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Assessing the value of NSW water entitlements

Final Report

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A Marsden Jacob Report

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Marsden Jacob Associates Pty Ltd
ABN 66 663 324 657
ACN 072 233 204

e. economists@marsdenjacob.com.au
t. 03 8808 7400

Office locations

Melbourne
Perth
Sydney
Brisbane
Adelaide

Authors

Simo Tervonen	Principal at Marsden Jacob
Rod Carr	Director at Marsden Jacob

LinkedIn: Marsden Jacob Associates
www.marsdenjacob.com.au

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1. Executive summary

Marsden Jacob was engaged by the Natural Resources Access Regulator (NRAR) to develop valuations for water entitlements used in NSW and to provide guidance on the economic contribution of water to the NSW economy.

1.1 NSW water entitlements

Water entitlements are a form of property right over the use of water. In NSW, water entitlements broadly fall into two categories, basic landholder rights and water access licences.

Management of New South Wales water resources relies on a range of legislation, initiatives and cooperative arrangements with the Commonwealth and other state governments. The key piece of legislation for water management in NSW is the *Water Management Act 2000* (the Act).

This project focuses on the valuation of water access licences because works solely used to take water under basic landholder rights are exempt from water access licence conditions and regulations. An access licence provides the holder with the ongoing right to access a share of a specified water source. During the water year, water is distributed or 'allocated' against access licences by the NSW government in response to factors such as changes in rainfall and water storage.

1.2 Natural Resource Access Regulator

Management of New South Wales water resources relies on a range of legislation, initiatives and cooperative arrangements with the Commonwealth and other state governments. The key piece of legislation for water management in NSW is the *Water Management Act 2000* (the Act).

Established in 2017 to support the delivery of a suite of new compliance requirements, NRAR ensures water is used lawfully and that all communities and the environment get a fair share. Established under the *Natural Resources Access Regulator Act 2017* (NRAR Act), NRAR was created to deliver efficient, effective, transparent and accountable enforcement of the laws. NRAR also works to maintain public confidence in the enforcement of those laws.

1.3 Project scope

The project scope focused on three key matters.

1. Estimating the value of the water that is subject to the new compliance requirements in NSW based on water market trades and analysis.
2. Estimating the value of water based on production value.
3. Estimating the value of broader economic activity related to water-based industry.

1.4 Summary findings

The summary findings from Marsden Jacob's analysis are as follows:

- **12,600 GL:** The total volume of water entitlements on issue (that are in scope) is over 12,600 gigalitres. This equates to more than 25 times Sydney harbours.
- **\$29 billion:** Valued by reference to water market trades, our analysis estimates that the total market value of NSW water entitlements that are subject to the new compliance requirements is around \$29 billion.
- **Values are growing:** At the state level, the 1-year volume-weighted average price (VWAP) of entitlements is over \$2,200 per ML. The 5-year VWAP is around \$1,800 per ML – this demonstrates how the values have increased over time across NSW. Should a similar growth in entitlement values continue, it means that the total market value of the entitlements could be more than \$35 billion in 5 years. However, we note that there are natural threshold limits (such as the value of the output) that govern the capacity to pay because water is an input to production.
- **Annual irrigation production value \$3-4 billion:** On a Gross Value of Irrigated Agricultural Production (GVIAP) basis, the water entitlements are supporting production valued at between \$3.1 to \$4.4 billion per annum, or a five-year average of \$3.5 billion.
- Irrigated production is a key revenue source for many **regional economies**. The regional contribution of water extends well beyond economic outcomes (including supporting cultural values and recreational activities). Quantifying the impact is difficult. Using an illustrative flow-on multiplier of 1.5 suggests that for GVIAP of \$3.5 billion, the total direct and flow-on impact from irrigated agricultural production alone (that is supported by water access entitlements across the state) would be \$5.25 billion.
- Considering that the value of the entitlements and the water-based production is billions of dollars, and is increasing, **effective monitoring and compliance is needed to maintain system integrity**.

2. Introduction

Marsden Jacob has been engaged by NRAR to develop valuations for water resources that are used in NSW and to provide guidance on the economic contribution of water-based production.

2.1 About NRAR and the NSW water compliance reforms

Established under the *Natural Resources Access Regulator Act 2017* (NRAR Act), NRAR was created to deliver efficient, effective, transparent and accountable enforcement of the laws. NRAR also works to maintain public confidence in the enforcement of those laws.

The NSW Government introduced a robust metering framework to improve the standard and coverage of non-urban water meters across NSW commenced on 1 December 2018. Under this framework, licensed water users are required to install compliant metering equipment on works that meet the metering thresholds by their roll-out date (Figure 1).

Figure 1: Roll-out dates for the NSW non-urban water metering framework



Source: DPIE, 2021

Recent field investigation by NRAR has identified that 69% of active pumps are now fully compliant with new metering rules¹.

¹ <https://www.dpie.nsw.gov.au/nrar/how-to-comply/metering/compliance-state-of-play>

Figure 2: Metering compliance rates, fully compliant works statewide as at 1 December 2021



Source: NRAR, 2022

2.2 Project scope

Marsden Jacob was engaged by NRAR to assess the value of water entitlements across NSW and provide guidance into the economic contribution of water and water-based production to the NSW economy.

In this project, we have gathered and analysed a range of available information about the value of the water which is subject to the new compliance requirements, the production value originating from this water, and the contribution of this water-based production activity to regional economies across NSW.

The project is focused on three key areas.

