MARSDEN JACOB ASSOCIATES

economics
public policy
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strategy

Water for the Environment Special Account—2nd independent review

Advice to the independent WESA review panel

Final

13 December 2021

Prepared for Water for the Environment Special Account – Independent Review Panel and the Department of Agriculture, Water and the Environment.

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Acknowledgements

Marsden Jacob consulted widely for this report. We would like to acknowledge and thank all the people we engaged with during this project. The report is better for your input. All final recommendations and views in this report are attributable to Marsden Jacob unless otherwise stated.

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1. Executive summary

1.1 Second independent review of the Water for the Environment Special Account

The Minister for Resources and Water has appointed an independent panel to undertake the second Water for the Environment Special Account (WESA) review. The *Water Act 2007* (Cwth) (the Water Act) requires two reviews to be conducted to report on progress towards WESA outcomes.

The first review of the WESA was tabled in the Australian Parliament out of session on 2 October 2020. The government's response to the first review acknowledged that, based on progress at the time, it was unlikely that the target of 450 GL long-term diversion limit equivalent (LTDLE) per year of additional environmental water and the easing and removal of constraints would be achieved in full. It further accepted that, at the current rate, the total amount of the WESA would not be expended by 30 June 2024. The response stated that 'the Australian Government does not support amending the Water Act and Basin Plan to extend the time frames for recovery of the 450 GL LTDLE of additional environmental water or the constraints measure projects.'

The terms of reference for the second review require the panel to:

- review whether the money credited to the WESA is sufficient to, by 30 June 2024:
  - increase the volume of Murray–Darling Basin (MDB) water resources available for environmental use by 450 GL LTDLE
  - ease or remove the constraints identified by the Murray–Darling Basin Authority (MDBA) on the capacity to deliver environmental water to the environmental assets of the Basin
- consider the progress that has been made since the last review and is expected to be made towards achieving the 450 GL volume-outcome
- consider whether the design of projects funded by the WESA to date is likely to be effective for achieving that outcome
- provide a written report to the minister.

The terms of reference limit the scope of the review to matters directly related to the WESA.

1.2 Project scope

Marsden Jacob Associates has been engaged to update the analysis that we undertook for the first WESA review. This report presents the results of our analysis of the issues on which the panel is seeking input.

1.3 Summary findings

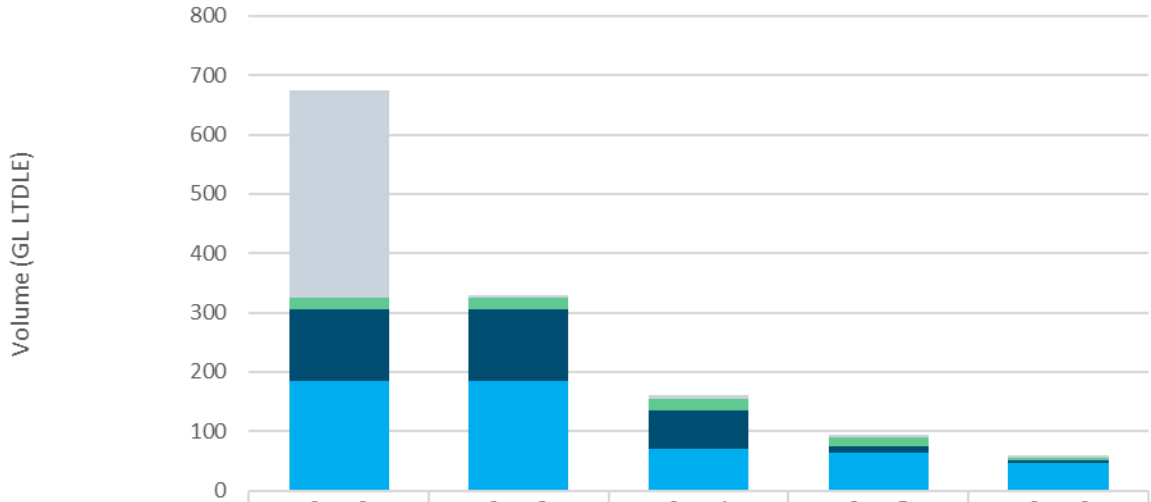
Key finding 1: The volume of water potentially recoverable in the Basin through water efficiency measures by June 2024 is estimated to be up to 60 GL

There is around 8,600 GL LTDLE of eligible surface water entitlements available in the MDB, excluding environmental holdings. Of that volume, we have estimated that the technical potential (Step 2 in Figure 1) is for up to 675 GL LTDLE to be recovered from water efficiency measures (encompassing on-farm, off-farm, urban, industrial, conveyance, and stock and domestic water). This amount has increased by 25 GL LTDLE from our first analysis because stock and domestic water was not previously considered and the LTDLE factors have changed.

WESA-funded efficiency measures programs are focused on off-farm projects. We estimate that, by removing all other on-farm opportunities, the potential for water recovery through a WESA-funded efficiency measures program focused on off-farm projects is up to 330 GL LTDLE with a range of 290 to 330 GL LTDLE (Step 3).

When socio-political drivers (Step 4), program attractiveness (Step 5) and time available (Step 6) are factored in, that reduces the upper bound estimate up to 60 GL LTDLE. Of which we note that 15.6 GL is already locked in for recovery from the Goulburn–Murray Water project.

Figure 1: Estimated water recovery under the WESA (GL LTDLE)



	Step 2	Step 3	Step 4	Step 5	Step 6
Up to	675	330	160	95	60
On-farm	350	5	5	5	5
Stock and domestic	20	20	20	15	5
Urban and industrial	120	120	65	10	3
Off-farm	185	185	70	64	47

Source: Marsden Jacob analysis.

Key finding 2: Water has become considerably more expensive since the WESA was established, but the budget should be adequate to recover 60 GL LTDLE

Since the establishment of the WESA, most MDB water markets have witnessed significant price increases.

High reliability/security water market prices in the southern MDB have remained stable, although there has been a slight decrease since the first review in November 2019. General security entitlement prices in NSW have increased by 10%–25%, and Victorian low reliability prices have also increased (the most significant increase has been in the Victorian Murray below Barmah Choke, where prices have effectively doubled). General security entitlement prices have increased in all northern MDB catchments since November 2019.[1]

Based on the remaining WESA funding of $1.54 billion, there will be sufficient funds to recover 60 GL LTDLE if all recoveries comprise a mix of general and high security entitlements. Only in the unlikely event that only high security entitlements are recovered with a market multiple of 3.75 would funding appear to be insufficient.

Key finding 3: There is insufficient funding to recover 450 GL LTDLE

The increase that has occurred in market prices means that there is insufficient funding available to recover 450 GL LTDLE, and market prices would have to fall back dramatically for that conclusion to change.

Key finding 4: New program arrangements appear to be leading to heightened interest and optimism that the speed of water recovery will increase

Since the first review, the key changes to the WESA-funded efficiency program (the Off-farm Efficiency Program, OFEP), include:

- removing the market multiple of 1.75. The market multiple is still considered, but the previous cap has been relaxed so that other benefits associated with infrastructure investment can be achieved.
- changes to the funding arrangement between the Australian Government and the states
- a more defined role for the department/Commonwealth in funding projects and working with partners
- a shift to focus predominantly on off-farm projects.

Interviews undertaken to support this analysis identified the following:

- The fixed market multiple of 1.75, which previously limited the value of funded projects in the earlier Water Efficiency Program, has been removed. A higher limit on the market multiple available under the OFEP is expected to unlock a number of projects that were previously considered financial unviable by proponents.
- Off-farm projects will be driven by the attitudes of irrigation infrastructure operators and the MDB states to water recovery. Potential off-farm project proponents have noted that it is essential for any efficiency measures project to have a measurable impact on the efficiency of their networks.

[1] Market values in this report are as at September 2021

- While crop water usage and commodity types are important considerations for any potential OFEP project, they are most important for on-farm projects. As a result of on-farm measures playing a smaller role in the OFEP, water usage and commodities circumstances will have a lower overall impact on likely participation in the program.

2. Introduction

Marsden Jacob has been engaged to assist the Department of Agriculture, Water and the Environment and the panel to undertake the second independent review of the WESA.

2.1 Second independent review of the Water for the Environment Special Account

The Minister for Resources and Water has appointed an independent panel to undertake the second Water for the Environment Special Account (WESA) review.

The *Water Act 2007* (Cwth) (the Water Act) requires two reviews to be conducted to report on progress towards WESA outcomes. The first review of the WESA was tabled in the Australian Parliament out of session on 2 October 2020.

The government's response to the first review acknowledged that, based on progress at the time, it was unlikely that the target of 450 GL long-term diversion limit equivalent (LTDLE)[2] per year of additional environmental water and the easing and removal of constraints would be achieved in full. It further accepted that, at the current rate, the total amount of the WESA would not be expended by 30 June 2024. The response stated that 'the Australian Government does not support amending the Water Act and Basin Plan to extend the time frames for recovery of the 450 GL LTDLE of additional environmental water or the constraints measure projects.'

The terms of reference for the second review require the panel to:

- review whether the money credited to the WESA is sufficient to, by 30 June 2024:
  - increase the volume of Murray–Darling Basin (MDB) water resources available for environmental use by 450 GL LTDLE
  - ease or remove the constraints identified by the Murray–Darling Basin Authority (MDBA) on the capacity to deliver environmental water to the environmental assets of the Basin
- consider the progress that has been made since the last review and is expected to be made towards achieving the 450 GL volume outcome
- consider whether the design of projects funded by the WESA to date is likely to be effective for achieving that outcome
- provide a written report to the Minister.

[2] LTDLE is a method used to standardise the calculation of expected water recoveries in the MDB from different water access entitlement categories and across catchments in the Basin. In short, each entitlement type across the MDB has a calculated LTDLE factor (between 0 and 1). The registered nominal volume of an entitlement is then multiplied by that factor to calculate the entitlement's LTDLE volume. It is important to make the distinction between the nominal and LTDLE volumes of entitlements, as MDB water recovery is measured on an LTDLE basis. It is noteworthy that LTDLE factors are focused on historical patterns of water usage and allocation yield for different entitlement classes; they are not a prediction of or a guide to future water use.

The terms of reference limit the scope of the review to matters directly related to the WESA. The panel has recognised that a range of broader issues related to the MDB's water resources and the recovery of water for environmental use concern stakeholders. However, those broader issues are not the focus of this review.

2.2 Project scope

The Department of Agriculture, Water and Environment (DAWE) has engaged Marsden Jacob Associates (Marsden Jacob) to assist the panel. The terms of reference include:

1. Updating the analysis we provided to support the panel on water market insights, including prices and volumes of water within the MDB.
2. Updating the analysis we provided to support the panel's finding on the volume of water potentially recoverable in the Basin through water efficiency measures, given the combined effect of key limiting factors. Broadly, this has involved estimating:
    a. the size of the consumptive pool in the MDB that could potentially be drawn from for water recovery through WESA-funded efficiency measures programs
    b. the potential for water recovery through such programs that are focused on off-farm projects
    c. the potential for water recovery through such programs, considering limiting factors such as current social views, government policies and political positions
    d. the potential for water recovery through such programs, considering the programs' attractiveness to potential participants and any changes to those factors since the first review
    e. the potential for water recovery through such programs, given the time available to 30 June 2024, which is approximately 18 months shorter than at the first review
    f. the cost to recover the volume of water potentially recoverable in the Basin under such programs, given limiting factors
    g. the total volume that can feasibly be recovered with the remaining WESA funds, given current water market prices and market multiples
    h. the current total cost to recover 450 GL LDTLE through WESA-funded efficiency measures programs.
3. In providing the updates outlined above:
    a. ensure that the approach used is consistent with that used for the first report so that the outputs can be compared directly to those from the first review
    b. explain any changes in the input assumptions and data transparently, so the panel can identify the reasons for any changes in the outputs relative to those from the first review
    c. provide updated graphs and figures consistent with those included in the first report.

2.3 Water Efficiency Program

On 3 March 2021, the Minister for Resources and Water announced the closure of the Water Efficiency Program (WEP) to any further applications. The WEP provided funding to eligible water

rights holders in the MDB to help them upgrade their water infrastructure to improve water use efficiency. Applications received by 3 March were assessed using the existing processes. Three of the four delivery partners agreed to terminate their contractual arrangements. A fourth delivery partner will remain involved in delivering approved projects until 2024, when the remaining on-farm projects are to be completed.

2.4 Off-farm Efficiency Program

The Minister for Resources and Water also announced the Off-farm Efficiency Program (OFEP) on 3 March 2021 as the vehicle to recover up to 450 GL of additional environmental water using funds from the WESA.

The OFEP invests in water delivery infrastructure to reduce water losses in the MDB, providing benefits to water users and the community by sharing the water saved between consumptive users and the environment. Projects under the OFEP are financed based on the infrastructure costs rather than the value of the water recovered, which is the fundamental difference between the OFEP and the WEP.

The objectives of the program are to:

- better prepare water delivery networks, irrigators and communities for the future
- provide economic stimulus to support regional communities
- achieve neutral to positive socio-economic outcomes that are supported by the community
- reduce water losses to increase the volume of water available for the environment, irrigation networks, irrigators and communities
- enhance environmental outcomes in the MDB by increasing the volume of MDB water resources available for environmental use by up to 450 GL.

Funding under the OFEP is available through three streams:

- State-led Off-farm: $1.33 billion available for MDB states' delivery of eligible off-farm proposals
- Off-farm Efficiency Grants Program: $150 million available for the Australian Government's Business Grants Hub to deliver project proponents' eligible off-farm proposals
- State-led On-farm: $60 million is available for MDB states' delivery of eligible on-farm proposals.

The Australian Government has extensive experience in the funding of off-farm water efficiency through both state priority projects and programs such as the Private Irrigation Infrastructure Operators Program. However, a key difference with the OFEP is that most of the program delivery will now be a responsibility of the states (see Section 4.4 for more details).

2.5 A stocktake of open channel networks and concept proposals

In December 2019, the MDB Ministerial Council requested a list of off-farm infrastructure projects that could address water losses. The purpose of the open channel network stocktake was to

ascertain whether there are further opportunities for investment in water delivery infrastructure to improve efficiency, modernise networks and generate water savings by reducing water losses.

In June 2020, the MDB Ministerial Council broadened the scope of the stocktake to include off-farm infrastructure investments that could provide regional stimulus, contribute to agricultural productivity and/or result in water savings. The request also asked basin jurisdictions to identify the range of funding sources (regardless of their requirements) that may be available for projects in the MDB.

From July to August 2020, the department consulted off-farm stakeholders, and several entities provided concept proposals for the stocktake. They included Basin states, irrigation infrastructure operators, private irrigation districts and corporations able to provide off-farm water recovery.

Around 50 concept proposals involving approximately 70 GL of potential water recovery were included in the final report on the Stocktake of Off-farm Infrastructure Projects commissioned by the MDB Ministerial Council. The subsequent DAWE estimate of the water savings was 70-100 GL to be recovered under the OFEP by 30 June 2024.

3. Water market insights

3.1 Key findings

Since the establishment of the WESA, there have been significant price increases in most MDB water markets. This will have both positive and negative impacts on the WESA outcome. Beneficially, it means that projects that were not technically viable at lower market multiple price points are expected to be brought forward (see Section 4). Conversely, it means that the maximum volume that could potentially be recovered (if the take-up of the program were high) would be budget constrained (see Section 5.10).

In summary, our analysis of water market prices has identified the following:

- High reliability/security water market prices in the southern MDB remain stable, but with a slight decrease since the first review in 2019. In contrast, general security entitlement prices (NSW) have increased by 10%–25%. Victorian low reliability prices have increased; the most significant increase has been in the Victorian Murray below Barmah Choke, where prices have effectively doubled.
- Increasing demand for low reliability water is being driven by its carryover potential to help provide water across water years.
- Compared to the analysis undertaken at the time of the first WESA review, high security entitlement market prices in most northern MDB catchments have been relatively stable, although the liquidity is low.
- General security entitlement prices have increased in all northern MDB catchments since November 2019. This has been underpinned by drought conditions ending in mid-2020, significantly improving water availability through increased dam storage levels and announced allocations (see Figure 10) in those zones.
- While there have been changes to water market prices since the first WESA review, the key point is that prices remain high compared to when the WESA was established.
- Based on data from the Bureau of Meteorology's *Water information dashboard*,[3] the total volume of entitlement that was traded across the MDB has ranged from 500 GL to 780 GL (nominal) per year in the southern Basin and 300 GL to 600 GL (nominal) per year in the northern Basin. The Bureau of Meteorology's data includes outliers (such as zero value trades), when these are removed the 150 to 280 GL (nominal) per year in the southern Basin. This confirms that the market continues to be relatively liquid, and that transaction levels are significant greater than the volume that is likely to be recovered through water efficiency projects.

[3] Bureau of Meteorology, *Water information dashboard*, online.

3.2 Summary of current and outlook prices

Table 1: Current and outlook prices, southern MDB, as at September 2021 ($/ML)

Region	Entitlement type	Market price ($/ML) as at November 2019	Market price ($/ML) as at September 2021	Price outlook ($/ML)
		HIGH RELIABILITY/SECURITY		
SA Murray	Class 3	7,000–8,000	6,800–7,200	5,000–10,000
Vic. Murray	High reliability	5,000–7,250	4,500–6,500	4,000–8,000
Goulburn	High reliability	4,300–5,000	4,000–4,400	3,500–8,000
NSW Murray	High security	6,500–9,900	7,000–8,900	5,000–10,000
Murrumbidgee	High security	7,800–8,500	7,300–7,800	6,000–10,000
		LOW RELIABILITY / GENERAL SECURITY		
Vic. Murray	Low reliability	450–650	500–650 (above choke) 1,000–1,350 (below choke)	300–800
Goulburn	Low reliability	350–425	450–600	250–550
NSW Murray	General security	1,350–1,850	1,600–1,700 (above choke) 2,100–2,350 (below choke)	1,000–2,300
Murrumbidgee	General security	1,900–2,000	2,100–2,350	1,500–2,500

Source: Marsden Jacob analysis.

