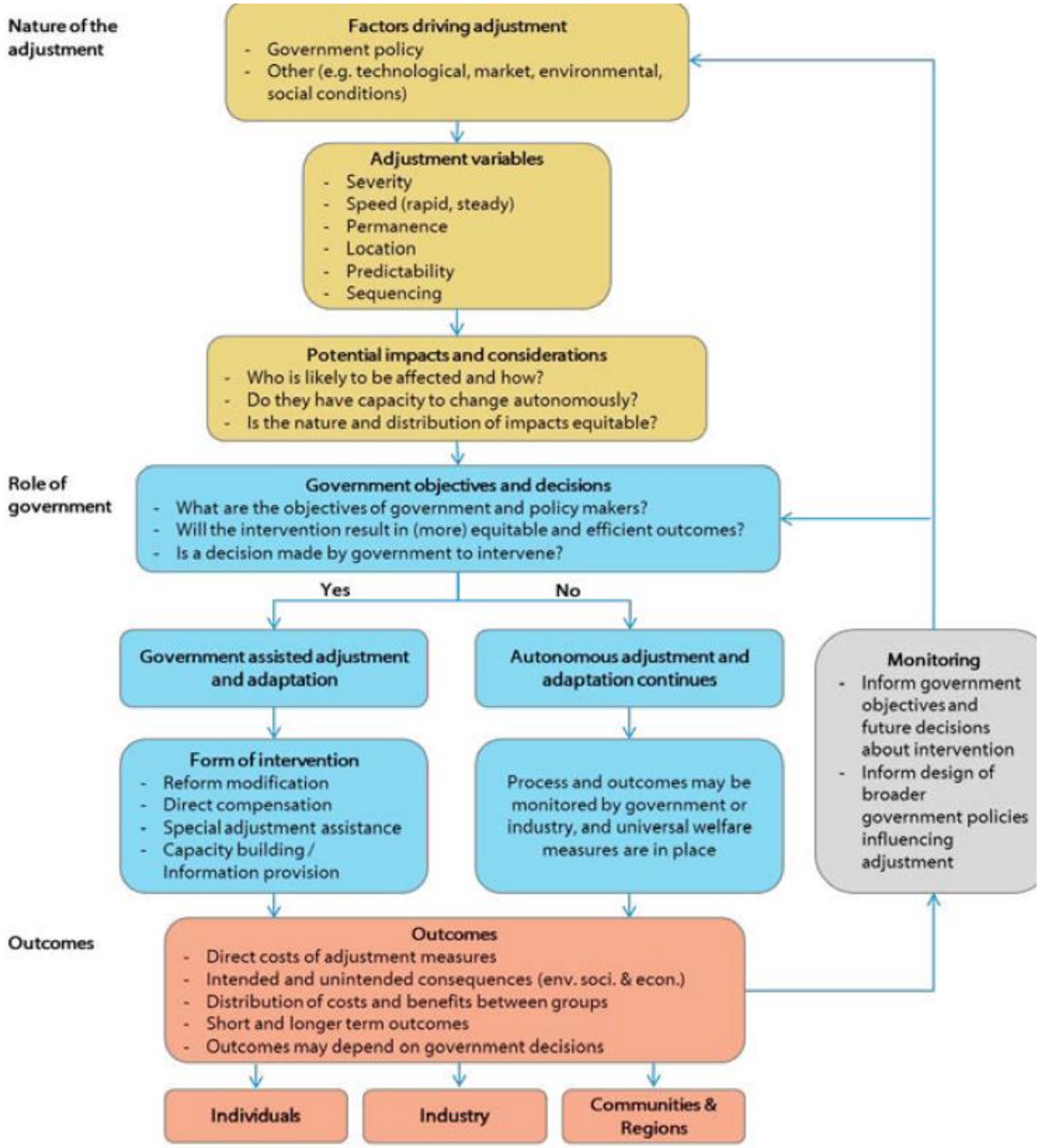
Government policy initiatives may seek an economic outcome or address social or environmental challenges. Such policies may include microeconomic reforms (e.g. deregulation) or environmental or social policies. Water buybacks are an example of a government policy initiative that has the potential to drive adjustment. The redistribution of water to the environment from such policy is aimed at

addressing impacts to the environment caused by overallocation. It has the potential to drive adjustment because it can influence whether and how water is used in agricultural production.