1. **Estimating the value of the water that is subject to the new compliance requirements in NSW based on water market trades and analysis.** The timeframe for this analysis includes both shorter time frames (6 months to 1 year) and longer time frames (5 years). Value estimates are provided by water sharing plan (WSP) regions².
2. **Estimating the value of water based on production value.** This task uses producer surplus measures and margin analysis for the agricultural production for which this water is an input. Valuations are provided by WSP regions.
3. **Estimating the value of broader economic activity related to water-based industry.** This task estimates the value of water-based production's economic contribution to their respective local, regional and NSW economies, taking into account economic benefits to the broader community rather than just benefits to the individual water users.

² We have assumed that these WSPs are per Attachment D of the NSW Non-Urban Metering Policy (available here: https://www.industry.nsw.gov.au/data/assets/pdf_file/0017/312335/nsw-non-urban-water-metering-policy.pdf)

3. NSW water entitlements and their management

This section introduces water entitlements in NSW and governing legislation and regulations.

3.1 Water entitlements – legislative framework overview

Management of New South Wales water resources relies on a range of legislation, initiatives and cooperative arrangements with the Commonwealth and other state governments.

The key piece of Commonwealth legislation relating to water is the Commonwealth *Water Act 2007*. Schedule 1 of the Act contains the Murray-Darling Basin Agreement, to which the NSW Government is party. The Commonwealth *Basin Plan 2012* was adopted under the *Water Act 2007*. Water resource plans are a key requirement of the Basin Plan 2012.

Operating in compliance with the Commonwealth legislation, the key piece of legislation for water management in NSW is the *Water Management Act 2000* (the Act).

The Act governs water sharing, licensing, approvals and water trading when a water sharing plan (WSP) has been enacted for a particular area and specific water sources within that area.

Table 1 summarises some of the NSW water management framework features that underpin the value of the water assets.

Table 1: Overview of the NSW water management framework

NSW water management framework
<p>1. The Act</p> <p>The <i>Water Management Act 2000</i> governs water sharing, licensing, approvals and water trading in NSW when a water sharing plan has been enacted for the particular area and the specific water source. Under the Act, there are separate regulatory arrangements for access licences, use approvals, works approvals, controlled activity approvals and aquifer interference approvals. Among other things, the Act further defines categories of access licences and different dealing types in NSW.</p>
<p>2. The regulations</p> <p>The key regulation made under the Water Management Act is the Water Management (General) Regulation 2018. The regulation specifies important procedural and technical matters related to the administration of the Act. For example, it prescribes additional categories of access licences and further declares which types of access licences are specific purpose access licences.</p>
<p>3. Access Licence Dealings Principles Order</p> <p>The Access Licence Dealings Principles Order 2004 provides detail and clarity on dealings permitted under the Water Management Act and in relevant water sharing plans. For instance, it outlines the principles for specific types of access licence dealings, such as the tradability of specific purpose access licences (both allocation and entitlement trades).</p>
<p>4. Water sharing plans (referred to as ‘management plans’)</p> <p>The main tools in the Act for managing the state’s water resources are water sharing plans (WSP). The plans</p>

NSW water management framework

are used, for example, to set out the rules for the sharing of water in the particular water source between water users and the environment and rules for the trading of water in the particular water source.

5. Water resource plans (referred to as 'management plans')

Water resource plans are developed to meet requirements set out by the federal Basin Plan 2012. The entire NSW portion of the Murray–Darling Basin is already covered by statutory water sharing plans made under NSW legislation. The NSW water sharing plans will remain the primary legal framework governing how water is accessed and shared. Water resource plans build on those arrangements to deliver requirements under the Basin Plan.

6. Policies

Various policies clarify the requirements for specific activities under the NSW water legislation framework. They include the following:

- **NSW non-urban water metering framework:** Licensed water users are required to install compliant metering equipment on works that meet the metering thresholds by their rollout date.
- **NSW Aquifer Interference Policy:** This policy clarifies the requirements for obtaining water licences for aquifer interference activities under NSW water legislation and sets minimal impact considerations for assessing those activities. The recharge component of MAR is considered to be an aquifer interference activity.

3.2 NSW water entitlement types

Water entitlements are a form of property right over the use of water. In NSW, water entitlements broadly fall into two categories, basic landholder rights and water access licences.

This project focuses on the valuation of water access licences, because works solely used to take water under basic landholder rights are exempt from water access licence conditions and regulations. An access licence provides the holder with the ongoing right to access a share of a specified water source. During the water year, water is distributed or 'allocated' against access licences by the NSW government in response to factors such as changes in rainfall and water storages.

Entitlements belong to two main resource types, surface and groundwater. Regulated surface water systems have their water controlled by infrastructure (i.e., water storage), which stores and releases water. In unregulated surface water systems, water supply is not enhanced by releases of stored water, typically being run-of-river water. Groundwater refers to the water below the land surface. It is stored in fractured rocks, porous rocks and soils called aquifers or groundwater systems.

In the current NSW framework, water entitlements are primarily governed by the Act and the Water Management (General) Regulation 2018 in areas where WSPs operate. There are various prescribed access licence categories for surface and groundwater sources. The entitlement type will affect the following aspects (including but not limited to):

- **The ability to trade water:** Certain licence categories are ineligible for trading, or there may be specific restrictions on trading (as determined in the Access Licence Dealings Principles Order 2004 and water sharing plans).
- **The order of allocation between licence categories:** WSPs specifying the amount of water that is available for extraction from a water source under a long-term average annual extraction limit.

The available water within this extraction limit is then shared between water access licences based on the WSP rules.

For example, regulated surface water entitlements have different reliabilities, which define the priority of allocating water for water entitlements.

Higher reliability entitlements (such as high security access licences) may receive a full 100% water allocation during all but the most severe droughts, whereas lower reliability entitlements (such as general security access licences) only receive allocation if there's enough water available in storages after higher reliability allocations have been made.