Table 2: Current and outlook prices, northern MDB, as at September 2021 ($/ML)

Region	Entitlement type	Market price ($/ML) as at November 2019	Market price ($/ML) as at September 2021	Price outlook ($/ML)
		HIGH SECURITY		
Macquarie	High security	6,000	6,000	4,500–8,000
Lachlan	High security	4,500	4,500	4,000–7,500
Border Rivers	High security	6,500	6,500	5,800–7,200
		GENERAL SECURITY		
Macquarie	General security	1,700	2,000–2,100	1,200–2,200
Lachlan	General security	1,200	1,300–1,500	850–1,600
Border Rivers	General security Class A	3,600	5,000	3,200–5,500
Namoi	General security	2,500–3,000	3,400–4,000	1,750–4,500
Gwydir	General security	2,700–3,000	3,600–3,800	2,400–4,500
Condamine Balonne	Medium priority	3,800–4,000	4,000–4,700	3,200–5,500

Region	Entitlement type	Market price ($/ML) as at November 2019	Market price ($/ML) as at September 2021	Price outlook ($/ML)
(St George)				
Condamine Balonne (Central Condamine Alluvium)	Groundwater	5,000	6,500–7,000	5,500–7,500

Source: Marsden Jacob analysis.

3.3 Approach

Even one or two years ahead, accurately projecting market prices is very difficult and involves wide confidence bounds. Water markets have undergone a number of structural shifts that cannot be captured in the historical data, and that affects the robustness of price predictions from longer term market prediction models (econometric models). So, instead of relying on econometric modelling to estimate the project water entitlement prices, we used the following method:

- We performed statistical modelling that focused on a number of key market price drivers, including:
  - water availability (for example, inflows to storages and announced allocations)
  - the size of the consumptive pool
  - market performance during previous droughts (the millennium drought and more recently) and wet periods
  - commodity market and production trends.
- We reviewed information on water intermediaries and water exchanges from across the MDB to test the current market drivers and price outlooks for different entitlement types.
- We reviewed historical broker interviews (Marsden Jacob has been interviewing brokers since early 2011 and has a running log of the results from those interviews).
- We drew upon and updated our net margin models for key crop types. The models can be used to estimate price ceilings for key irrigated crops based on capacity to pay
- The inflow analysis was informed by the MDBA's River Murray inflow data.
- The Bureau of Meteorology provided water market permanent trade volumes.

3.4 Water market products

Products in the Australian water market can be grouped into three categories:

1. *Primary products*—the basic trade mechanism for allocation and entitlement transfers
2. *Secondary products*—products that have been derived from the characteristics of allocations and entitlements and/or are executed using the basic trade mechanism to achieve a specific outcome

3. *Related products*—products that are not derived from or related to the characteristics of allocations and entitlements but can be used in conjunction with them.

The market price analysis in this report focuses on one aspect of the primary product market known as the entitlement (or permanent) market. An entitlement trade involves the transfer of ownership of an entitlement between two parties. The price of water entitlements is essentially equivalent to the discounted returns to water allocated to entitlements (which we estimate using net margins in Section 3.6.3).

In the analysis, we also refer to the allocation market, which is also known as the spot allocation trade or temporary trade. The transfer of allocation between one party and another is specifically for the duration of the ongoing irrigation season.

3.5 Historical and current prices

The total volumes of water entitlements and resources are capped in the MDB, resulting in changes in supply and demand for water being reflected in the price of water in the water market.

The high degree of hydrological connectivity in the southern MDB allows for trade in water entitlements and water allocations between river systems; however, accessing the water is subject to the status of use restrictions. The southern MDB is Australia's most significant water market and is widely regarded as one of the world's most sophisticated water markets.

Conversely, the disconnected nature of most river systems in the northern MDB means that most water market activity there is between farmers within single regions, so prices can be quite different in different regions.

All figures in this section use cleaned data (that is, outlier trades have been excluded).

3.5.1 Southern MDB

Figure 2 through Figure 5 demonstrate the following:

- Prices for both high and general security/reliability entitlements fell after the millennium drought (Figure 2).
- Prices for high reliability (Vic.), high security (NSW) and Class 3 (SA) entitlements increased significantly over the period from 2014 to 2019. From 2007 to 2019, the overall southern MDB volume weighted average price (VWAP) increased by over 400% (Figure 3). Very recently, some markets have started to firm up again.
- Prices for general security (NSW) and low reliability (Vic.) entitlements increased over the period from 2014 to 2019. Since then, general security values have declined due to drought leading to low announced allocations (Figure 6), but the prices have firmed recently as water availability has increased (Figure 4 and Figure 5), whereas prices for low reliability entitlements (apart from Vic. 1A) have increased strongly.

Based on our research and interviews with brokers and other water market participants, the key factors that explain the maintenance of elevated prices include:

- continuing demand from horticulture (nuts and citrus) producers and viticulturists for higher reliability

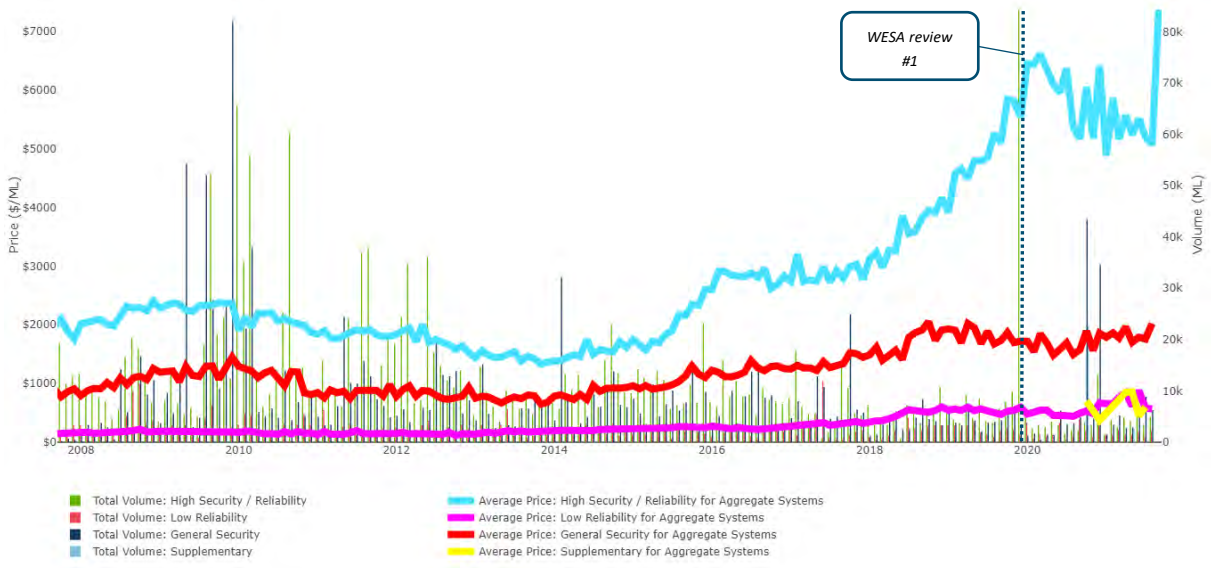
entitlements

- increased demand from cotton producers for general security entitlements
- increasing demand for low reliability water, because it is being actively used to carry over water across water years
- reduction in supply in the entitlement market because there are fewer sellers and the Commonwealth Environmental Water Holder holds more water.

The lower and higher security entitlement types previously tended to follow similar price trends, but a significant divergence has been observed over the past two years. Higher security entitlement prices have declined, whereas lower security entitlement prices have either increased significantly (low reliability Zone 7) or fallen and then recovered (general security zones 10 and 11). Key factors driving this include the following:

- *Water availability*—as shown in Figure 6, the availability of water (announced allocations) from general security entitlements has improved because dam storage levels are increasing across the southern Basin, so irrigators who need water in the short run are no longer looking towards higher security entitlements.
- *Thin markets*—a number of brokers have commented that where previously there were many sellers, for instance because of generational change occurring, there are now fewer.

Figure 2: Southern MDB entitlement market summary, 2008 to 2021 ($/ML)

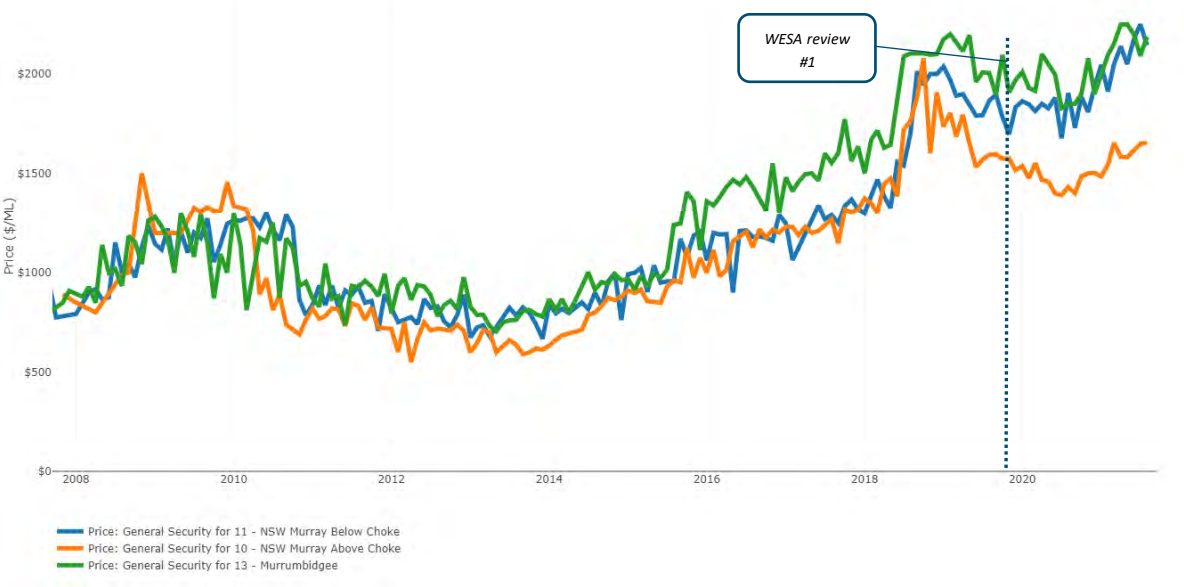


Source: Marsden Jacob and Waterflow™ analysis.

Figure 3: Murray below Barmah Choke high security/reliability entitlement market summary, 2008 to 2021 ($/ML)

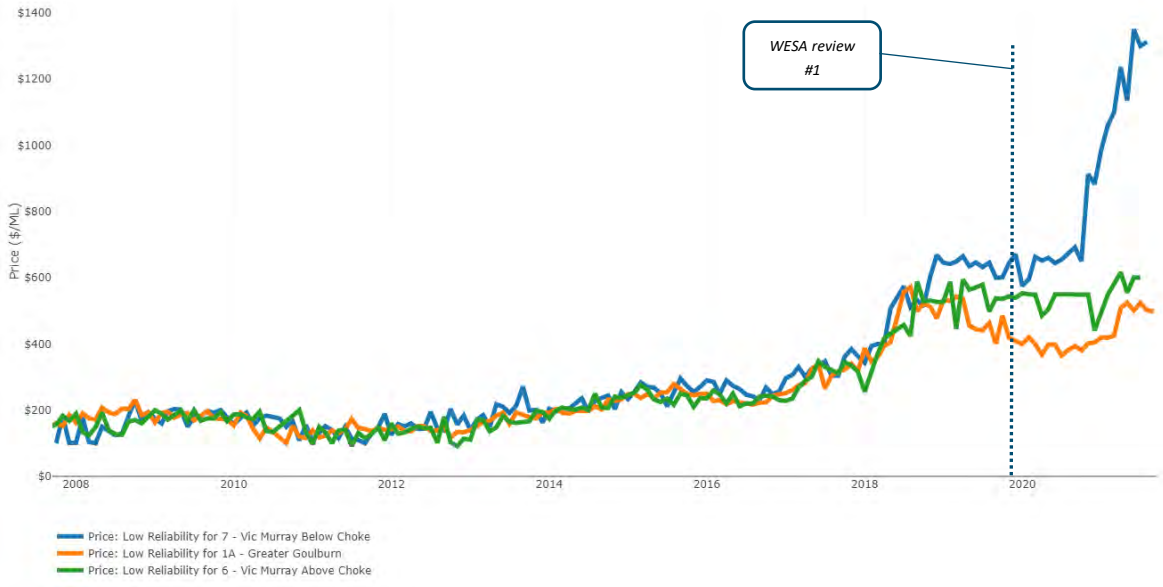
Source: Marsden Jacob and Waterflow™ analysis.

Figure 4: NSW general security entitlement market summary, 2008 to 2021 ($/ML)



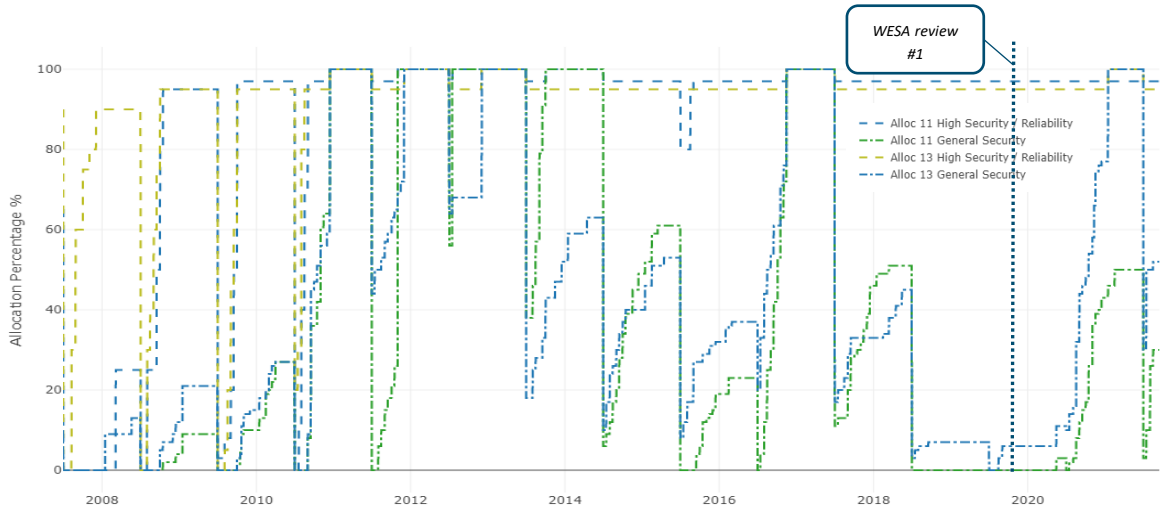
Source: Marsden Jacob and Waterflow™ analysis.

Figure 5: Victorian low reliability entitlement market summary, 2008 to 2021 ($/ML)



Source: Marsden Jacob and Waterflow™ analysis.

Figure 6: NSW Murray and Murrumbidgee, announced allocations, 2008 to 2021 (%)



Source: Marsden Jacob and Waterflow™ analysis.

Table 3 illustrates the softening in prices for high security/reliability entitlements. Compared to market prices in November 2019, current prices are up to 10% lower (depending on the entitlement type).

In contrast, general security entitlement prices (NSW) have increased by 10%–25%, while low reliability prices (Victoria) have increased; the most significant increase has been in the Victorian Murray below Barmah Choke, where prices have effectively doubled.

Table 3: Market price comparison of selected southern connected MDB entitlements ($/ML)

Region	Entitlement type	Market price July 2018	Market price November 2019	Market price September 2021
SA Murray	Class 3	4,050–3,400	7,000–8,000	6,800–7,200
Vic. Murray above Barmah Choke	High reliability	3,400–3,550	5,000–5,500	4,500–4,900
Vic. Murray above Barmah Choke	Low reliability	400–500	450–550	500–650
Vic. Murray below Barmah Choke	High reliability	4,000–4,200	6,500–7,250	6,100–6,500
Vic. Murray below Barmah Choke	Low reliability	500–600	550–650	1,000–1,350
Goulburn	High reliability	3,350–3,550	4,300–5,000	4,000–4,400
Goulburn	Low reliability	450–550	350–425	450–600
NSW Murray above Barmah Choke	High security	3,500–4,000	6,500–8,000	6,500–8,000
NSW Murray above Barmah Choke	General security	1,900–2,000	1,350–1,575	1,600–1,700
NSW Murray below Barmah Choke	High security	4,900–5,050	7,900–9,900	8,500–8,900
NSW Murray below Barmah Choke	General security	2,000–2,100	1,650–1,850	2,100–2,350
Murrumbidgee	High security	5,000–5,200	7,800–8,500	7,300–7,800
Murrumbidgee	General security	2,000–2,200	1,900–2,000	2,100–2,350

Source: Marsden Jacob analysis.