Conceptual framework

Aither's conceptual framework (Figure 8) outlines the structural adjustment process including structural adjustment drivers, the considerations for whether there is a case for government intervention, how the Government may or may not intervene, and the outcomes from the adjustment process on individuals, industry, communities and regions.

There are a range of factors that drive adjustment, these include market, environmental, social and technological conditions, as well as government policy. Change is natural part of evolution in the economy, however, there can be challenges associated with adjustment – some individuals, businesses and communities may be adversely affected in the process, and there are costs associated with transition, which should be considered, particularly where adjustment is policy-induced. Governments have to consider whether there is a case for government intervention to achieve more equitable and efficient outcomes or if it is more appropriate to let autonomous adjustment take its course.



Source Aither 2014

Figure 8 Conceptual framework for structural adjustment

Autonomous adjustment

Most adjustment occurs naturally and autonomously, and without specific government intervention. This is generally the most efficient outcome because individuals and firms observe and respond to market signals about the need for change and redistribution of resources throughout the economy. In broad terms, autonomous adjustment could also be argued to be equitable because adjustment costs are met by those who need to adjust. Autonomous adjustment encourages self-reliance and responsibility, independence, and responsiveness to market signals, and helps to avoid expectations of government support.

However, where there is severe or rapid change or where transitions are difficult or costly for those required to change, there may be an uneven distribution of costs and benefits. Those outside the particular industry undergoing change, such as individuals or communities whose service fails, or rapidly changing industries, may be caught short by the pace or scale of change. The impacts of change at the industry level can be more severe for communities or individuals where capacity to adapt is limited. These scenarios may be considered inequitable by those needing to adjust. Such situations may also be viewed as inefficient if the likely outcome of autonomous adjustment is increased long term social and economic costs. This suggests that certain adjustment situations may give rise to equity concerns there may be a legitimate case for government intervention.

Government intervention

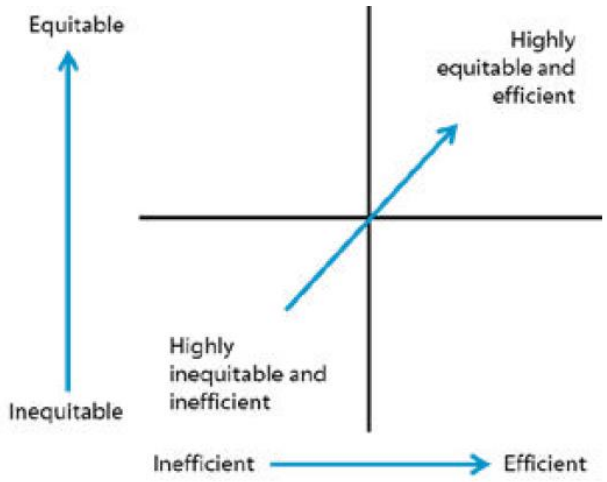
Government intervention occurs when the government decides to intervene in the adjustment process, with measures targeted at those most impacted and potentially also designed to achieve particular government objectives. Government objectives may include facilitating economic efficiency and change, addressing distributional or equity effects, meeting broader community expectations or buying reform (i.e. reducing concern amongst stakeholders, or addressing impacts, to implement reforms efficiently). Governments should consider interventions that aim to achieve the most equitable and efficient outcomes, but this can be challenging to determine particularly as the nature of what is considered 'equitable' can be contentious.

Some of the ways in which government can intervene include:

- **Capacity building/information provision:** Information is provided to individuals and businesses to help them understand policy reform (or other changes in adjustment drivers) and develop rational responses. This may also include retraining programs tailored to specific adjustment issues.
- **Reform modification:** Where transition pressures are a direct and immediate consequence of government policy reforms being pursued for reasons other than structural adjustment, one response involves changing that reform itself to better achieve adjustment objectives or to prevent unintended or perverse adjustment outcomes. This includes:
  - **Phasing**: implementing the reform over time to give affected parties time to adjust.
  - **Dilution**: limiting the extent of the reform.
  - **Broad-based reform**: combining the reform with a broad range of policy changes so that the impacts are more manageable.
  - **Ex-post modification**: changing the reform following its initial implementation in an attempt to better achieve adjustment objectives.