- **Setting priorities between licence categories:** Both the Act and the regulations determine the order of use among licence categories. The priority can be in relation to when a licence holder can extract water or when they can take water during periods when the supply of water is insufficient to satisfy all water requirements. WSPs can also provide locally for different rules of priority for each of those situations.
- **The ability to carry water over:** Certain licence categories are ineligible for carrying unused water over from one water year to another (as determined in water sharing plans).

For the purpose of this report, specific purpose access licences (SPAL) have not been considered. SPALs are issued for a specified purpose (for instance, stock and domestic, or local water utility use), and are generally not tradable separate to land. Table 2 presents the entitlement types that have been included in the analyses for this report.

Table 2: NSW water entitlement types

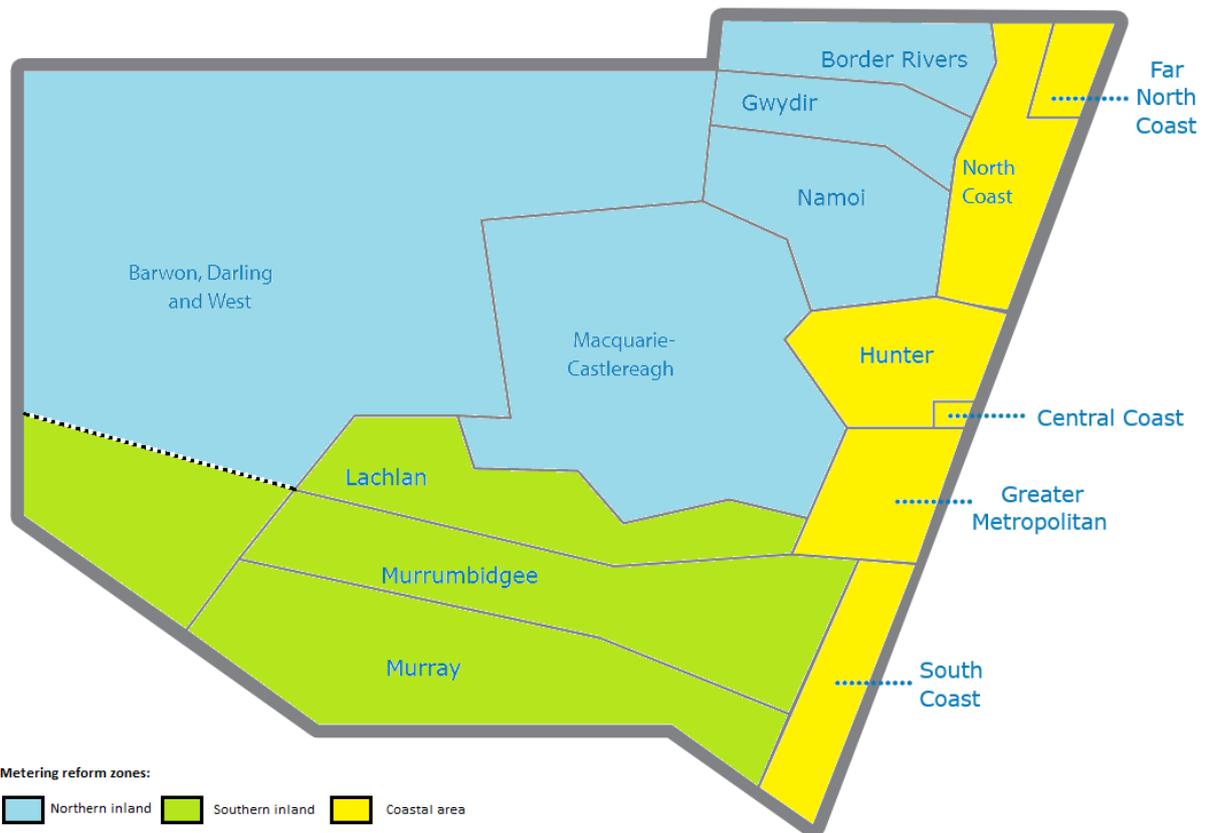
Licence category	Resource type
Aquifer	Groundwater
Aquifer (general security)	Groundwater
Aquifer (high security)	Groundwater
Coleambally Irrigation (conveyance)	Regulated surface water
Murrumbidgee Irrigation (conveyance)	Regulated surface water
Regulated river (conveyance)	Regulated surface water
Regulated river (general security A)	Regulated surface water
Regulated river (general security B)	Regulated surface water
Regulated river (general security)	Regulated surface water
Regulated river (high security)	Regulated surface water
Supplementary water	Regulated surface water
Supplementary water (Lowbidgee)	Regulated surface water
Unregulated river	Unregulated surface water
Unregulated river (A class)	Unregulated surface water
Unregulated river (B class)	Unregulated surface water
Unregulated river (C class)	Unregulated surface water
Unregulated river (high flow)	Unregulated surface water
Unregulated river (special additional high flow)	Unregulated surface water

3.3 NSW water zones and regions

For this report, all NSW water sources and entitlements have been grouped into zones and regions (Figure 3). We note that the Barwon, Darling and West region extends into both Northern and Southern inland zones. Whilst most of the water sources within that region belong to the Northern inland zone, a few are located in the south, hence belonging to the Southern inland zone.

Across NSW, there are 59 WSPs. A full list of WSPs is provided in Appendix 1.

Figure 3: NSW water zones and regions



Source: Adapted from DPIE, available at: <https://www.industry.nsw.gov.au/water/plans-programs/water-sharing-plans/status>

4. What is the value of the water entitlements?

Water access entitlements are tradable commodities that are witnessing value growth. This section discusses the value of the water entitlements on issue across NSW.

4.1 Key findings

The total entitlement pool analysed in this report consists of 752 water sources with 32,478 water access licences, holding 12,610,130 megalitres (ML) of water.