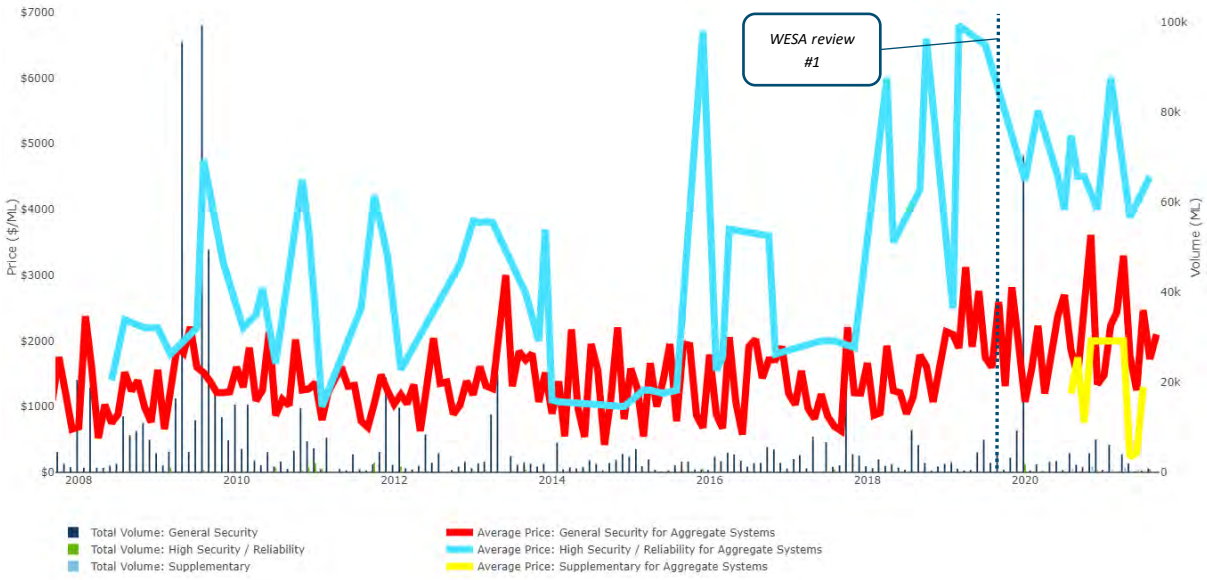
3.5.2 Northern MDB

Figure 7 through Figure 9 show the following:

- Trading activity for general and high security entitlements is much thinner in the northern MDB, and there can be extended gaps between trades. This is particularly true for high security entitlements in northern NSW, because there is not a great deal of high security entitlement, as a high proportion of the water is in the form of general security entitlements.
- Compared to prices in the southern MDB, prices in most zones have been relatively stable. Over the long term, the most significant value increases have occurred in the Lachlan and Macquarie catchments (Figure 8). Market analysis has found as follows:
  - Prices in the Lachlan are continuing to increase. The irrigation sector in the Lachlan was very badly affected during the millennium drought, and a significant proportion of irrigators left the region, so storage levels have held up better than in other regions and the irrigation sector is growing. The value growth is also underpinned by new investment in agriculture and shifts in crop types in the Lower Lachlan area, where cool climate cotton is coming into the valley.
  - In the Macquarie, there have been a number of significant investments into irrigation-efficiency infrastructure, and the region is witnessing significant generational change and farm consolidation, which means demand is high and prices are increasing.
- Prices in the Border River, Gwydir and Namoi catchment trading zones have been somewhat stable but with a steady upward pattern, especially over the past three water years. In general, the northern MDB

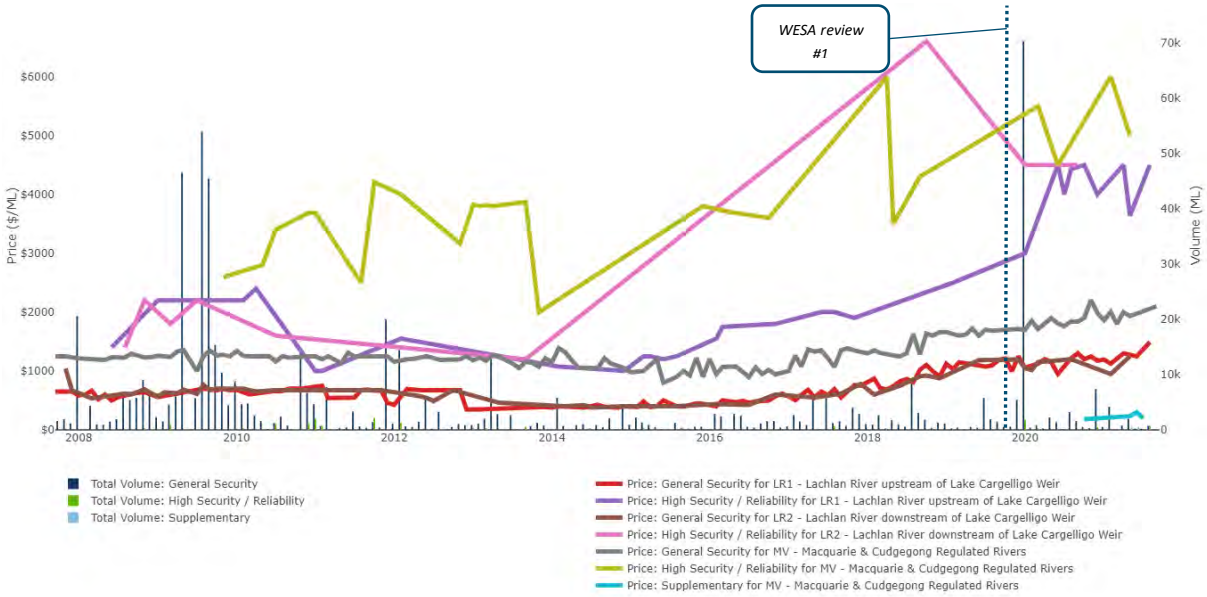
markets are mature markets in which established crop types (particularly cotton) are driving market performance. Buoyant cotton and winter crop prices underpin the entitlement value increases and the recent increase in water availability.

Figure 7: Northern MDB entitlement market summary, 2008 to 2021 ($/ML)



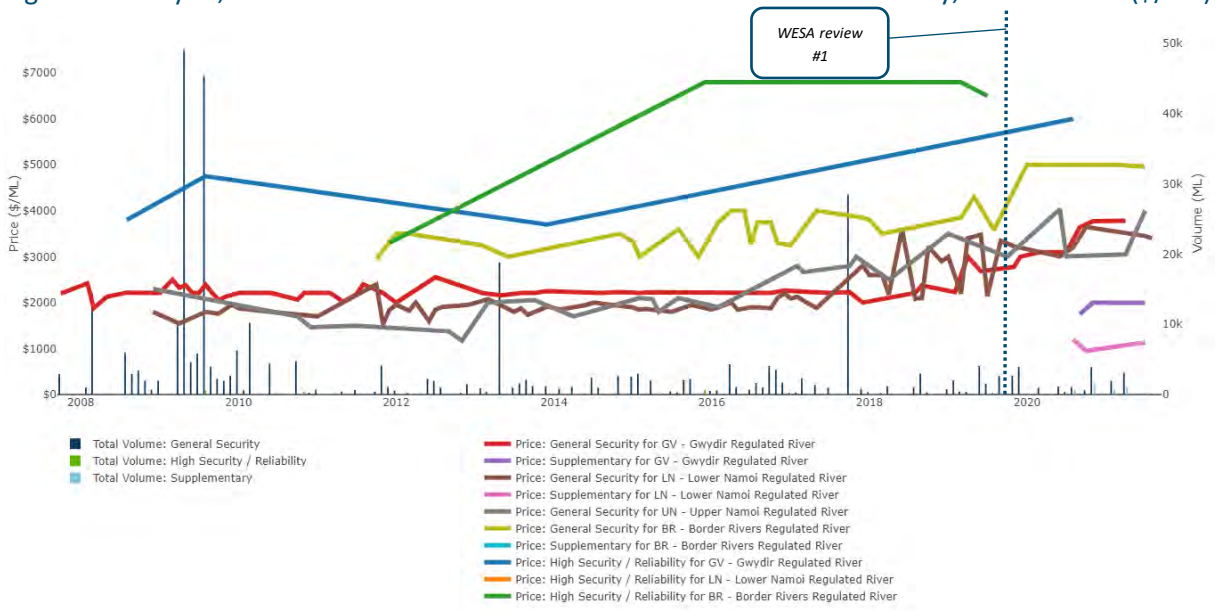
Source: Marsden Jacob and Waterflow™ analysis.

Figure 8: Lachlan and Macquarie entitlement market summary, 2008 to 2021 ($/ML)



Source: Marsden Jacob and Waterflow™ analysis.

Figure 9: Gwydir, Namoi and NSW Border Rivers entitlement market summary, 2008 to 2021 ($/ML)



Source: Marsden Jacob and Waterflow™ analysis.

Table 4 shows that, compared to the analysis undertaken at the time of the first WESA review, high security entitlement market prices in most northern MDB catchments have been relatively stable (noting that the liquidity is low), whereas general security entitlement prices have increased across all northern MDB catchments.

It is important to note that high security entitlements are rarely traded in all northern MDB catchments. Therefore, price movements for high security entitlements have a less material impact on the market than general security trends.

General security prices have increased since November 2019. This has been underpinned by drought conditions ending in mid-2020, significantly improving water availability through increased dam storage levels and announced allocations (see Figure 10) in these zones.

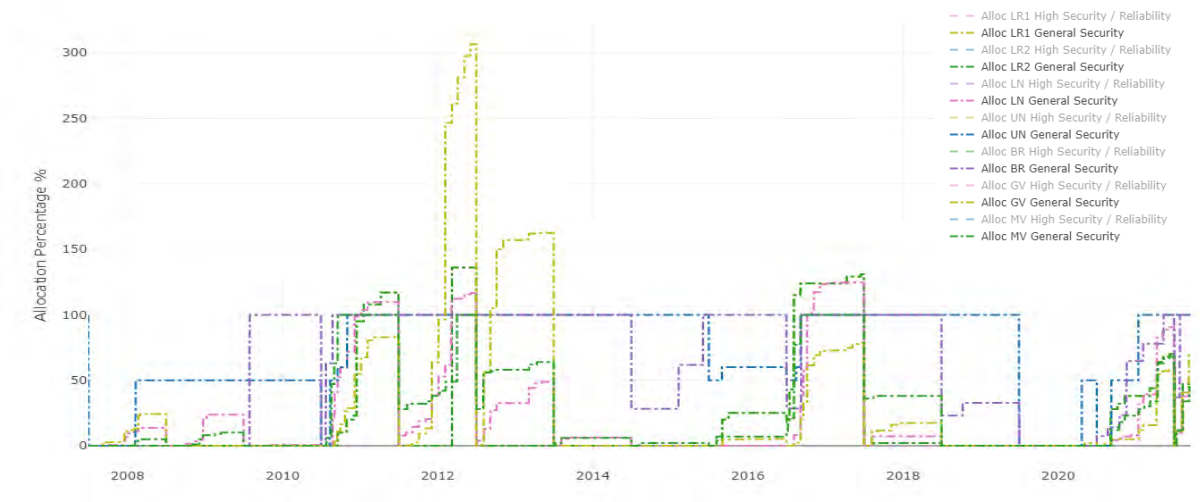
Table 4: Market price comparison of selected northern MDB entitlements ($/ML)

Region	Entitlement type	Market price July 2018	Market price November 2019	Market price September 2021
Macquarie	High security	4,300	6,000	6,000
Macquarie	General security	1,400	1,700	2,000–2,100
Lachlan	High security	2,500	4,500	4,500
Lachlan	General security	800	1,200	1,300–1,500
Border Rivers	High security	6,800	6,500	6,500
Border Rivers	General security Class A	3,500	3,600	5,000
Namoi	General security	2,000–3,000	2,500–3,000	3,400–4,000
Gwydir	General security	2,200–2,300	2,700–3,000	3,600–3,800

Region	Entitlement type	Market price July 2018	Market price November 2019	Market price September 2021
Condamine Balonne (St George)	Medium priority	3,500–3,800	3,800–4,000	4,000–4,700
Condamine Balonne (Central Condamine Alluvium)	Groundwater	2,000–2,200	5,000	6,500–7,000

Source: Marsden Jacob analysis.

Figure 10: Lachlan, Border Rivers, Gwydir and Namoi, general security announced allocations, 2008 to 2021 (%)



Source: Marsden Jacob and Waterflow™ analysis.

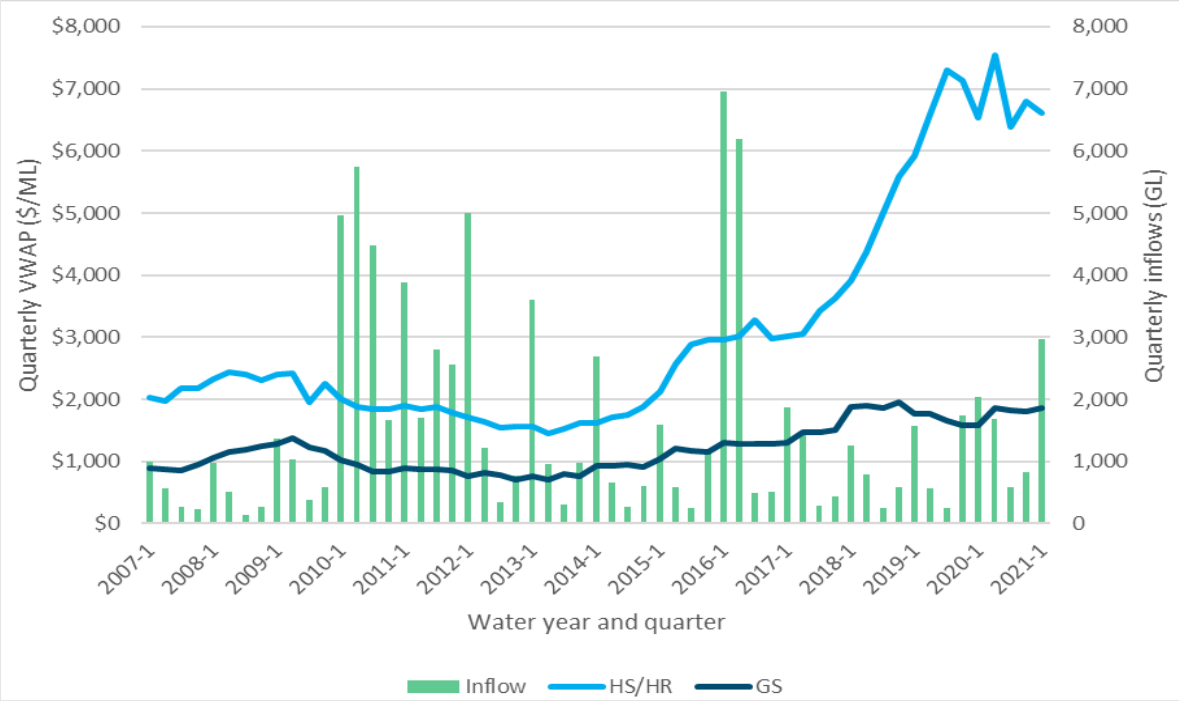
3.6 Price outlooks

The price outlooks are based on historical and current prices, expert knowledge, and likely upper bounds imposed by the realities of farm business profitability (see Section 3.6.3). The outlooks are reported for aggregated zones, meaning that some of the idiosyncrasies of individual trading zones (and the crops grown there) have been averaged out.

Box 1: Historical price changes during wet and dry periods

Climate and weather (wet or dry periods) have significant impacts on water availability and market prices (see Figure 11). For instance, as a result of three consecutive years of above-average inflows (water years 2010 to 2012), both high security/reliability and general security prices decreased by 30%–40%.

Figure 11: Market prices ($/ML) and River Murray inflows (GL), water years 2007 to 2021



VWAP = volume weighted average price.

Source: MDBA, Waterflow™.

The only significant wet period since 2012 occurred in 2016 (and lasted only one water year). Prices remained around $3,000/ML and $1,400/ML for high security/reliability and general security entitlements, respectively, through the 2016 water year.

After 2016, below-average inflows (in conjunction with other market drivers) caused entitlement prices to reach unprecedented levels; by late 2019, high security/reliability prices had more than doubled, while general security prices had increased by 30%–40%. The disparity in price increases reflects the fact that high security/reliability entitlements generally yield high allocations even during dry periods, whereas general security entitlements have reduced allocations during dry periods.

After 2020, River Murray inflows have returned to average or slightly above-average levels, reflecting wetter conditions. This has caused high security/reliability and general security prices to converge slightly, as high security/reliability prices have softened and general security values have firmed. Increased inflows have resulted in increased allocation levels for general security entitlements, and high security/reliability entitlements are hence attracting a lower price premium.

3.6.1 Capacity to pay: high security/reliability entitlements

Table 5 shows the likely ranges of capacity-to-pay values for different crop types, based on margin analysis. The ranges include allowances for farm size and management practices, and whether the purchase is for a newly established farm or for the expansion of existing operations. Also, to a lesser degree than temporary prices, entitlement prices are affected by short-term fluctuations in output

(crop) prices. The combination of all of those factors results in an estimated range of capacity-to-pay values, rather than a point estimate.

The current market price in selected zones in the southern MDB has been included to provide some insight into the crop types that are likely to be 'making the market', those that might soon be or are already priced out of the market, and those that still have room to move and have the capacity to pay higher than the current market price.

There are a number of higher security entitlement types across the MDB, including high security (NSW), high reliability (Vic.), and Class 3 (SA) entitlements.

For those entitlement types, the current market prices and outlook ranges are shown in Table 5.

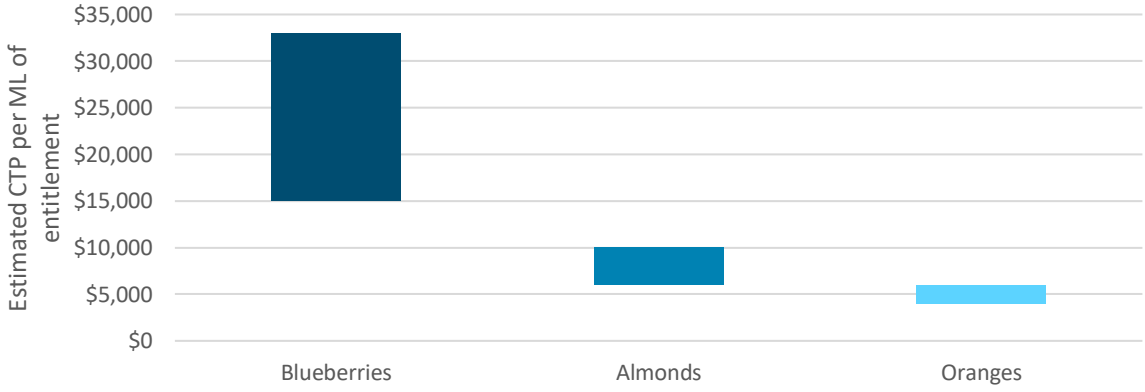
Table 5: Outlook market prices for high security/reliability entitlements ($/ML)

Entitlement type	Current market price (September 2021)	Outlook range
Murrumbidgee high security	7,800–8,500	6,000–10,000
Vic. Murray high reliability	4,500–6,500	4,000–8,000
Goulburn high reliability	4,000–4,400	3,500–8,000
NSW Murray high security	6,500–8,900	5,000–10,000
SA Murray Class 3	6,800–7,200	5,000–10,000
Border Rivers high security	6,500–6,800	5,800–7,200

Source: Waterflow™, Marsden Jacob analysis.

From the net margin analysis, the current market price for higher security entitlements (Table 5) reflects returns from almonds (and nut crops more generally), and there may even be some upside potential, whereas it appears that the current market price continues to exceed citrus producers' capacity to pay unless they already have sizeable holdings and are using the extra entitlements for expansion or water security purposes (Figure 12).

Figure 12: Estimated capacity to pay for 1 ML of high security/reliability entitlement, selected crops



CTP = capacity to pay.

Source: Marsden Jacob analysis.

It is noteworthy that the production of some niche crops, such as blueberries, remains highly profitable at current entitlement prices, which means that prices could move higher in a relatively more supply-constrained water market or if production of those crops increases.

3.6.2 Capacity to pay: general security entitlements

Table 6 shows current market prices and outlook ranges for general security entitlements.