  Governments can modify reforms, such as the design of the water purchasing program, using the above approaches to avoid unintended outcomes and gain greater public support for its implementation.
- **Special adjustment assistance:** assistance measures aimed at helping individuals and firms by reducing adjustment costs and cushioning the adverse effects of either an ongoing transition or a specific policy change. An example of adjustment assistance includes providing assistance to affected communities who were not involved in the sale of water entitlements.
- **Direct compensation**: A lump-sum payment to identified losers from a specific policy change such as government purchases of water entitlements.

Figure 9 illustrates the concept that there are different levels of efficiency and equity inherent in different approaches to managing adjustment. This includes government interventions which (depending on their design) may be more equitable but may be inefficient (top left). Some government responses of the past have been both inequitable and inefficient because they have distorted change, rewarded rent seeking behaviour, not addressed equity concerns and come at high financial cost (bottom left).



Source Aither 2014

Figure 9 Efficiency and equity in responding to structural adjustment

Water purchasing programs as a policy driven structural adjustment

A water purchasing program in the MDB is an example of an adjustment driven by government policy. Government's objective is to reallocate water from consumptive users to the environment to improve the sustainable management of water resources.

The government obtains water entitlements by directly compensating willing sellers. Such programs are voluntary and water users are financially compensated. This provides sellers income and revenue to retire debt, reinvest or exit the irrigation sector and enter into new industries. There is an argument to say this is equitable and efficient and is a way of 'buying reform' (as opposed to, for example, compulsorily acquiring the entitlements, which would likely meet with resistance and could fail).

However, the process of purchasing water removes water from the consumptive pool, with some water moving out of production and associated reductions in production in the irrigation sector. For some irrigators or irrigation industries with greater adaptive capacity, impacts may be less significant. For others, including those directly or indirectly dependent on those irrigators or industries which reduce production, change could be difficult to adapt to.

Water rights purchasing program reform modification and complementary measures

Governments can support communities by modifying its reform or implementing complementary measures aimed at assisting communities through the adjustment period or using a combination of both. Policy initiatives may include:

- Modifying the reform to minimise socio-economic impacts by:
    - ensuring the Government purchases water entitlements from less regions less vulnerable to more water purchasing.
    - specifying the types of water entitlements purchased by the Government that will have the least socio-economic or community impacts first.
- Providing support to attract or develop alternative industries with the aim of diversifying the region's economy.
- Investing in education and services to promote regional population growth and increase skills within the community.
- Investing in capacity development and retraining in new industries to assist irrigators transition to new forms of employment.
- Providing training and information for new farming operations that are less water intensive.

Facilitating adjustment

In many cases adjustment to structural change is difficult to avoid. Early and positive actions, including engaging with change, is suggested to be more beneficial than delaying adjustment until a major crisis occurs. Avoiding adjustment is frequently unsustainable in the long term. Governments should consider early, strategic interventions that align with the achievement of specified objectives.

Governments should assist in adjustment situations where there are equity concerns, and the pace or severity of change is difficult, costly or where there is an uneven distribution of costs and benefits. Individuals or communities in these situations may be caught short by the pace or scale of change and the impacts of change can be more severe because their adaptive capacity is limited. In these cases, government assistance is warranted to avoid long-term social and economic costs that would have occurred if autonomous adjustment ran its course.

Broad based support instruments are often the best way to deal with the negative consequences associated with change, as the use of special adjustment assistance (i.e. subsidies) can disproportionately benefit larger producers and create equity concerns. Broad based support instruments include training, skills and capacity building. To address equity and community or regional impacts (rather than special interests), then an alternative approach to supporting industries would be to focus on the communities, and those who are most vulnerable. This could include focusing on information, skills, (re)training, education, regional public services, accessibility and appropriateness of general welfare and social security measures, regional networks and leadership, and adaptive capacity. Co-investment in new job creating activities may also be an option.

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