At the state level, the 1-year volume-weighted average price (VWAP) of entitlements is over \$2,200 per ML. The 5-year VWAP is around \$1,800 per ML – this demonstrates how the values have increased over time across NSW. Value increases have been underpinned by

- continuing demand for water from horticulture (such as fruit and nuts) and viticulture for higher reliability and groundwater entitlements, especially during dry years
- increased demand for water from cotton producers for general security entitlements, especially during years when there has been more water available
- increased demand from high value crops (blueberries, for example) in areas where water markets have only started to mature (such as Coastal NSW)

To estimate the total value of the NSW water entitlements, the total volume of entitlements on issue was multiplied by the estimated market value per licence category. Based on the analysis, the estimated total market value of NSW water entitlements is over \$29 billion. The most valuable water assets are located in the Southern inland zone and the Murray and Murrumbidgee regions, noting that these are also the areas where the largest amount of entitlements have been issued.

4.2 Valuation methodology and sources

To estimate the value of the water that is subject to the new compliance requirements in NSW, the water entitlements were valued by reference to water market trades. Specifically, market trade data from the last five water years was collected for each water source and entitlement type (as per Table 2).

To prepare and analyse the underpinning valuation data the following analytical steps were undertaken:

- Entitlements on issue data was assembled from the NSW Water Register to develop a definitive list of all water types and held volumes in the desired water areas

- There are 752 water sources with 32,478 water access licences, with a total of 12,610,130ML of access entitlements (noting this assumes that one water share equals 1 ML of water)
- Trade data from 1 July 2016 to 30 August 2021 was compiled from the following sources:
 - NSW Water Register
 - Bureau of Meteorology Water Information Dashboard
 - Marsden Jacob [Waterflow™](#)
 - NSW Government's [Controlled Allocations](#) outcomes
- Trade data was pre-cleaned by removing \$0 trades and other obvious outliers such as trade values greater than \$15,000/ML
- Trade data was then thoroughly cleaned to remove other outliers by reviewing each trade individually per water source
- As a result of the cleaning process, a dataset of 4,151 trades was used to calculate market values for each entitlement type per water source. Specifically, volume-weighted average prices (VWAP) were calculated for 6-month, 1 and 5-year time frames.

The data collection and cleaning work was underpinned by our deep understanding of entitlement values across the state as we have undertaken prior work in nearly all NSW surface and groundwater catchments.

Moreover, our valuation methodology follows established assumptions and procedures for valuing water entitlements. Our approach is consistent with Australian Accounting Standards Board (AASB) 13³ and other guidance. As per AASB 13, the approach uses prices and other relevant information generated by market transactions involving identical or comparable assets to value the assets on a fair value measurement basis. This is Marsden Jacob's preferred valuation technique for water entitlements whenever sufficient data is available.

However, due to the broad nature of this project's valuation task, the aggregate level water value estimates in this report are provided for informational purposes only and are not to be used or considered as a commercial valuation of any particular entitlement type.

4.3 Entitlement values by zone, region and whole of NSW

The market value analysis results are presented in Table 3, which presents the total entitlements on issue (EOI) and VWAPs aggregated on the whole of state, zone, and region level. The analysis shows that across NSW, water values have increased over the last five years. In the Northern and Southern inland zones, the values have slightly softened when comparing the average prices over the last year and the last six months (predominantly due to drought conditions ending in large areas across inland NSW), whereas in the Coastal area values have continued to increase significantly.

³ https://www.aasb.gov.au/admin/file/content105/c9/AASB13_08-15_COMPfeb16_01-19.pdf

Table 3: Entitlements on issue (ML) and 5-year, 1-year, and 6-month VWAPs (\$/ML), by zone, region and state (up to August 2021)

Region	Total EOI	5-year VWAP	1-year VWAP	6-month VWAP	Central estimate
NSW Total	12,610,130	\$1,789	\$2,267	\$2,217	
Coastal area	1,070,231	\$1,282	\$1,862	\$2,556	
Central Coast	18,431	\$2,187	\$2,500	\$4,000	\$3,577
Far North Coast	104,625	\$677	\$986	\$1,290	\$1,203
Greater Metropolitan	235,297	\$931	\$1,662	\$2,967	\$2,975
Hunter	494,123	\$1,964	\$2,338	\$2,903	\$1,864
North Coast	152,405	\$1,023	\$1,240	\$1,581	\$2,223
South Coast	65,351	\$496	\$917	\$1,000	\$616
Northern inland	3,527,443	\$1,712	\$2,349	\$2,256	
Barwon, Darling and West	250,912	\$1,208	\$500	n.a.	\$1,180
Border Rivers	492,083	\$1,731	\$2,246	\$2,059	\$2,625
Gwydir	804,306	\$2,210	\$3,174	\$3,118	\$3,372
Lachlan ⁴	15,915	\$891	\$926	\$876	\$876
Macquarie-Castlereagh	1,095,048	\$1,183	\$1,687	\$1,820	\$1,700
Murrumbidgee ⁵	3,494	\$610	n.a.	n.a.	\$3,531
Namoi	865,686	\$1,716	\$2,129	\$1,814	\$1,949
Southern inland	8,012,455	\$1,859	\$2,276	\$2,161	
Barwon, Darling and West	340,665	\$1,723	\$1,145	\$1,145	\$525
Lachlan	995,093	\$1,244	\$1,980	\$1,159	\$1,694
Murray	2,674,812	\$1,933	\$2,485	\$2,205	\$2,458
Murrumbidgee	4,001,885	\$2,150	\$2,261	\$2,440	\$2,720

To estimate the total value of the NSW water entitlements, the total volume of entitlements on issue was multiplied by the estimated market value per licence category (central estimate in Table 3 represents an aggregation of the estimated market values of all entitlement types per region). The latter was informed by the market data analysis, and supplemented by proxy values where trade evidence was considered insufficient, skewed (for example, when trade values of a single water source are overrepresented when VWAPs are aggregated on a region level⁶) or outdated⁷.