Table 6: Outlook market prices for general security entitlements ($/ML)

Entitlement type	Current market price (September 2021)	Outlook range
Murrumbidgee general security	2,100–2,350	1,500–2,500
NSW Murray general security	1,350–1,850	1,000–2,300
Macquarie general security	2,000–2,100	1,200–2,200
Lachlan general security	1,300–1,500	850–1,600
Border Rivers general security Class A	5,000	3,200–5,500
Namoi general security	3,400–4,000	1,750–4,500
Gwydir general security	3,600–3,800	2,400–4,500

Source: Waterflow™, Marsden Jacob analysis.

In the south, general security entitlement prices reflect returns from dairy and mungbean production (Figure 13). However, as cotton production is rapidly expanding southward, we understand that cotton is now 'making the market' in some of the southern catchments.

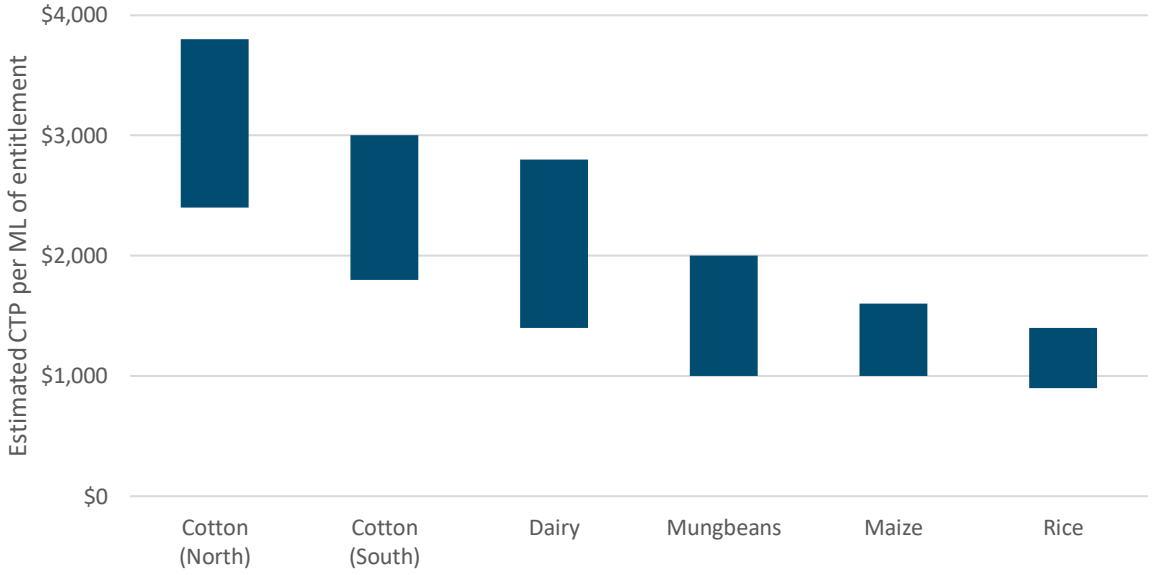
In the north, in contrast, cotton has long been the dominant crop. Trades in northern catchments are infrequent, meaning that price signals can be quite noisy.

From January 2020 to July 2021, general security entitlement Class A water was traded in NSW Border Rivers for around $5,000/ML. Those trades reveal that a new price point has been set in that region: prices exceed the estimated capacity to pay from a whole-of-business perspective for a cotton producer. The current market prices range for general security water in the lower Namoi are around $3,500/ML, which is down marginally from the high of $4,000/ML that was observed in January 2020.

The higher prices can be justified either for existing operations, that have existing portfolios of water, adding to their water holding, or alternatively for growers who are optimistic about the cotton price outlook. The long-run price used in our analysis assumes $450 per bale for cotton, whereas cotton has recently been fetching over $650 per bale—the highest level in more than six years.[4] That higher value was not used in our modelling because margin analysis for a farm business needs to be based on long-run values, not short-run values.

[4] 'Prices going above and beyond', *Agribusiness Monthly*, Rabobank, September 2021, online.

Figure 13: Estimated capacity to pay for 1 ML of general security entitlement, selected crops



CTP = capacity to pay.
Source: Marsden Jacob analysis.

3.6.3 Margin analysis summary

Because the price of water entitlements is essentially equivalent to the discounted returns to water allocated to entitlements, we performed net margin modelling to inform our assessment of capacity to pay.

Table 7 and Table 8 summarise margin estimates for selected crops, grouped by the type of entitlement typically used to irrigate the crop. These are point estimates only, so they do not capture the full range of margins across all farms. In both tables, the estimates have been rounded to the nearest $100.

Table 7: Margin estimates for selected crops that are typically grown using high security/reliability water

		Blueberries	Almonds	Oranges
New establishment	NPV net margin/ha (over 20 years)	$150,000	$59,000	$52,600
	NPV net margin/ML (over 20 years)	$20,000	$8,400	$5,250
	Levelised net margin/ML	$2,400	$990	$618
Expanding production	NPV net margin/ha (over 20 years)	$215,000	$62,400	$53,000
	NPV net margin/ML (over 20 years)	$29,000	$8,900	$5,300

		Blueberries	Almonds	Oranges
	Levelised net margin/ML	$3,400	$1,050	$625

NPV = net present value.

Source: Marsden Jacob analysis of NSW Department of Primary Industries and AgMargins gross margin budgets.

Table 8: Margin estimates for selected crops that are typically grown using general security water

		Cotton (north)	Cotton (south)	Dairy	Mungbeans	Maize	Rice
New establishment	NPV net margin/ha (over 20 years)	$31,000	$28,000	$4,650	$2,300	$8,700	$17,500
	NPV net margin/ML (over 20 years)	$3,100	$2,800	$2,200	$1,500	$1,500	$1,350
	Levelised net margin/ML	$360	$325	$260	$180	$170	$160
Expanding production	NPV net margin/ha (over 20 years)	$31,000	$29,000	$5,850	$2,800	$9,000	$18,000
	NPV net margin/ML (over 20 years)	$3,100	$2,900	$2,750	$1,900	$1,500	$1,400
	Levelised net margin/ML	$365	$340	$320	$220	$180	$160

NPV = net present value.

Source: Marsden Jacob analysis of NSW Department of Primary Industries and AgMargins gross margin budgets.

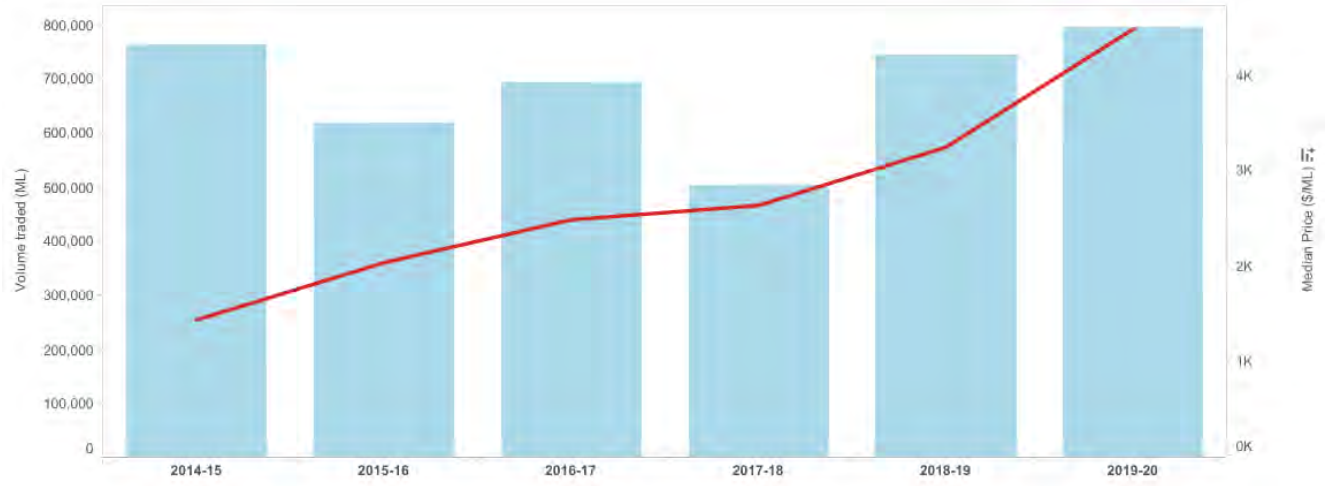
3.7 Water entitlement trade history

As discussed in Section 4, a number of factors are affecting participation and thus limiting the potential to recover the 450GL LTDLE under the WESA. The panel requested that Marsden Jacob consider broader factors that, while not likely to occur, could affect water recovery under the WESA.

Under the Water Act, amounts standing to the credit of the WESA may be debited to purchase water access rights concerning MDB water resources to further WESA objectives.

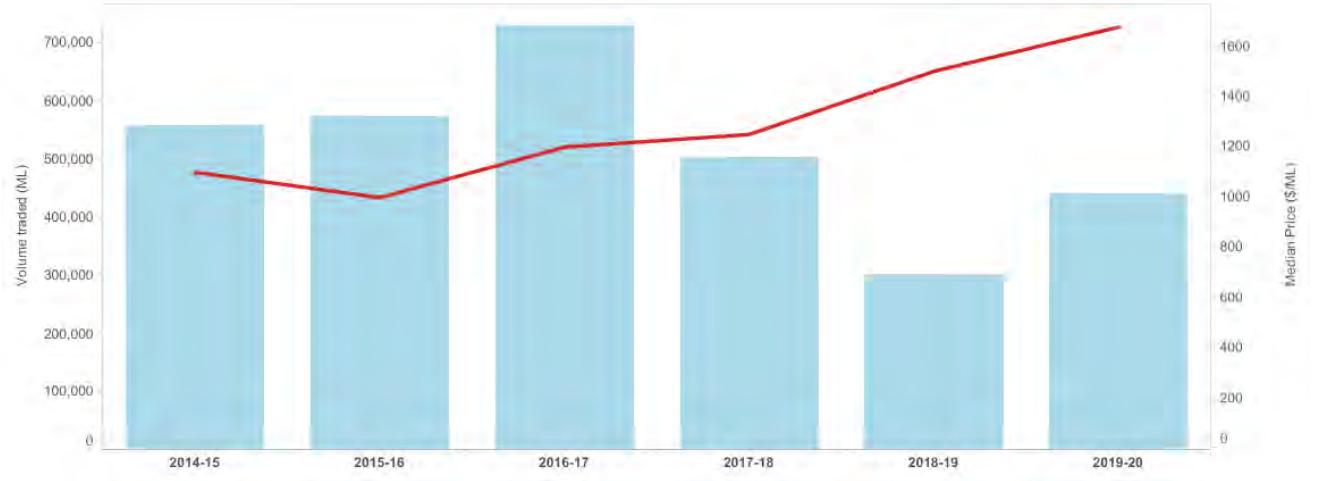
Based on data from the Bureau of Meteorology's *Water information dashboard*, entitlement trade has ranged from 500 GL to 780 GL (nominal) per year in the southern Basin and from 300 GL to 600 GL (nominal) in the northern Basin (Figure 14 and Figure 15). The Bureau of Meteorology's data includes outliers (such as zero value trades) which although legitimate transfers of entitlement can skew the price analysis. When outliers are removed the total volume traded is 150 to 280 GL (nominal) per year in the southern Basin (Figure 16: Entitlement trade history, southern MDB, 2014–15 to 2019–20 (ML). This suggests that, whether including or excluding outliers, there is sufficient market liquidity for a significant volume of water to be purchased over the remaining three years if the current policy position were to be relaxed.

Figure 14: Entitlement trade history, southern MDB, 2014–15 to 2019–20 (ML)



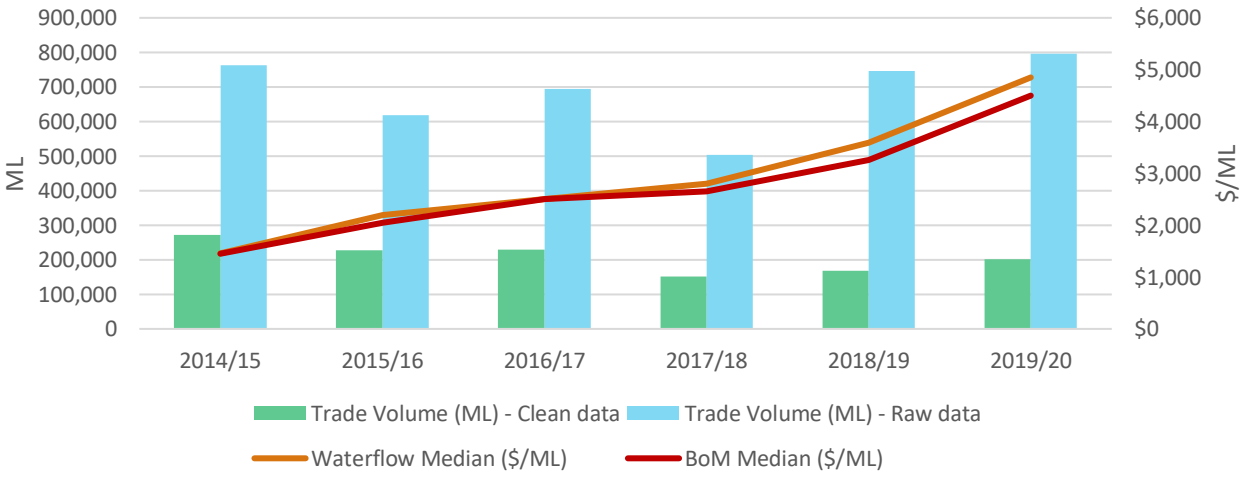
Source: Bureau of Meteorology.

Figure 15: Entitlement trade history, northern MDB, 2014–15 to 2019–20 (ML)



Source: Bureau of Meteorology.

Figure 16: Entitlement trade history, southern MDB, 2014–15 to 2019–20 (ML), cleaned Waterflow™ compared to BoM data



Source: Waterflow™ and Bureau of Meteorology.

4. Factors affecting participation in WESA-funded efficiency measures programs

4.1 Key findings

- As previously noted, a number of changes have been implemented to water efficiency program arrangements since the first WESA review. The key changes to the WESA-funded efficiency program (the OFEP) include removing the market multiple, changes to the funding progress between the federal government and the states, no delivery of projects by the department, and a shift to focus on off-farm projects.
- The fixed market multiple of 1.75 that limited the value of funded projects in the earlier WEP has been relaxed. A higher limit on the market multiple is available under the OFEP and is set at a level expected to unlock more expensive project opportunities.
- As a result of the recent drought, irrigated agriculture water use across the MDB in 2019–20 was lower than during the millennium drought. New South Wales reported the largest decrease in the volume of water applied to crops and pastures, down 49% to 1.3 million ML.
- The ABS reported that crop selection and water use decisions were influenced by the prevailing conditions of high temperatures, below-average rainfall and reduced water availability.[5]
- Off-farm projects will be driven by the attitudes of irrigation infrastructure operators (IIOs) and MDB states to water recovery. Potential off-farm proponents have noted that it is essential for any efficiency measures project to have a measurable impact on the efficiency of their networks.
- While crop water use and commodity types are important considerations for any potential OFEP project, they are more important for on-farm projects. As a result of on-farm projects playing a smaller role in the OFEP, water use and commodity types will have a lower overall impact on likely program participation.
- As always with water efficiency projects, proponents looking to participate in either on-farm or off-farm projects will need to weigh up the benefits from water efficiency works (depreciating asset) at a considerable multiple to current market prices against relinquising water assets that have been appreciating in value.

4.2 Approach

The success of the water efficiency programs funded through the WESA depends on participation—they are demand-driven programs. Consequently, a range of different factors, including water availability and commodity and other markets, will affect participation in any efficiency program funded by the WESA.

[5] ABS, 'Water used for irrigation falls 21% in 2019–20', media release, 14 May 2021, online.

In this section, we consider the economic and market implications since the first review and outline the changes to the WESA-funded efficiency programs responsible for achieving the 450 GL target.

4.3 Closure of the Water Efficiency Program

The program underpinning the recovery of 450 GL/y at the time of the conclusion of the first review was the WEP, which was launched in July 2019 to progress the recovery of additional environmental water through a procurement-based program. Proponents who met the criteria could apply for funding up to 1.75 times the market rate of the water entitlements to be recovered by the project. At the time of the publication of the first review, the WEP had recovered 0.2 GL/y of water for the environment. Including other efficiency measures projects funded by the WESA, 1.9 GL/y had been recovered towards the 450 GL/y target. On 3 March 2021, the Minister for Resources and Water announced the closure of the WEP to any further applications.

The success of the WEP was materially impacted by the imposition of the MDB Ministerial Council's additional socio-economic criteria. Of particular note, small projects considered by the WEP were all required to address the criteria making the application, eligibility, assessment, review and approval process incredibly lengthy and costly for proponents.

4.4 Off-farm Efficiency Program design

As noted in Section 2.5, the Minister for Resources and Water announced the OFEP on 3 March 2021 as the vehicle to recover up to 450 GL of additional environmental water using funds from the WESA.

The OFEP invests in water delivery infrastructure to reduce water losses in the MDB, providing benefits to water users and the community by sharing the water saved between consumptive users and the environment.

Funding under the OFEP is available through three streams: State-led Off-farm, the Off-farm Efficiency Grants Program, and State-led On-farm.

Compared to the WEP, the key program design changes include removing the market multiple, changes to the funding progress between the federal government and the states, and a shift to focus on off-farm projects.

Buyback of entitlements remains off the program agenda. The government continues to prioritise investment in water-saving infrastructure to achieve the water recovery required under the Basin Plan.

4.4.1 Market multiple: changes have been implemented

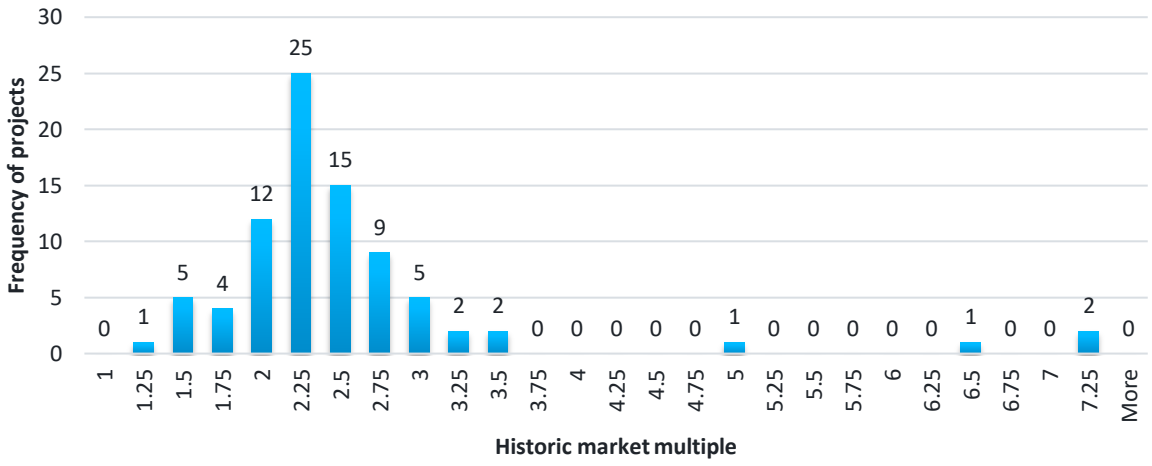
Prior water efficiency program initiatives have revealed that paying market rates for water entitlements is not enough to fund efficiency measures projects, and even at 1.75 times the market rate there was not a lot of interest in the WEP.

The fixed market multiple of 1.75, which stakeholders stated was limiting the value of funded projects in the earlier WEP, has been removed. A higher limit on the market multiple (but has not been disclosed) is available under the OFEP, and is set at a level expected to unlock the remaining, relatively more expensive, projects.

It is understood that the department will seek an independent assessment of the prices used in an applicant's budget and the calculated water savings and may seek to negotiate the funding sought and/or the water savings returned to the federal government to obtain a more acceptable market multiple.

Analysis of market multiples used for historical infrastructure projects funded by the federal government shows that they generally align with historical projects. Projects analysed include the Off-farm Irrigation Efficiency Program, the Private Irrigation Infrastructure Operators Program, the Victorian Farm Modernisation Project and state-led priority projects. Figure 17 shows that approximately 83% of the projects involved a market multiple between 1.75 and 3.0.

Figure 17: Historical market multiples



Source: DAWE and Marsden Jacob analysis.

4.4.2 Delivery arrangements

The state-led streams of the OFEP ($1.33 billion off-farm; $60 million on-farm) are the primary means of delivering projects. Those programs will be delivered by the states with agreements in the form of schedules to the Federation Funding Agreement—Environment. Federation funding agreements involve output-focused milestones for states to deliver against.

As a result, the states will be required to put in place their own contractual arrangements with any third-party project proponents.

This change, along with the changed market multiple, should improve the opportunity for water recovery compared to the WEP, but nonetheless the programs remain demand driven, so successful outcomes will depend on effective promotion and engagement with proponents.

Funding is also allocated to the Business Grants Hub stream ($150 million) for projects that are supported by the states and meet the socio-economic test, but that the states do not wish to administer. The expectation is that those grants may be used by smaller IIOs or irrigation schemes for projects such as rationalising or piping stock and domestic access.

By removing the federal government from the project application phase, it is hoped that the revised application and milestone payment processes will be more efficient and flexible than the WEP processes. However, as there are yet to be any projects accepted for the OFEP except the Goulburn–

Murray Water application, which was in part submitted under the WEP, it is difficult to determine whether these program changes will affect a typical project time frame.

Our analysis undertaken for the first WESA review showed that historical infrastructure programs were able to complete tens of projects per year. We therefore expect the governance processes set up to administer project applications as part of WESA efficiency measures programs to be less of a limiting factor on water recovery than other limiting factors, such as the market multiple.

4.4.3 Types of projects

The focus for WESA-funded efficiency programs will be on off-farm projects, but funding will still include a relatively small stream for on-farm projects ($60 million). The off-farm projects will need to improve the efficiency of water use and management to generate water savings that can be shared with the environment. It is expected that such projects will include:

- upgrading and modernising irrigation channels
- installing pressurised pipeline systems
- installing new or upgrading existing irrigation infrastructure or technology
- constructing secure stock and domestic water delivery systems.

While the WEP was open to similar projects as the OFEP, previous analysis has found that the market multiple of 1.75 was suitable only for small-scale on-farm projects, because off-farm projects are generally more expensive and require a higher multiple to be viable. Metering has been removed as a stand alone project option for the OFEP due to limited take-up during the WEP and because other government funding streams are available to support MDB metering objectives.

The off-farm projects included in the OFEP will focus on irrigation networks or IIOs and industrial, mining, urban, stock and domestic supply. The on-farm projects will complement off-farm projects in irrigation networks by installing new or upgrading existing irrigation infrastructure and technology on irrigation properties for agriculture.

We understand that the limited funding for on-farm projects reflects the expected low level of demand, given political and social factors. If the socio-political factors were not present, it is expected that the number of projects could be increased significantly.

4.5 Commodity changes

4.5.1 Water use

Since the first WESA review, there has been little to no change in the mix of crops grown in the MDB and low levels of water use following the drought. Higher water availability in 2021 compared to 2019 may help highlight any water efficiency deficits in on- and off-farm networks.

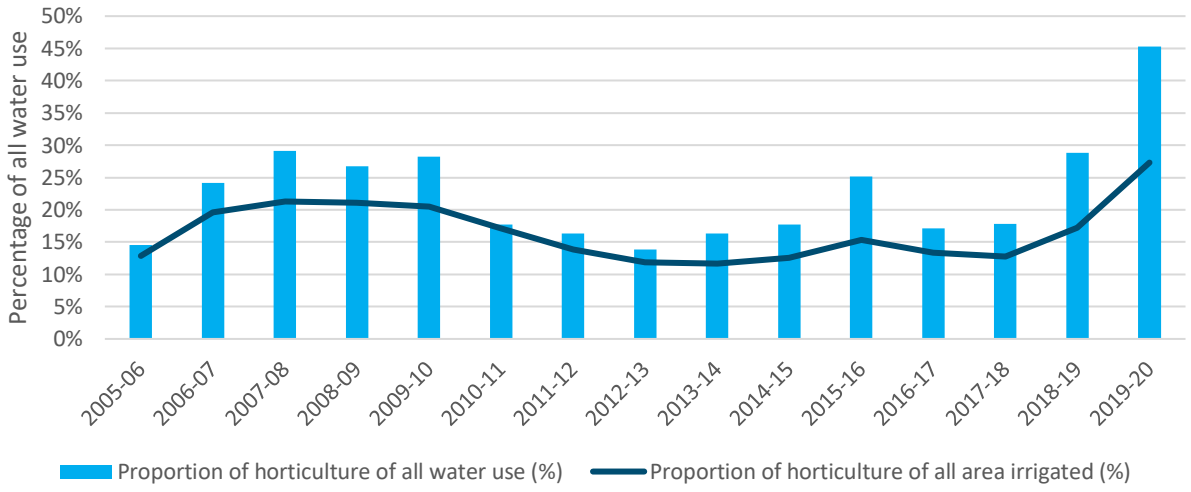
As climatic conditions have changed and new crop opportunities have emerged, the mix of commodities grown will favour water-intensive production. In any given region, commodity types are driven by the highest value crop that can be grown, given water availability. Figure 19 shows that there has been a steady increase in higher value crops, such as cotton, fruit and nuts.

The change to higher value commodities is reflected in the rise in the gross value of irrigated production since 2009–10. Since the first WESA review, the MDB has come out of drought and into a La Niña event, which delivered above-average rainfall in the 2019–20 water year.

However, the drought effects have lingered, so water use across the MDB in 2019–20 dropped to levels lower than during the millennium drought. New South Wales reported the largest decrease in the volume of water applied to crops and pastures, down 49% to 1.3 million ML.

The ABS reported that crop selection and water use decisions were influenced by the prevailing conditions of high temperatures, below-average rainfall and reduced water availability.[6] Figure 19 shows that pasture, cereal, rice and cotton production all contributed to relatively low water use and shows a reduced overall irrigated area in the MDB. Fruit and nuts crop producers reported a 2% decrease in water use and a 5% increase in irrigated area. A 5% increase in irrigated area was also observed for grapevines. Additionally, the proportional water use for fruit, nuts, vegetables and grapevines was the highest it has ever been in 2019–20, at 45% of all water use (Figure 18).

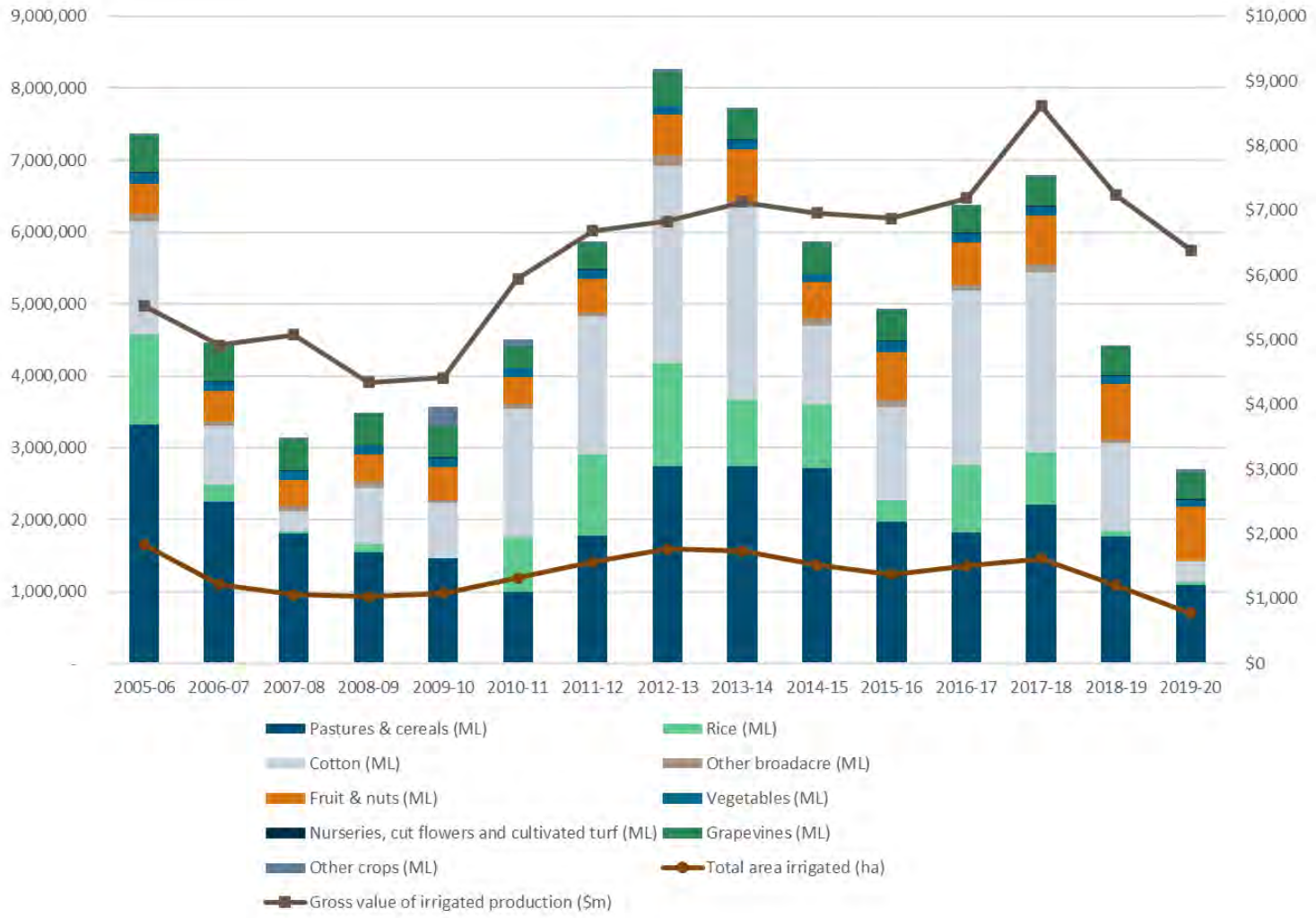
Figure 18: Proportion of water use and area irrigated for horticulture, 2005–06 to 2019–20 (%)



Source: ABS and Marsden Jacob analysis.

[6] ABS, 'Water used for irrigation falls 21% in 2019-20', media release, 14 May 2021, online.

Figure 19: MDB water use (ML, left) and gross value of irrigated production ($m, right), by crop type, 2005–06 to 2019–20



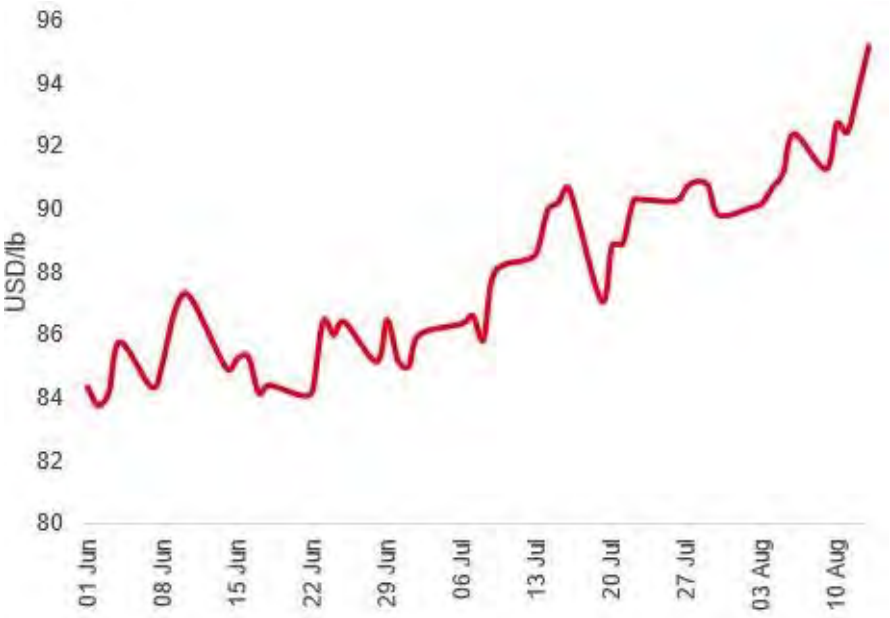
Sources: ABS, *Gross value of irrigated agricultural production* and *Water use on Australian farms* statistics, 2005 to 2020.

4.5.2 Commodity prices

Commodity prices for irrigated agricultural commodities have a significant economic impact on agricultural production across the MDB and vary widely from year to year, depending on water availability.

Since the first WESA review, low water availability has meant low production of cotton and rice crops. Cotton prices have been increasing and are expected to increase further in 2021–22 (Figure 20). This could lead to a large crop, driven primarily by a higher level of water availability and a price outlook for prices of over $600/bale.

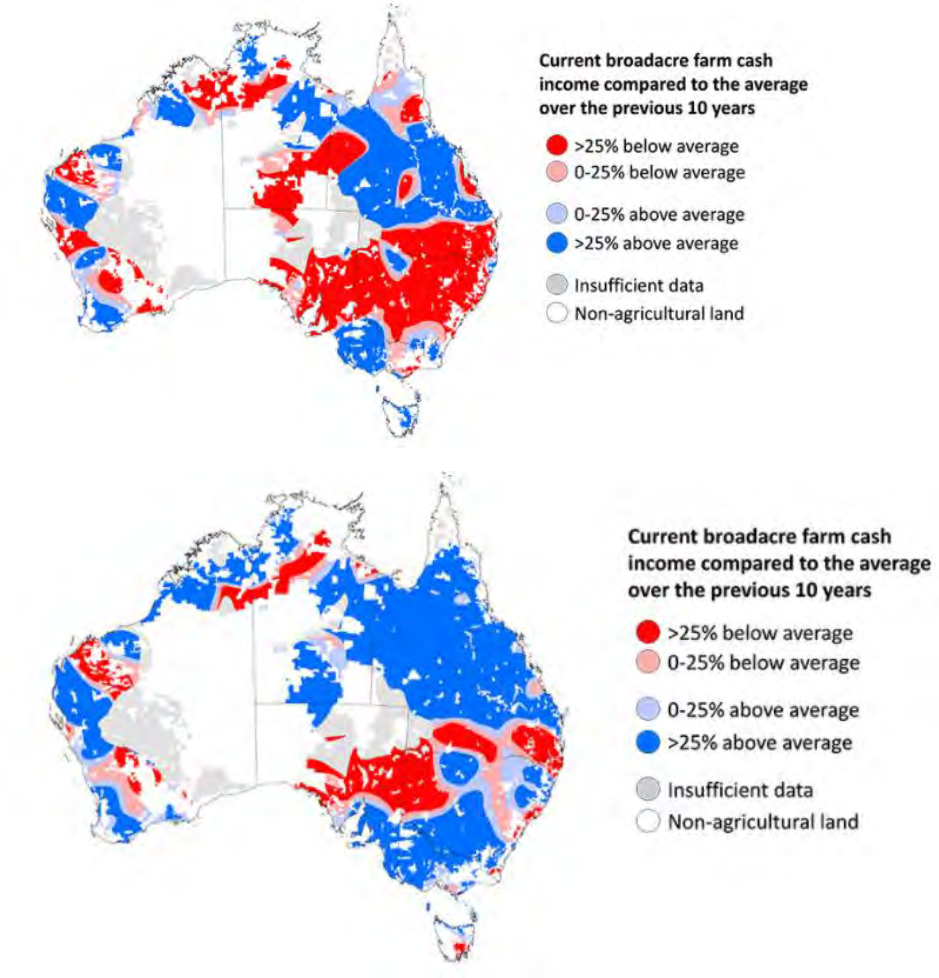
Figure 20: World cotton prices, June to August 2021 (US$/lb)



Source: Elders Rural.

Water availability plays a key role in determining the types and extent of annual crops grown, and permanent plantations such as almonds and citrus require water year on year. Current water availability and the potential to carry water over into 2022 mean that farm production is likely to increase above 2019–20 levels and provide needed revenue for areas affected by the recent drought. Improvements in commodity prices and farm revenue for broadacre crops (Figure 21) could increase appetite for on-farm projects, as farmers will be in a stronger financial position.

Figure 21: Broadacre farm cash income change, 2019–20 (top) and 2020–21 (bottom)



Source: ABARES, Australian Agricultural and Grazing Industries Survey estimates.

However, because a substantial volume of agricultural products produced in Australia is exported, commodity prices are expected to be affected by global shipping prices and could also be affected by labour resourcing constraints. Rabobank reports that increases in container shipping prices are expected to continue into 2022,[7] so higher prices will make it challenging to secure containers for exporters. The impact will potentially reduce competition from cotton harvests in Spain and the United States.