⁴ Although Lachlan is located in the Southern inland zone, two water sources (Orange Basalt and Young Granite Groundwater Sources) are managed under a WSP (NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020) which belongs to the Northern inland zone per Attachment D of the NSW Non-Urban Metering Policy (available here: https://www.industry.nsw.gov.au/data/assets/pdf_file/0017/312335/nsw-non-urban-water-metering-policy.pdf)

⁵ Although Murrumbidgee is located in the Southern inland zone, a single water source (Yass Catchment Groundwater Source) is managed under a WSP (NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020) which belongs to the Northern inland zone per Attachment D of the NSW Non-Urban Metering Policy (available here: https://www.industry.nsw.gov.au/data/assets/pdf_file/0017/312335/nsw-non-urban-water-metering-policy.pdf)

⁶ For instance, this was the case in the Barwon, Darling and West region in the Southern inland zone, hence the central estimate value is much lower than the VWAP prices.

⁷ Based on our experience and analysis conducted for this report, a proportion of NSW water sources and entitlement types do not have sufficient trade data to have statistically valid values. This is often the case for unregulated and groundwater entitlements. Where necessary, we have used proxy values based on a) values in the neighbouring catchments for the same entitlement type or b) values for the same entitlement type in other catchments that have broadly the same characteristics as the region in question.

Estimated total market values of NSW water entitlements by zone and region are presented in Table 4 and Table 5. Based on the analysis, the current total market value exceeds \$29.2 billion. The most valuable water assets are located in the Southern inland zone and the Murray and Murrumbidgee regions, noting that these are also the areas where the largest amount of entitlements have been issued.

For comparison, we also provided a lower bound estimate on the market value by using the 5-year VWAP prices instead of current market prices. The lower bound estimate is \$22.2 billion.

Table 4: Estimated total market value (\$ million) of water entitlements, by zone

Zone	Lower bound estimate based on 5-year VWAP	Best estimate market value
Coastal area	\$1,416.0	\$2,192.2
Northern inland	\$5,981.6	\$7,875.2
Southern inland	\$14,818.7	\$19,145.0
NSW Total	\$22,216.3	\$29,212.4

Table 5: Estimated total market value (\$ million) of water entitlements, by WSP region

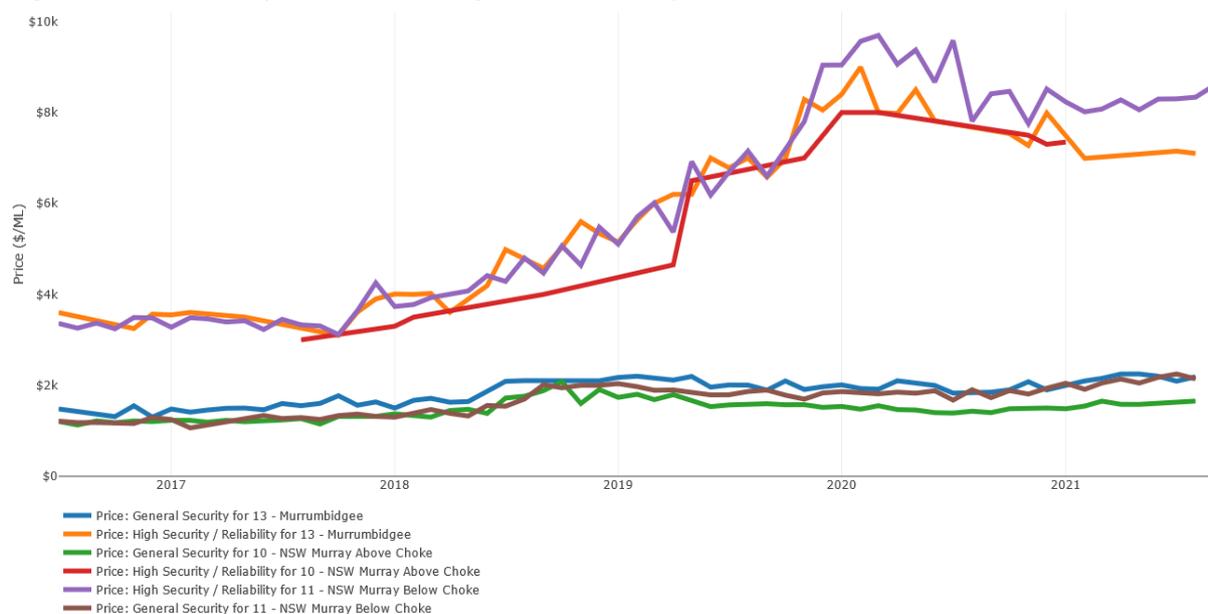
Region	Lower bound based on 5-year VWAP	Best estimated market value
Barwon, Darling and West	\$489.7	\$475.1
Border Rivers	\$914.4	\$1,291.8
Central Coast	\$65.3	\$65.9
Far North Coast	\$65.9	\$125.9
Greater Metropolitan	\$297.0	\$700.1
Gwydir	\$1,895.4	\$2,711.9
Hunter	\$773.5	\$921.1
Lachlan	\$1,239.7	\$1,699.6
Macquarie-Castlereagh	\$1,370.1	\$1,862.0
Murray	\$4,936.6	\$6,574.2
Murrumbidgee	\$8,417.8	\$10,718.6
Namoi	\$1,536.6	\$1,687.1
North Coast	\$177.0	\$338.9
South Coast	\$37.3	\$40.3
NSW Total	\$22,216.3	\$29,212.4

We note that the total value estimate of \$29.2 billion includes all entitlements on issue, including those held by the Commonwealth and state environmental water holders. In reality, not all of this water is available for production. However, we considered it appropriate to include all entitlements in the estimate as it provides a beneficial context in terms of the total value of the water resources NRAR is protecting, highlighting the importance of the compliance work to be undertaken by the NRAR.