4.6 Socio-political drivers

4.6.1 Irrigation infrastructure operators

Water efficiency programs under the WESA are demand driven and entirely voluntary, and it is clear from the volume recovered to date that demand from proponents of both on-farm and off-farm projects has been low.

[7] Rabobank, *Agribusiness Monthly*, online.

Off-farm projects primarily apply to IIOs, some of whom, along with their members, have been large contributors to water recovery in the MDB.

Therefore, the demand for projects will now come from entities that have previously decided not to participate but have now changed their minds, or from proponents who have already participated. However, for those who have already participated, much of the low-hanging fruit in their schemes will have already been picked as part of previous government water efficiency programs.

A range of possible cohorts is relevant to the off-farm programs. Those who are unlikely to participate are:

- proponents who participated in early rounds of water recovery and no longer consider that they can give up any additional water, despite the financial incentive
- proponents who have been opposed to any government water recovery project due to a range of concerns that they hold about the impact on regional economies of projects
- proponents who have not participated for a range of reasons and are considered to be 'on the fence' about whether to participate or not.

Those who are more likely to participate are:

- proponents who participated in early rounds of water recovery and are convinced of the long-term benefits of the investment and have further project opportunities
- proponents who have not previously participated, either because the market multiple precluded their participation or because they were opposed to sharing water savings. But, who are now interested in participating because they are observing the competitive benefits that arise from efficiency upgrades that have been implemented by others.

Overall, we believe that most opportunities for off-farm projects are with proponents who have not previously participated and are considered to be 'on the fence' or, through management changes, are now open to participating in efficiency measures programs. This is because most efficiency measure opportunities for off-farm infrastructure networks have already been undertaken through historical programs, leaving only a small subset of IIOs remaining.

4.6.2 State governments

Basin state governments have had a substantial impact on the viability of water efficiency programs under WESA.

Under the WEP, many of the state governments were responsible for assessing proposals under the socio-economic criteria. In November 2019, the NSW Minister for Water announced that 'NSW will not deliver the Water Resource Plans and NSW will not contribute to the additional 450GL in water recovery targets.' Similarly, the Victorian Government announced that further recovery towards the

450 GL target will be supported only if there are positive socio-economic impacts, meaning that it is no longer sufficient for projects to have a neutral socio-economic impact.[8]

While Victoria has remained resistant to any further water recovery, NSW's stance has since changed. In August 2021, the NSW Government called for projects to improve water efficiency through off-farm infrastructure to save water in the MDB.[9] It has committed to working with applicants to develop water efficiency concepts into project proposals until 30 June 2023, or until funding is fully allocated, for projects to be delivered by June 2024.

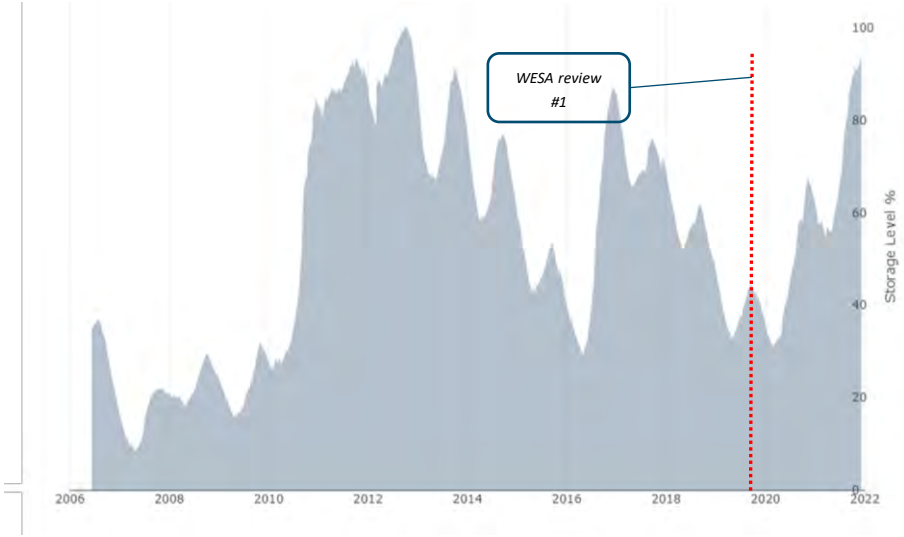
The change of stance by NSW could lead to more project proposals under the OFEP being successful and being implemented before June 2024.

4.7 Climate impacts

Climatic conditions can influence participation in water efficiency projects for several reasons. Climate is the primary driver of water availability for the MDB, affecting the planted areas and the subsequent revenue generated from irrigated agriculture. Storages in the MDB are currently at 95% of total capacity, up significantly from the volumes this time last year (55%).

Figure 22 and Figure 23 show the aggregate storage volume (in percentage terms) for the northern and southern MDB storages. Since the previous WESA review in late 2019, the volumes in storage in both regions have recovered substantially.

Figure 22: Aggregate storage volume, southern MDB, 2006 to 2021 (% of capacity)



Source: Waterflow™.

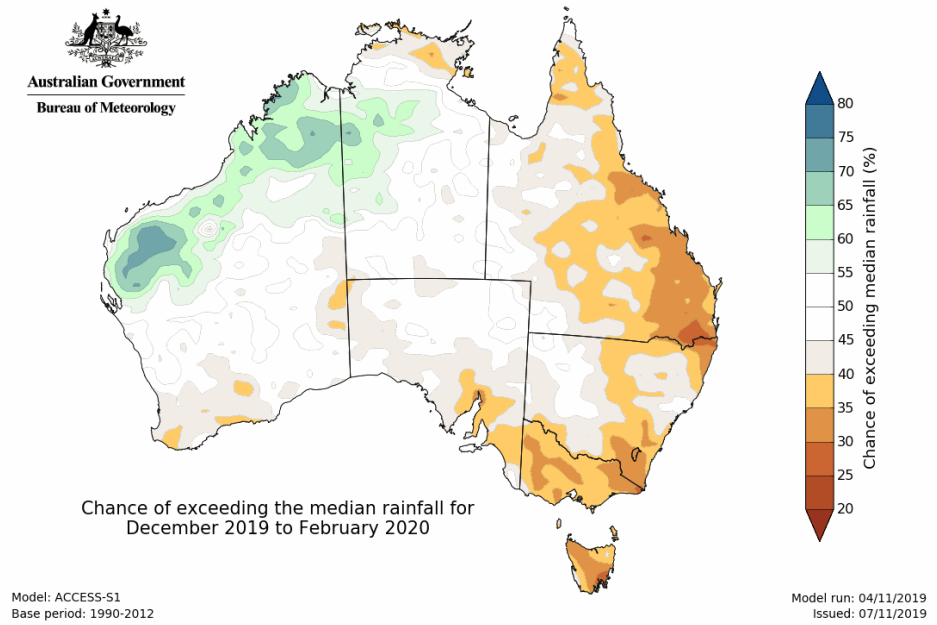
[8] Daniel Andrews, 'Standing up for Victorian irrigators', media release, 3 December 2019, online.
[9] 'Up to $1.5 billion available for off-farm efficiency projects in NSW', news release, NSW Government, 19 August 2021, online.

Figure 23: Aggregate storage volume, northern MDB, 2006 to 2021 (% of capacity)

Source: Waterflow™.

The first WESA review occurred when the MDB came out of a drought, with dry conditions across most of eastern Australia (Figure 24). As a result, water scarcity meant irrigators had low allocations and were potentially unwilling to give up water entitlements despite high water market prices. The low water availability meant annual crops were not grown, as shown in Figure 19. Those impacts applied to both on-farm and off-farm projects, as IIOs were delivering less water, reducing their revenue from customer orders. That situation has changed as wetter conditions have led to improved water supply outcomes.

Figure 24: Rainfall, Australia, December 2019 to February 2020



Source: Bureau of Meteorology.

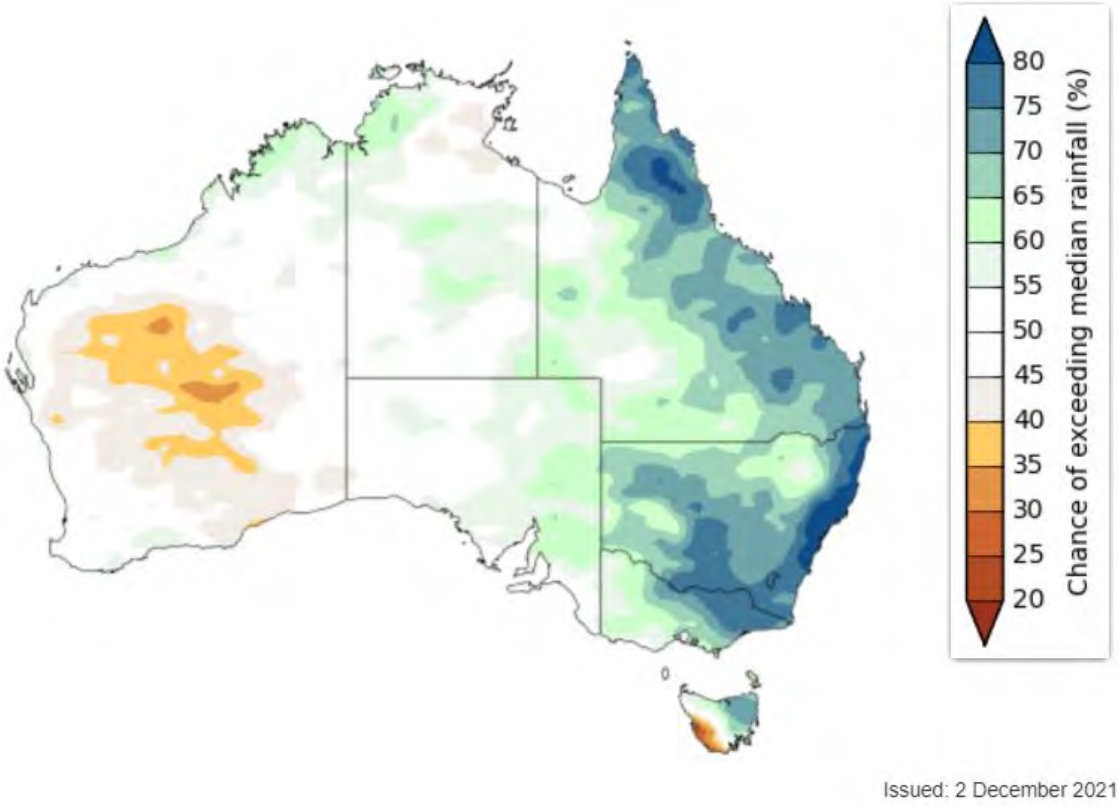
Two major weather systems influence the climate across the MDB: the Indian Ocean Dipole (IOD) and the El Niño – Southern Oscillation (ENSO).

The IOD refers to the difference between sea surface temperatures in the tropical western and eastern Indian Ocean. While the IOD is within neutral bounds, which has little influence on Australian climate.

El Niño refers to a period when sea surface temperatures in the central to eastern Pacific Ocean are significantly warmer than normal and is generally associated with reduced rainfall in Australia. Its opposing phase is La Niña, which is associated with increased rainfall in Australia.

La Niña is firmly established in the tropical Pacific. Climate models suggest this La Niña will persist until the late southern hemisphere summer or early autumn 2022. La Niña events increase the chance of above average rainfall across much of northern and eastern Australia during summer. Figure 25 shows increased chances of above-average rainfall for much of eastern and northern Australia to December 2021.

Figure 25: Rainfall, Australia, October to December 2021



Source: Bureau of Meteorology.

5. The volume of water potentially recoverable in the Basin through water efficiency measures by June 2024

5.1 Key findings

As requested by the panel, we have analysed the potentially recoverable volume based on an assessment against a series of criteria, as summarised in Table 9 and further detailed in Figure 26.

Table 9: Summary of recoverable volume analysis (LTDLE)

Eligible surface water entitlements	Technical potential	Technical potential with off-farm focus	Socio-political	Program attractiveness	Timing
8,600 GL	up to 675 GL	up to 330 GL	up to 160 GL	up to 95 GL	up to 60 GL

- There is around 8,600 GL LTDLE of eligible surface water entitlements available in the MDB, excluding environmental holdings.
- Our analysis of technical potential concluded that up to 675 GL LTDLE is potentially recoverable.
  - The total technical potential has increased from the first WESA review. We estimate that an upper bound of 675 GL could be recovered through water efficiency initiatives (in the absence of any constraints related to time, budget or participation).
- WESA-funded efficiency measures programs that are focused on off-farm projects could potentially recover up to 330 GL.
  - We estimate that, by removing all other on-farm opportunities, the potential for water recovery through a WESA-funded efficiency measure program focused on off-farm projects is up to 330 GL LTDLE, with a range of 290 GL to 330 GL LTDLE.
- When a range of socio-political factors is considered, up to 160 GL LTDLE could potentially be recovered.
  - We have estimated the potential for water recovery through the WESA-funded OFEP (considering limiting factors such as current government policies and our understanding of the positions of eligible entities) to be around 115 GL to 160 GL LTDLE.
- Analysis of program attractiveness identified that up to 95 GL LTDLE is potentially recoverable.
  - We have estimated the potential for water recovery through the WESA-funded OFEP (considering the program's attractiveness to potential participants and any changes to that factor since the first review) to be 65 GL to 95 GL LTDLE.

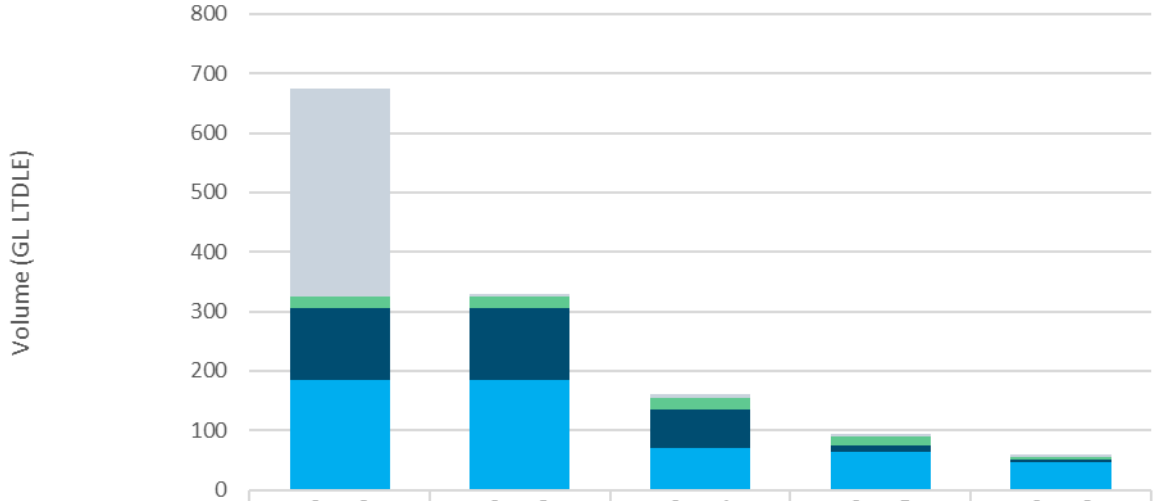
- When timing constraints (30 June 2024) are assessed, up to 60 GL LTDLE is potentially recoverable.
  - We estimate that timing constraints reduce the volume of recovery by 2024 by up to 60 GL, inclusive of existing recoveries and commitments.

Since the establishment of the WESA, most MDB water markets have witnessed significant price increases, and that affects the recovery potential from the special account, although, as noted above, other considerations are more significant.

While high reliability/security water market prices in the southern MDB have remained stable, with a only a slight decrease since the first review in 2019, general security entitlement prices (NSW) have increased by 10%–25%. Victorian low reliability prices have also increased; the most significant increase has been in the Victorian Murray below Barmah Choke, where prices have effectively doubled. General security entitlement prices have increased in all northern MDB catchments since November 2019.

Based on the remaining WESA funding of $1.54 billion, there will be sufficient funds to recover 60 GL LTDLE if all recoveries comprise a mix of general and high security entitlements. It is only under the unlikely condition that only high security entitlements are recovered at a market multiple of 3.75 that the funding would be insufficient (Figure 26).

Figure 26: Estimated water recovery under the WESA (GL LTDLE)



	Step 2	Step 3	Step 4	Step 5	Step 6
Up to	675	330	160	95	60
On-farm	350	5	5	5	5
Stock and domestic	20	20	20	15	5
Urban and industrial	120	120	65	10	3
Off-farm	185	185	70	64	47

Source: Marsden Jacob analysis.

5.2 Introduction

The panel has asked Marsden Jacob to update its analysis to support the panel's finding on the volume of water potentially recoverable in the MDB through water efficiency measures, given the combined effect of key limiting factors.

In this analysis, we have estimated:

- the size of the consumptive pool in the MDB that could potentially be drawn from for water recovery through WESA-funded efficiency measures programs
- the potential for water recovery through such programs that are focused on off-farm projects
- the potential for water recovery through such programs, considering limiting factors such as current social views; government policies and political positions; the program's attractiveness to potential participants; and any changes to those factors since the first review
- the potential for water recovery through such programs, considering the program's attractiveness to potential participants and any changes to that factor since the first review
- the potential for water recovery through such programs, given the time available to 30 June 2024, which is approximately 18 months shorter than at the first review
- the cost to recover the volume of water potentially recoverable in the Basin under such programs, given the limiting factors of time, socio-political factors, program attractiveness and available funding
- the total volume that can feasibly be recovered with the remaining WESA funds, given current water market prices and market multiples
- the current total cost to recover the remaining 450 GL LDTLE through WESA-funded efficiency measures programs.

Because our approach is based on high-level analysis, it accounts for the main (but not all) factors affecting water recovery and is based on limited consultation.

The results show the compounding effects of time, budget, limiting factors and awareness on the total potential recoverable volume under the OFEP.

5.2.1 Approach

We have used a range of data sources to inform our analysis and accurately estimate the volume of water potentially recoverable in the MDB through water efficiency measures by June 2024. The following section has been informed by a catchment-by-catchment analysis of potential recovery and by the department's Stocktake of Off-farm Infrastructure Projects. We have also consulted a number of key data and information sources.

As requested by the panel, our analysis assesses the potential volume of water that could be recovered (in LTDLE terms) in a stepwise manner, taking into account a series of factors that affect the volume (Table 10).