4.4 Values have increased over time

As was seen in Table 3, water values have increased significantly over the last five years. However, certain entitlement types have experienced a more rapid increase than the others. As an example, Figure 4 presents the high and general security entitlement prices in the NSW Murray and Murrumbidgee over the last five years. High security entitlements have more than doubled in value over this time, whereas general security entitlements' growth has been steady but not as pronounced.

Figure 4: NSW Murray and Murrumbidgee entitlement prices, 2016 to 2021



Source: Marsden Jacob Waterflow™

Regarding future market values, it is possible that water values continue to appreciate in the future. However, Marsden Jacob considers it unlikely that the growth will be as significant as it has been over the last five years, at least for the Murray-Darling Basin (MDB) regulated surface water catchments where water markets are most liquid.

4.5 Summary

To summarise, the 1-year VWAP of NSW water entitlements is over \$2,200 per ML. The 5-year VWAP is around \$1,800 per ML, demonstrating how the values have increased over time across NSW. The total value of the entitlements is estimated to be around \$22-29 billion.

Should a similar growth in entitlement values continue, it means that the total market value of the entitlements could be more than \$35 billion in 5 years. However, we note that there are natural threshold limits associated with the realities of farm business profitability (such as the value of the output vs. price of water as an input) that ultimately govern the potential for further growth in entitlement values.

5. How much production is water entitlements supporting?

This section provides an overview of the value of production that water entitlements are supporting across NSW.

5.1 Key findings

Based on the analysis undertaken for this project, the annual production value that is being supported by water entitlements across NSW is valued in the billions of dollars.

Gross value of irrigated agricultural production (GVIAP): On a GVIAP basis, the water entitlements are supporting production valued at between \$3.1 to \$4.4 billion per annum, or a five-year average of \$3.5 billion.

Producer surplus: On a producer surplus basis, the water entitlements are generating around \$2.45 billion in producer surplus benefit.

These estimates are conservative because water entitlements are also being used to support various industrial production activities such as mining, processing (e.g., abattoirs, gins, mills), and even some manufacturing. The production values associated with these industries are not factored into these values.

The value of production continues to increase per megalitre of water, with irrigators seeking to maximise the rent through both improved production yield and by transitioning from lower to higher-value production.

Notably, for some crops, such as cotton, as yield increases, higher water application rates are observed. Horticultural tree crops have to apply water every year and even more so during drought to maintain viability.

5.2 Methodology and sources

Two methods are used in this section to consider the value of production from in-scope NSW water entitlements:

- **Method 1:** Producer surplus estimate
- **Method 2:** Gross value of irrigated agricultural production (GVIAP)

Method 1: Producer surplus

Producer surplus is the difference between the price that a producer receives and the cost of production. To estimate the value of NSW water entitlements on a producer surplus basis, we have estimated:

- 1) how much water is available for production,
- 2) how this water is allocated between different crop types, and
- 3) the margin estimates for the key crop types.

To assess the potential production value of the NSW water assets, we have removed the entitlements that have been acquired by the Commonwealth and state governments for environmental use from the pool of entitlements on issue. We have also excluded conveyance entitlements from this part of the analysis to avoid an over-estimate of the value of production.

To estimate how much water would then be available and used annually for production, we have used specific assumptions regarding allocation yield and utilisation factors⁸ by licence category (Table 6).

Table 6: Allocation yield and utilisation assumptions, by licence category

Licence category	Allocation yield	Utilisation
High security	100%	94%
General security	70%	81%
Supplementary	50% (based on the fact that access to water is not available every year)	51% (based on the fact that access to water is not available every year)
Unregulated	50% (based on the fact that water is not available at all times per access conditions)	51% (based on the fact that water is not available at all times per access conditions)
Aquifer	100%	55%

To allocate the resulting pool of water between different crop types, we have developed weightings by crop type and licence category for each region. These weightings are based on actual water use statistics (for example, ABS' [Water Use on Australian Farms](#) data) and certain assumptions regarding annual and permanent crops and 'matching' entitlement categories. For instance, in our analysis in the Lachlan region, the general security usage is equally split between cotton, cereals and pastures.

Production value estimates are underpinned by a margin-based analysis. We have primarily relied on gross margins (as opposed to net margins) for the annual producer surplus approach to valuing because of the short term/annual nature and ability to easily scale up or scale down production. Gross margins are defined as the gross income from an enterprise less the variable costs involved in achieving it, and they only capture the costs and benefits for a single season. The values and approach are consistent with what was agreed with DPIE and NSW Treasury team for the Regional Water Strategies⁹ project where Marsden Jacob has been involved.

Method 2: GVIAP¹⁰

GVIAP refers to the gross value of agricultural commodities that are produced with the assistance of irrigation. The gross value of commodities produced is the value placed on recorded production at

⁸ These factors are derived from actual usage statistics (source <https://www.industry.nsw.gov.au/water/allocations-availability/water-accounting/usage-dashboard>) and from utilisation factors used in this document: https://www.industry.nsw.gov.au/data/assets/pdf_file/0019/162181/technical-paper-derivation-technical-factors-nsw.pdf

⁹ <https://water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies>

¹⁰ <https://www.abs.gov.au/methodologies/gross-value-irrigated-agricultural-production-methodology/2017-18>

the wholesale prices realised in the marketplace. This definition of GVIAP does not refer to the value that irrigation adds to production, i.e. the 'net effect' that irrigation has on production.

The Australian Bureau of Statistics (ABS) estimates the GVIAP yearly based on production, commodity prices, and water use data derived from ABS' Rural Environment and Agricultural Commodities Survey (REACS) and non-ABS sources, including marketing authorities and industry bodies.