Table 10: Factors that were considered, 2019 compared with 2021

	2019 WESA	2021 WESA
Step 1	Total available entitlements	Total available entitlements
Step 2	Technical potential	Technical potential revised to include stock and domestic
Step 3	Time	Refocus of the OFEP onto off-farm projects effectively removes all on-farm projects
Step 4	Socio-political	Socio-political constraints
Step 5	Program attractiveness	Program attractiveness
Step 6		Time

The approach that we have used to assess the potentially recoverable volume involved both a top-down and a bottom-up assessment for Steps 2 through 6. Key information sources that we relied upon to support this assessment were:

- the amount of water in the consumptive pool, net of environmental water holdings, as sourced from the Bureau of Meteorology and state water registers
- water efficiency projects that have already been undertaken in the catchment and whether further efficiency projects might be possible
- the volume of entitlements on issue for each catchment, including the impact of recovering further entitlements
- project eligibility under the OFEP
- potential recovery, given the consumptive pool in the region.

The location and likelihood of projects set out in the department's stocktake was the key information source that supported the bottom-up assessment.

It should be noted that all volumes in the remainder of this section are in LTDLE adjusted terms, unless otherwise indicated.

5.3 Determining the size of the consumptive pool in the MDB (8,600 GL)

The first step in our analysis was to determine the total eligible surface-water entitlements that make up the consumptive pool in the Basin. Eligible surface water entitlements[10] exclude:

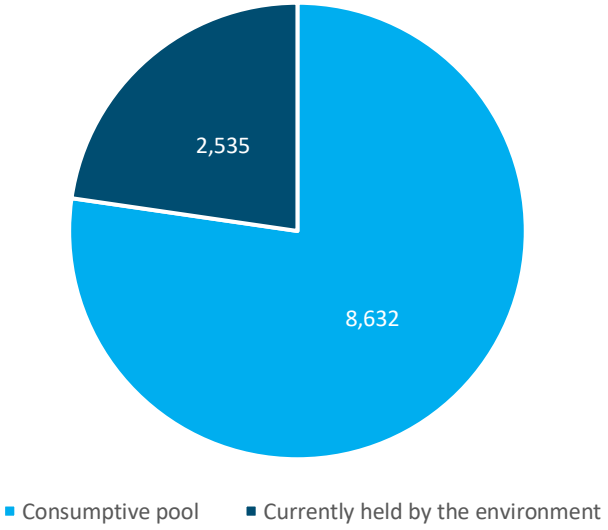
- entitlements held for environmental purposes by the Commonwealth Environmental Water Holder and its state counterparts
- groundwater entitlements.

[10] State water registers and the Bureau of Meteorology *Water information dashboard*.

We determined the size of the consumptive pool across the MDB for each entitlement class by subtracting the current environmental holdings held by the federal and state environmental water holders from the total entitlements on issue.[11] We then looked at the LTDLE cap factors of each entitlement type in each sustainable diversion limit unit, by location, and converted holdings into LTDLE values.[12]

Based on this process, we determined that ~8,600 GL is available for consumptive purposes and that ~2,500 GL is currently held for environmental purposes (Figure 27). In contrast to the findings of the first WESA review, this volume has increased (from ~8,200 GL available for consumptive purposes and ~2,300 GL currently held for environmental purposes) due to changes in the cap factors and the inclusion of stock and domestic entitlements.

Figure 27: Consumptive pool in the MDB (GL LTDLE)



Source: Marsden Jacob analysis.

5.4 Total potential water recovery through WESA-funded efficiency measure programs given no constraints (up to 675GL)

Marsden Jacob estimates that up to 675 GL LTDLE of water could be recovered under WESA funded efficiency measures programs through off-farm, on-farm, urban, industrial, stock and domestic projects without any budget or participation-related constraints.

As discussed in our approach (above), we used a range of analytical approaches and information sources to estimate the volume of entitlement that might potentially be recoverable through the WESA, assuming no constraints on the types of projects that could be undertaken and including stock and domestic projects (which were not previously considered to be in scope). Note that this analysis includes the volumes that have already been recovered.

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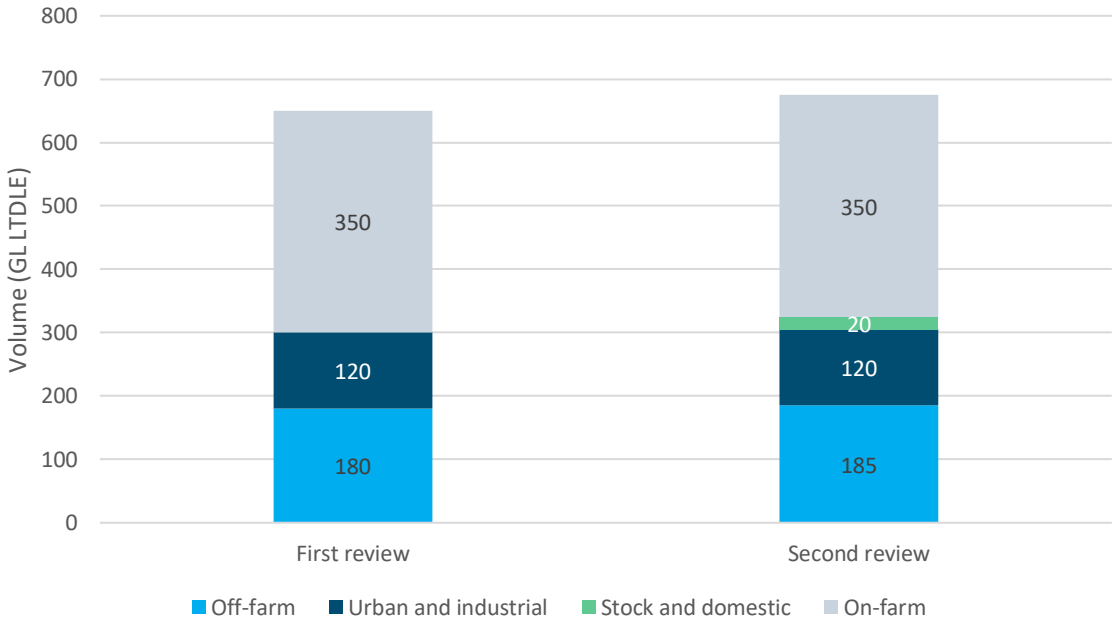
[11] This is based on public information on the Commonwealth Environmental Water Holder and Victorian Environmental Water Holder websites and state water registers.

[12] LTDLE factors were obtained from Basin state websites and federal government documents.

Our analysis concluded that on-farm and off-farm projects would make up most of the ongoing water recovery. As illustrated in Figure 28, the mix of project types has changed since the first WESA review following the introduction of stock and domestic opportunities and minor changes to Murrumbidgee off-farm projects. On- and off-farm projects still make up the majority of opportunities for efficiency measure programs under WESA.

Based on this analysis we estimate that the WESA could recover up to 675 GL in the absence of any constraining factors.

Figure 28: Estimated water recovery by project type between the first and second review (GL LTDLE)



Source: Marsden Jacob analysis

The technical potential analysis includes committed projects that are yet to commence (namely, the Goulburn-Murray Water project which is contracted to recover 15.9 GL) and excludes projects that have already been completed.

Subject to the conversion methodology used by the NSW Government, discussions with stakeholders identified that there may be a larger volume of stock and domestic water available, if delivery-system (river) efficiency improvements are factored into calculations. However, because those are not a separately identifiable entitlement and the NSW conversion process remains uncertain, our analysis of stock and domestic opportunities is limited to regulated entitlements in NSW.

In the next sections, we analyse the impact of a series of factors that affect the volume of water that could be recovered using the WESA funding.

5.5 Estimated potential water recovery through WESA-funded efficiency measures programs that are focused on off-farm projects (up to 330 GL)

The current WESA-funded efficiency measures program, the OFEP, invests in water delivery infrastructure to reduce water losses in the MDB (refer to Section 2 for details of the previous and current program arrangements).

Funding under the OFEP is available through three streams: State-led Off-farm, the Off-farm Efficiency Grants Program, and State-led On-farm.

As a result of recommendations from the first review and subsequent departmental analysis (including the stocktake), the efficiency measures program accountable for attaining the 450 GL, the OFEP, now focuses primarily on off-farm opportunities.

The department has estimated that $60 million of on-farm funding is likely to be consumed through small-scale projects in South Australia, that may generate approximately 5 GL.

The exclusion of all other on-farm opportunities is thus estimated to reduce the potential for water recovery through a WESA-funded efficiency measures program to be up to 330 GL (see Figure 26).

5.6 Estimated potential water recovery through WESA-funded efficiency measures programs, given limiting socio-political factors (up to 160 GL)

Water efficiency programs under WESA are demand driven, and it is clear from the volume recovered to date that demand from proponents of both on-farm and off-farm projects has been low. The repositioning of the program to focus on off-farm projects has given the program a clearer focus and appears to have contributed to increased socio-political support since the first review.

However, there are still locations within the MDB where historical water recovery by governments is viewed as contributing to negative socio-economic impacts and where entities with decision-making authority are understood to not be interested in participating in the programs, so it is unlikely that any water recovery will take place in those areas regardless of a refocus to off-farm projects.

In the first review, we estimated the impact of social and political factors on potential water recovery under the WEP by assuming no on-farm water recovery in regions in NSW and Victoria and no off-farm water recovery in the NSW Murray.

At the time of this second review, the Victorian Government is understood to not support on-farm recovery, although minor off-farm recovery comes from Goulburn–Murray Water. The NSW Government's stance on on-farm recovery (no assumed on-farm recovery) also remains unchanged. However, the NSW Government is now more supportive of off-farm projects as the OFEP moves towards the state-based delivery of projects focusing primarily on off-farm recovery.

In August 2021, the NSW Government called for projects to improve water efficiency through off-farm infrastructure to save water in the MDB. Water Infrastructure NSW is working with eligible industry applicants to identify existing and new efficiency project opportunities. Eligible projects involve works to irrigation networks and urban, industrial and stock and domestic systems.

So, when taking into consideration the socio-political factors, our analysis assumes that off-farm recovery in NSW will increase (compared to the prediction in the first WESA review), which is supported by the evidence from the stocktake, while also acknowledging that some possible sources of water recovery through off-farm efficiency measures (for example, Murray Irrigation) are understood to be opposed to further recovery from efficiency upgrades to their irrigation networks.[13]

Based on our analysis of information sources and direct engagement undertaken to inform this review, we thus estimate the potential water recovery through WESA-funded efficiency measures projects, given limiting socio-political factors, to be up to 160GL, with a range of between 115 GL and 160 GL (see Figure 26).

5.7 Estimated potential water recovery through WESA-funded efficiency measure programs, considering the program's attractiveness to potential participants (up to 95 GL)

When considering the attractiveness of the program to possible participants, the first WESA review found the market multiple to be a key limiting factor. In this second review, when we consider program attractiveness, we find that the market multiple is no longer a key limiting factor for all but the most expensive urban and industrial projects, as the market multiple has been relaxed (previously, it was 1.75; see Section 4.4.3).

Instead, we note that the department's stocktake of potential projects provides a clear signal that, while many off-farm projects were previously too expensive, the program is attractively positioned for those applicants and the market multiple is no longer a barrier to participation.

Based on our analysis of possible projects and informed by the information from the stocktake, we have estimated that, when program attractiveness is factored in, the potential recovery is up to 95 GL, with a range of between 65 GL and 95 GL. This is consident with the departmental analysis.

From Figure 26, it can be seen that the key change is the reduction in recovery from urban and industrial sources, as they are expected to be prohibitively expensive because they need the highest water security level and may also be reluctant due to the impacts of the recent drought, as discussed in Section 4.

In our analysis of program attractiveness, we again drew on the information presented in the stocktake report to help 'ground truth' our catchment-by-catchment analysis.

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[13] Michael Condon, Nikolai Beilharz, David Claughton, Warwick Long, 'Research confirms there is not enough water to meet the requirements of the Murray–Darling Basin Plan', *ABC News*, 21 August 2021, online.

The Stocktake of Off-Farm Infrastructure Proposals commissioned by the MDB Ministerial Council (see Section 2.5) contains a range of off-farm concept proposals submitted by Basin states, IIOs, private irrigation districts and corporations to provide off-farm water recovery.

From the information and proposals submitted in the stocktake, the department has produced an options list of potential projects that might occur in irrigation networks with a recovery potential of 175 GL (see Appendix 1). The projects range in likelihood from already contracted, to applications likely in 6 and 12 months, to several unlikely projects. The options list also considers socio-political factors. While the department's listed proposals are mostly still in the concept or feasibility study phase, the list does provide a source of information to assess the potential for water recovery through the OFEP.

5.7.1 Analysis of the stocktake volume estimates

Note that, when considering the department's stocktake, we have reflected on the fact that each proponent (whether the direct entity or member of an entity) holds a range of water entitlements to service its needs. At this stage, based on the information in the stocktake, we do not have a clear understanding of the types of water entitlement being offered. However, in our opinion, it is unlikely that a project would proceed in its entirety if the volume of recovery water is material compared to the proponent's overall entitlement holdings. For example, the NSW Moira Private Irrigation District currently has approximately 25 GL of entitlement. The proposed project would see almost 60% of its entitlement recovered (see Table 11).

Additionally, projects that involve stock and domestic licences in NSW will need to be converted into an entitlement tradeable by the Commonwealth Environmental Water Holder. There is currently no legislative process for stock and domestic access licences in NSW that allows them to be traded. This limits the ability to recover those entitlements until such a process is established, even without timing or funding constraints.

We thus reviewed all proposals for which an application is expected in the next 12 months to check the volumes of water holders' entitlements against potential recovery volumes (Table 11). While it is not possible to determine the exact make-up of entitlements at this time, we have gathered together the best estimates of entitlements held based on our expertise and public information.

Table 11: Estimated likelihood of potential proposals

Project proponent	Project type	Department estimate (GL)	Lower bound (GL)	Upper bound (GL)	Entitlement on issue / notes
Vic.: Goulburn–Murray Water	Goulburn–Murray Water – Water efficiency project	15.9	15.9	15.9	Proposal submitted
Qld: Mallawa Irrigation	Various	2	0	0	Likely to be gap bridging water
NSW: Gunbar Water Private Irrigation District	Gunbar Water pipeline extension	3	1.5	1.5	1.7 GL, but project water may come from Murrumbidgee Irrigation
NSW: Hay Private Irrigation District	Water efficiency project	1	0	0	2.3 GL
NSW: Murrumbidgee Irrigation	Various	20	15	20	160 GL
NSW: Trangie Nevertire Co-operative Ltd	Modernisation completion	1	1	1	16 GL
NSW: Civil and Earth	Basin-wide Stock and Domestic Systems (pilot project)	5	0	5	45.2 GL
On-farm	Various projects	5	5	5	Limited information on where water is coming from
South Australian stormwater harvesting projects	7 projects	2.4	2.4	2.4	Limited information on where water is coming from
ACT projects	Various urban projects	8.3	3	3	77.6 GL across ACT, but unsure where project water is coming from
NSW: Bringan Irrigation Trust	Bringan Irrigation Trust upgrade	1	0	0	2.7 GL
NSW: Moira Private Irrigation District	System reconnection	15	0	10	25.4 GL; not going to surrender 15 GL of that
NSW: Romani Joint Water Supply	System modernisation	1	1	1	2.6 GL
NSW: West Corurgan Private Irrigation District	System modernisation	15	10	10	56 GL

Project proponent	Project type	Department estimate (GL)	Lower bound (GL)	Upper bound (GL)	Entitlement on issue / notes
NSW: Civil and Earth	Basin-wide Stock and Domestic systems (full project)	15	0	5	45.2 GL
NSW stock and domestic	Various projects	20	0	5	45.2 GL
NSW urban projects	Various projects	5	5	5	Unknown water location and whether it is town/utility water (issues with tradeability) or non-specific purpose access licence water
Victorian projects	4 small-scale low water recovery off-farm projects	5	5	5	Do not know where this water comes from, but there is plenty left in Victoria, considering the size of the projects
Total			**65**	**95**	

5.8 Estimated potential water recovery through WESA-funded efficiency measure programs given timing constraints (60 GL)

The final factor that we have been asked to consider is the time available. A timing constraint arises for the OFEP because payments for efficiency projects funded from the WESA cannot be made after 30 June 2024. At this stage, we have assumed there to be no flexibility in this constraint for this analysis. The Australian Government position remains that it will not amend the Water Act and Basin Plan to extend the time frames for recovery of the 450 GL or the delivery of constraints projects.

The first WESA review's assessment of time, by Marsden Jacob, used historical infrastructure programs to estimate the technical potential for water recovery. The department's stocktake provides a specific dataset of observed projects from which the impact of time can be estimated.

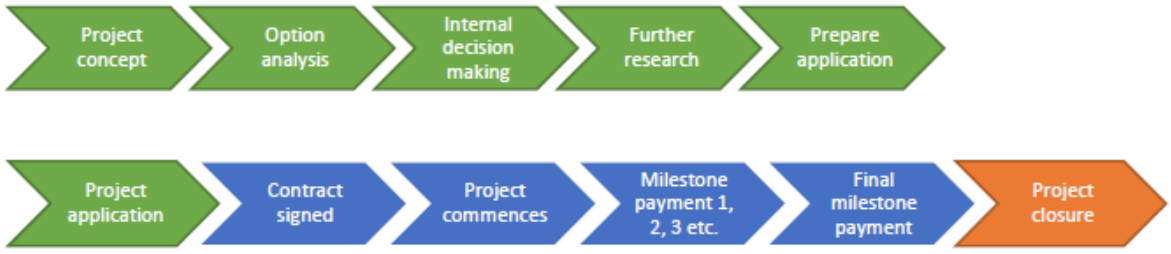
However, there appears to be some potential for payments to be made to efficiency measures projects in progress but not completed by 30 June 2024 if the water recovery is completed by that date. If this approach were adopted, it would change our finding about the potential water recovery, but advice on this is needed from the department before it can be taken into consideration.

Given that off-farm efficiency projects can take several years to complete, construction is largely constrained to winter and final funding payments are often not made until a project is complete, the remaining three years of the efficiency programs will significantly constrain the volume that can practically be recovered. Off-farm upgrades typically need to be implemented in winter because that is when the use of water delivery systems is at its lowest and the systems are able to be modified.

To estimate the potential recovery through the OFEP, reflecting timing constraints, we have assumed that the department's project proposal list in Appendix 1 represents the proposals most likely to be received in the next three years. Of which we note that 15.6 GL is already locked in for recovery from the Goulburn–Murray Water project.