5.2.1 Water available for production

Table 7 presents the estimated water available for production by region. Based on our assumptions (discussed above), a total of 4,773GL could potentially be annually used (on average) to support irrigated agricultural production in NSW.

Table 7: Estimated water available for production, by region

Region	Water available for production (ML)
Barwon, Darling and West	69,120
Border Rivers	234,292
Central Coast	5,927
Far North Coast	35,497
Greater Metropolitan	83,424
Gwydir	318,232
Hunter	234,145
Lachlan	479,876
Macquarie-Castlereagh	449,714
Murray	977,371
Murrumbidgee	1,424,051
Namoi	391,099
North Coast	47,029
South Coast	22,859
NSW Total	4,772,637

We acknowledge that this is an overestimate of the amount of water that would be used for agricultural production, because in reality, some of these water entitlements are held by other water users (e.g., mines, golf courses, abattoirs, to name a few), so not all water is used for agricultural production. However, to assess the potential production value in NSW, we have used agricultural margin values as a proxy.

We note that this approach is likely to mean that the results are conservative because the producer surplus value of water to industrial water users will typically be higher.

5.2.2 Producer surplus

As previously discussed, we have assumed that key water users across the regions are irrigators. The economic value of improved water availability or reliability for irrigators is based on estimates of producer surplus for key crop types that are held by Marsden Jacob. Table 8 summarises the key crop types that were considered in each of the regions.

Table 8: Key crops, by region

Region	Irrigators of annual crops	Irrigators of permanent crops
Macquarie	<ul style="list-style-type: none"> • Cotton • Wheat 	<ul style="list-style-type: none"> • Oranges • Viticulture • Horticulture (Vegetables) • Dairy/sheep/meat
Lachlan	<ul style="list-style-type: none"> • Cotton • Wheat 	<ul style="list-style-type: none"> • Oranges • Dairy/sheep/meat
Gwydir	<ul style="list-style-type: none"> • Cotton • Wheat 	<ul style="list-style-type: none"> • Oranges • Pecans
Far North Coast	<ul style="list-style-type: none"> • Lucerne • Sorghum 	<ul style="list-style-type: none"> • Nurseries, cut flowers and turf • Macadamias • Dairy cattle
North Coast	<ul style="list-style-type: none"> • Lucerne (Hay) • Sorghum 	<ul style="list-style-type: none"> • Nurseries, cut flowers and turf • Blueberries • Dairy cattle
Namoi	<ul style="list-style-type: none"> • Cotton • Cereal crops 	<ul style="list-style-type: none"> • Oranges
Border Rivers	<ul style="list-style-type: none"> • Cotton • Cereal crops 	
Western	<ul style="list-style-type: none"> • Cotton • Cereal crops 	<ul style="list-style-type: none"> • Viticulture
South Coast	<ul style="list-style-type: none"> • Lucerne (Hay) 	<ul style="list-style-type: none"> • Viticulture • Dairy cattle
Murray	<ul style="list-style-type: none"> • Cotton • Rice • Cereal crops 	<ul style="list-style-type: none"> • Almonds (Nuts) • Viticulture • Dairy/sheep/meat
Murrumbidgee	<ul style="list-style-type: none"> • Cotton • Rice • Cereal crops 	<ul style="list-style-type: none"> • Almonds (Nuts) • Viticulture
Greater Hunter/ Central Coast/ Greater Metropolitan	<ul style="list-style-type: none"> • Lucerne (Hay) 	<ul style="list-style-type: none"> • Nurseries, cut flowers and turf • Blueberries • Vegetables • Viticulture • Dairy/sheep/meat

5.3 Producer surplus value by region and crop type

By multiplying the available water estimates by the crop margins, annual producer surplus values have been estimated. [Table 9](#)

[Table 9](#) presents these estimates by region. Based on our analysis, the total potential producer surplus value of the NSW water entitlements to irrigators exceeds \$2.45 billion.

In recent years, utilisation of water has increased in NSW. Should this trend continue to a point where all water that is made available is used for agricultural production (100% utilisation rate), our analysis indicates that the total producer surplus would increase to be \$3.84 billion.

Table 9: Regional producer surplus values (\$ million) in NSW, by region

Region	Total
Barwon, Darling and West	\$24.4
Border Rivers	\$74.0
Central Coast	\$8.9
Far North Coast	\$89.8
Greater Metropolitan	\$472.2
Gwydir	\$120.6
Hunter	\$97.5
Lachlan	\$115.7
Macquarie-Castlereagh	\$167.5
Murray	\$350.1
Murrumbidgee	\$550.8
Namoi	\$133.4
North Coast	\$240.2
South Coast	\$6.5
NSW Total	\$2,451.6

5.4 Value of irrigated production

The gross value of irrigated agricultural production (GVIAP) refers to the gross value of agricultural commodities that are produced with the assistance of irrigation. When the ABS calculates GVIAP, it is based on each irrigated 'commodity group' produced by agricultural businesses. That is, GVIAP is generally not calculated for individual commodities but for groups of 'like' commodities according to irrigated commodity groupings on the agricultural censuses and survey forms.

Over the period 2014-15 to 2018-19 the GVIAP ranged from \$3.1 to \$4.4 billion (Table 10).