Based on analysis undertaken in the first review, the average project life cycle, including pre- and post-application phases, ranges from around 4.5 to 5.5 years for the types of eligible projects (Figure 29). For off-farm projects, the pre-application phase took 1.75 years on average and the post-application 3.6 years on average. Those timings indicate that, unless proponents' projects are well developed and have passed through the key application phases, they are unlikely be finished before 30 June 2024.

Figure 29: Typical pre- and post-application phases for efficiency projects



Source: Marsden Jacob analysis.

5.8.1 Discussions with stakeholders

To better understand the department's project proposal list, we have undertaken several interviews with stakeholders to understand better each project's challenges and opportunities, with a particular focus on timing (Table 12).

Table 12: Case studies with stakeholders

Project proponent	Project type	Likelihood of application
Qld: Mallawa Irrigation	Various	Likely application within 6 months
NSW: Gunbar Water Private Irrigation District	Gunbar Water pipeline extension	
NSW: Murrumbidgee Irrigation	Various	
NSW: Civil and Earth	Basin-wide Stock and Domestic systems (pilot project)	
NSW: Moira Private Irrigation District	System reconnection	Likely application within 12 months
NSW: West Corurgan Private Irrigation District	System modernisation	

Source: DAWE.

To effectively evaluate each of the proponents, we asked the following questions:

1. What is the current status of your proposal? Concept / ready to submit / other
2. Will it involve one project or several different projects? How much water?
3. How long do you think it will take before you will be in a position to submit an application?
4. How long do you expect it will take you to complete the project?
5. What are the key risks to achieving the project timeline? Would you contribute water early if that delayed delivery?

Overall, the engagement with stakeholders provided key insights into both the challenges being faced and observed opportunities from the perspective of project proponents. In summary, they commented as follows:

- There is increased optimism and interest in project opportunities, particularly as the funding multiple has been relaxed and market prices have stabilised.
- Some noted difficulties in getting the required evidence together to demonstrate to members and boards the benefits of efficiency measures projects.
- They were overcoming long-term social issues with the Basin Plan and handing water over to the Commonwealth, but there has been some turnover in decision-makers, which means that interest from some entities has increased.
- Stakeholder consultation, project administration and management fees can be the same for both

$50,000 projects and $5 million projects, so they sought flexibility in this regard. Further, there was some concern that two levels of government involvement will complicate and increase approval time frames and reporting load.

- The timing of projects for winter periods when water demand is low is important in order not to impinge on the summer irrigation season.

When time constraints are factored into the analysis, we estimate that recovery will be around 60 GL[14].

5.9 Estimated potential water recovery through WESA-funded efficiency measures programs, given funding constraints

The current status of most of the potential projects is that they are in either the concept or the feasibility study phase. This poses a challenge in estimating the funding required to complete the projects. Unlike under the WEP, where the funding of projects was based on the value of surrendered water entitlements, OFEP funding will be based on the cost of infrastructure, with the market multiple adjusting to meet the cost.

As discussed in Section 4.4.1, the market multiple for previous infrastructure projects undertaken by the federal and state governments has been around 2.25 times the prevailing market price. To determine the estimated recovery through the OFEP, given funding constraints, we have assessed the recovery potential of 40 GL and 60 GL using market multiples of 1.75, 2.75 and 3.75. This reflects the fact that projects under the OFEP increasingly need a higher market multiple to pay for the infrastructure because low-cost alternatives have mainly already been implemented.

In this analysis, we have used the average southern Basin VWAP for general and high security/reliability water entitlements of $2,000/ML and $7,000/ML (nominal), respectively. This equates to approximately $3,300/ML LTDLE (cap factors of 0.60[15]) for general security/reliability and $7,400/ML LTDLE for high security/reliability (cap factor of 0.95[16]).

As discussed in Section 3, these prices are considerably higher than when the WESA was established but have remained relatively stable (for most entitlement types) over the period between the first and second WESA reviews. Additionally, we have used southern MDB prices, as most potential recovery is expected to occur in the southern Basin.

Figure 30 highlights the range of funding required to recover between 40 GL and 60 GL, which is the range of potential recovery under WESA-funded efficiency programs. Based on the remaining WESA funding of $1.54 billion, there is sufficient funding to recover 60 GL across all entitlements. The

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[14] The assessment of recovery potential includes committed projects that are yet to commence (namely, the Goulburn-Murray Water project which is contracted to recover 15.9 GL) and excludes projects that have already been completed.

[15] The average cap factor for general security/reliability entitlements in NSW Murrumbidgee, NSW Murray, Vic. Murray and Goulburn is 0.60.

[16] The average cap factor for high security/reliability entitlements in NSW Murrumbidgee, NSW Murray, Vic. Murray and Goulburn is 0.95.

funding would only be inadequate if the 60GL is exclusively high security/reliability entitlements with a market multiple of 3.75 (Table 13).

Figure 30: Cost of potential recovery under six market multiple scenarios ($ billion)

Source: Marsden Jacob analysis.

Table 13 and Figure 31 further illustrate the maximum recovery of entitlements for a range of market multiples and recovery compositions. In general, they show that the funding is not adequate to recover the full 450 GL because market prices have increased substantially over the life of the WESA.

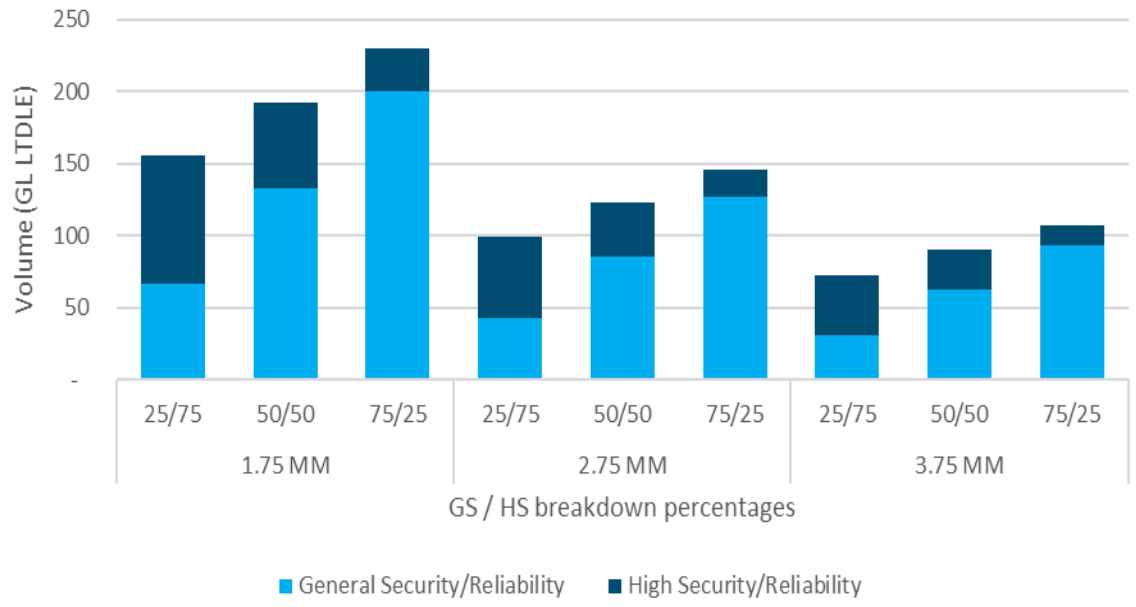
However, it is important to note that funding is not the critical constraint on recovery. Our analysis has found that several other factors, including socio-political factors, the time available and program attractiveness, will mean that the budget constraint is unlikely to be a material issue over the remaining life of the WESA.

Table 13: Maximum estimated recovery based on 100% recovery of entitlement type (GL LTDLE)

Multiplier	1.75	2.75	3.75
General security/reliability	267	170	124
High security/reliability	119	76	55

Source: Marsden Jacob analysis.

Figure 31: Breakdown of general security and high security recovery scenarios under varying market multiples (GL LTDLE)



MM = market multiple.

Source: Marsden Jacob Analysis

5.10 Current total cost to recover 450 GL LDTLE through WESA-funded efficiency measures programs

As part of the first WESA review, Marsden Jacob developed several water recovery scenarios that identified the potential and likely sources of water entitlements available to and accessible by the WESA to meet the 450 GL target. Our best estimate showed the total cost to recover 450 GL to be around $4.8 billion, given market prices in November 2019. According to that estimate, the recovery would cost much more than the $1.575 billion budget, and most of the water would be recovered from the southern MDB. The largest individual entitlement group contributing to the 450 GL recovery target is expected to be general security water from NSW, but the types of entitlement across the MDB will be broader compared to under the other scenarios.

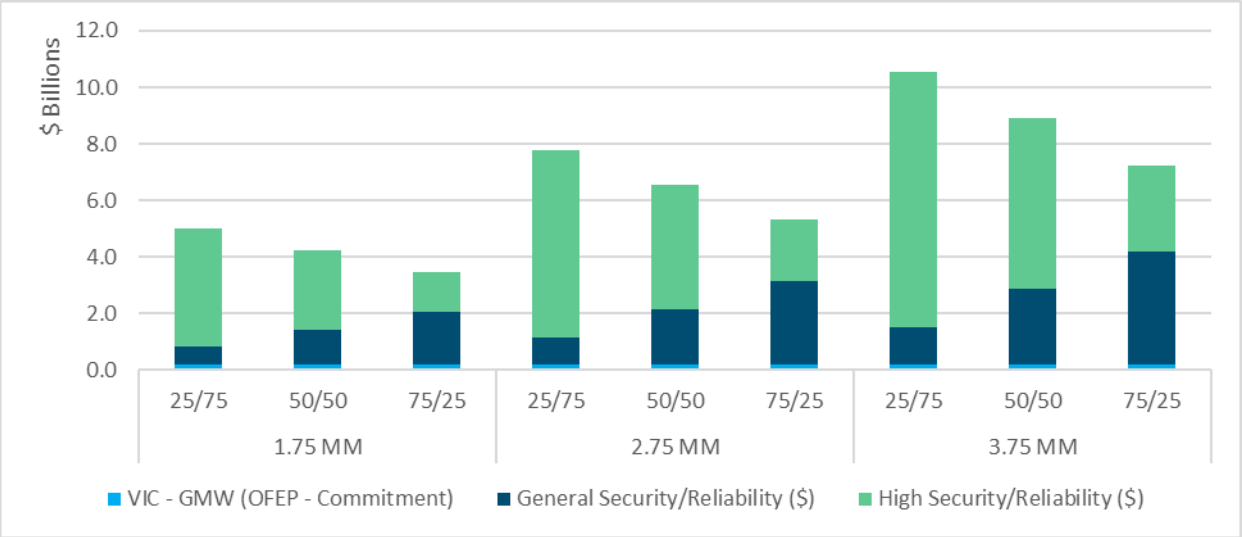
The panel has requested that Marsden Jacob estimate the cost of recovering 450 GL through WESA-funded efficiency measures programs, given current water market prices. For this review, we have estimated the recovery under three market multiples and three entitlement breakdowns to illustrate the range of potential recovery scenarios. Although a market multiple of 1.75 is unlikely to recover additional water based on the first review, we have included it to help illustrate the range of recovery costs between the first and the second WESA reviews.

To value each scenario, we assumed that most of the water recovered would be likely come from the southern MDB and applied a general security/reliability price of $3,300/ML LTDLE and a high security/reliability price of $7,400/ML.

The cost of recovering 450 GL under varying market multiples and a mix of general and high security entitlements ranges from $3.5 billion to $10.6 billion (Figure 32). The least expensive options involve a more significant proportion of recovered water coming from general security entitlements; however, we estimate that the most likely scenario will include a greater high security/reliability volume.

For the second WESA review, we estimate that the cost to recover 450 GL is more likely to be at least $6.5 billion because the market multiple has been relaxed (previously, it was 1.75). As discussed with the panel, this assumes that the average market multiple would be at least 2.75 through efficiency programs.

Figure 32: Estimated cost to recover 450 GL under varying general and high security breakdowns and market multiples ($ billion)



MM = market multiple.

Source: Marsden Jacob analysis.

5.11 Alternative recovery scenarios

An analysis to determine the volume of water potentially recoverable in the MDB through water efficiency measures, given the combined effect of limiting factors, can take many analytical paths.

To support the panel's deliberations, we have assessed variants of the order in which limiting factors could be applied. At the same time, all of them conclude that the maximum recoverable volume is up to 60 GL. The importance of this analysis, as detailed below, is that it highlights that, in Marsden Jacob's opinion, the most important factors affecting recovery are now the remaining time available and socio-political opposition to some recovery opportunities.

5.11.1 WESA 2019

For instance, in the first WESA review in 2019, the recovery assessment considered:

- total available entitlements

- technical potential, given no constraints
- the impact of time constraints
- socio-political factors
- program attractiveness.

The end result was a recovery potential of up to 60 GL (Table 14).

Table 14: 2019 first WESA review calculation steps

	2019 WESA review process	GL LTDLE
Step 1	Total available entitlements	Up to 8,200
Step 2	Technical potential	Up to 650
Step 3	Time	Up to 195
Step 4	Socio-political	Up to 120
Step 5	Program attractiveness	Up to 60

5.11.2 Scenario 1

For the second review, the panel has requested that Marsden Jacob consider two additional scenarios. The first is a replicate of the 2019 first WESA review as stepped out in Table 14, but using updated information regarding the key limiting factors and potential projects in the department's stocktake list.

The results are shown in Table 15, indicating that, when time constraints are factored in, the recovery volumes immediately reduce to be up to 60 GL.

This conclusion is based on the assumption described in Section 5.8: that the department's project proposal list in Appendix 1 includes the most likely proposals to be received in the next three years.

This is further supported by analysis that we undertook in the first review, which found that the average project life cycle, including pre-and post-application phases, ranged from 4.5 to 5.5 years for the types of eligible projects. For off-farm projects, the pre-application phase took 1.75 years on average and the post-application 3.6 years on average. Those timings indicate that, unless proponents are in post-application phases, projects are unlikely to be finished before 30 June 2024.

Second, consultations with network providers identified several challenges associated with participating in the OFEP that ultimately require time to overcome, such as data collection, customer engagement and the feasibility of project construction during winter periods.

Table 15: First WESA review process with updated information

	Replicate of first WESA review	GL LTDLE
Step 1	Total available entitlements	Up to 8,600
Step 2	Technical potential	Up to 675
Step 3	Time	Up to 60
Step 4	Socio-political	No change
Step 5	Program attractiveness	No change

5.11.3 Scenario 2

The second scenario that the panel requested us to evaluate (described in Table 16) produces the same result of recovery potential of up to 60 GL. Steps 1 and 2 (available entitlements and technical potential) remain the same.

Estimating Step 3 and the potential recovery, given limiting socio-political factors, we assume no further on-farm recovery in Victoria and some off-farm recovery in NSW Murray, acknowledging that Murray Irrigation is against further recovery in its irrigation network.[17] With that removed from the technical potential, this leaves up to 350 GL of water potentially available for recovery.

In estimating Step 4, we assumed that the department's stocktake and subsequent options list constitute a majority of the likely projects, particularly as there are now less than three years (and only two full winters) remaining before 30 June 2024.

As we have noted, to check the potential we assessed the entitlements on issue for each of the proponents to gauge the likelihood of them participating. We assumed that a project proposal is unlikely to proceed in its entirety if the volume of recovery water is material compared to the proponent's overall entitlement holdings. For example, the NSW Moira Private Irrigation District currently has approximately 25 GL of entitlements. The proposed project would see almost 60% of its entitlement recovered. From a potential recovery with limiting factors of up to 350 GL, we estimate that the effect of program attractiveness factors will reduce the recovery potential to up to 100 GL.

Step 5 assesses time as a limiting factor identically to Section 5.8, assuming that the department's project proposal list in Appendix 1 includes the most likely proposals, and that network providers face several challenges associated with participating in WESA-funded efficiency measure program.

Table 16: Alternative recovery scenario to estimate potential recovery under the WESA

	MJA alternative recovery scenario	GL LTDLE
Step 1	Total available entitlements	Up to 8,600
Step 2	Technical potential	Up to 675
Step 3	Socio-political factors and program attractiveness	Up to 330
Step 4	Program attractiveness and the department's stocktake list	Up to 100
Step 5	Time	Up to 60

[17] Condon et al., 'Research confirms there is not enough water to meet the requirements of the Murray–Darling Basin Plan'.

Appendix 1. Stocktake summary

Project proponent	Project type	Likelihood of application
Vic.: Goulburn–Murray Water	Goulburn–Murray Water – WEP	Submitted
Qld: Mallawa Irrigation	Various	Likely application within 6 months
NSW: Gunbar Water Private Irrigation District	Pipeline extension	
NSW: Hay Private Irrigation District	Delivery efficiency project	
NSW: Murrumbidgee Irrigation	Various	
NSW: Trangie Nevertire Co-operative Ltd	Modernisation completion	
NSW: Civil and Earth	Basin-wide Stock and Domestic systems (pilot project)	
On-farm	Various on-farm	
South Australian stormwater harvesting projects	7 projects	
ACT projects	Various urban projects	
NSW: Bringan Irrigation Trust	Upgrade	Likely application within 12 months
NSW: Moira Private Irrigation District	System reconnection	
NSW: Romani Joint Water Supply	System modernisation	
NSW: West Corurgan Private Irrigation District	System modernisation	
NSW: Civil and Earth	Basin-wide Stock and Domestic systems (full project)	
NSW stock and domestic	Various projects	
NSW urban projects	Various projects	
Victorian projects	4 small-scale low water recovery off-farm projects	
NSW: Jemalong Irrigation Ltd	Various	Project not likely to result in water recovery but department will discuss applications with network
NSW: Marthaguy Irrigation Scheme	Seepage and evaporation management	
NSW: Murray Irrigation Ltd	Various	
NSW: Narromine Irrigation Board of Management	Network upgrade	
NSW: Western Murray Irrigation	Improving peak flows	
NSW: Tenandra Scheme	Matching scheme capacity to future demand	

Source: Department of Agriculture and Water Resources.

Acronyms and abbreviations

ABS	Australian Bureau of Statistics
DAWE	Department of Agriculture, Water and the Environment
ENSO	El Niño – Southern Oscillation
GL	gigalitre
IIO	irrigation infrastructure operator
IOD	Indian Ocean Dipole
LTAAY	long-term average annual yield
LTDLE	long-term diversion limit equivalent
MDB	Murray–Darling Basin
MDBA	Murray–Darling Basin Authority
ML	megalitre
OFEP	Off-farm Efficiency Program
VWAP	volume weighted average price
WESA	Water for the Environment Special Account