Table 10: GVIAP, NSW Total (\$)

	2014-15	2015-16	2016-17	2017-18	2018-19
GVIAP	3,054,026,168	3,053,405,592	3,652,402,650	4,358,182,706	3,577,255,422

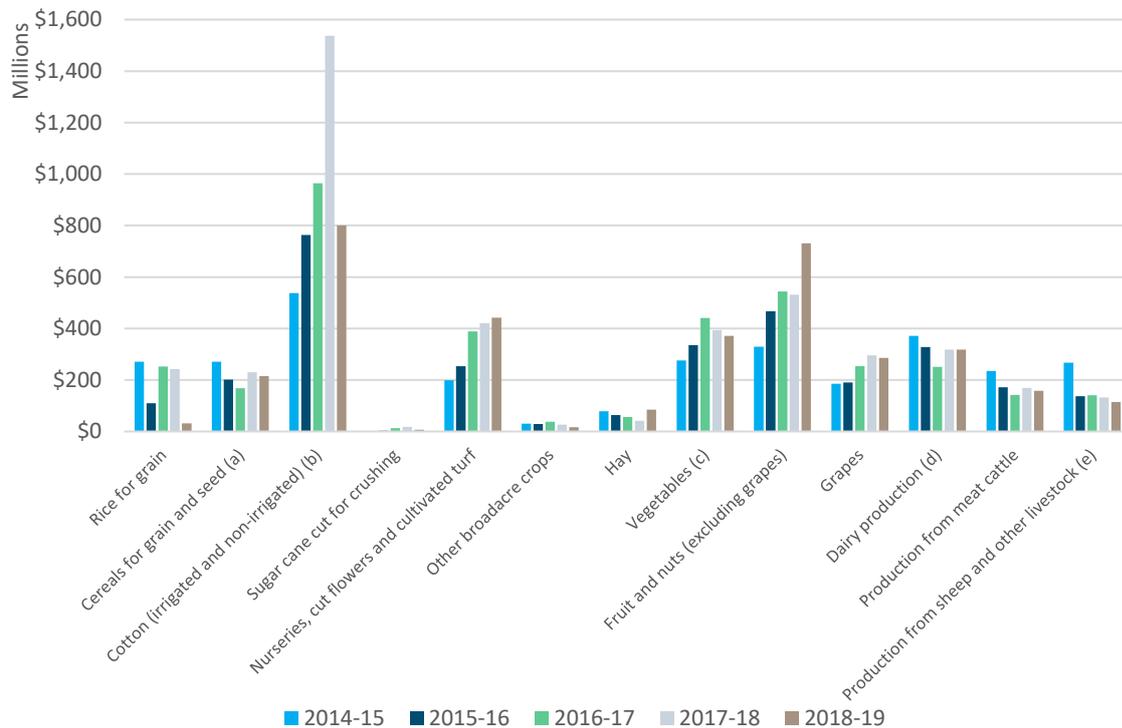
Source: ABS, 4610.0 Water Account, Australia, 2018-19

5.4.1 GVIAP by commodity group

Many commodities rely on irrigation water. Of these, annual crops (e.g., cotton, rice, cereals) tend to be more volatile because they scale up and down depending on water availability whereas perennial crops are more stable because they cannot scale production (e.g., horticulture and viticulture).

The GVIAP is thus relatively volatile because it is a function of water availability. Figure 5 shows that the key reason for the decline in GVIAP in 2018-19 was a reduction in water availability that resulted in reduced production of cotton and rice. Cotton and rice production fell by nearly \$950 million dollars when compared with 2017-18 (see Figure 5).

Figure 5: GVIAP by commodity group, NSW



The Australian Bureau of Statistics Water Account (4610.0) confirms that the estimated volume of water used by the NSW agricultural sector fell by nearly fifty per cent over this period due to reduced rainfall and dam storage levels:

- 3,600 GL (2016-17)
- 3,872 GL (2017-18)
- 2,032 GL (2018-19)

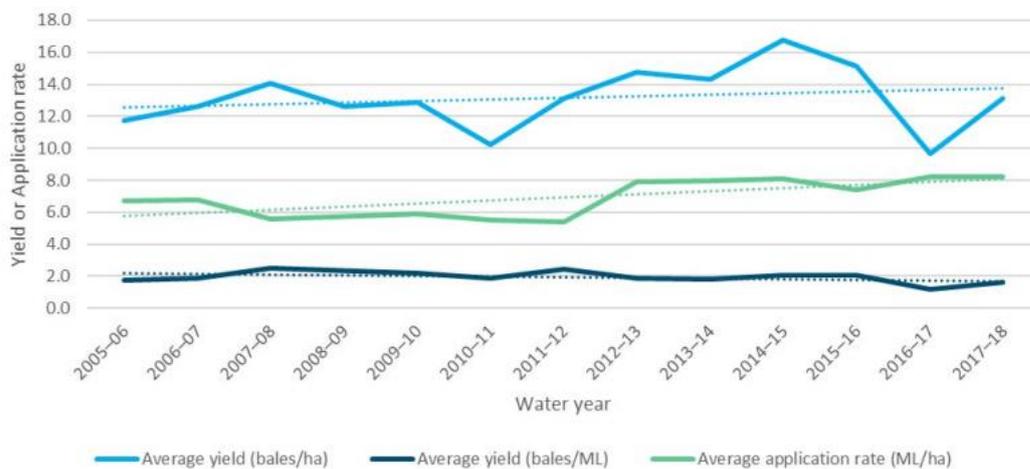
This also means that the value of production continues to increase per megalitre of water, with irrigators seeking to maximise the rent through improved production yield (see Figure 6) and transitioning from lower to higher-value production. Some key developments in this regard include:

- **Cotton:** While cotton has been grown across Northern NSW for some years, the Murrumbidgee/Riverina region is experiencing strong growth, with new gins opening in Carrathool and Hay in 2015 and a third new gin in Coleambally in 2020. This growth in cotton

production has come at the expense of rice production (see Figure 7), with irrigators switching into cotton because of the higher margin returns. The average yield is increasing, but this is being achieved with higher water application, highlighting the critical importance of water as an input to production and the competing pressures being placed on this limited resource.¹¹

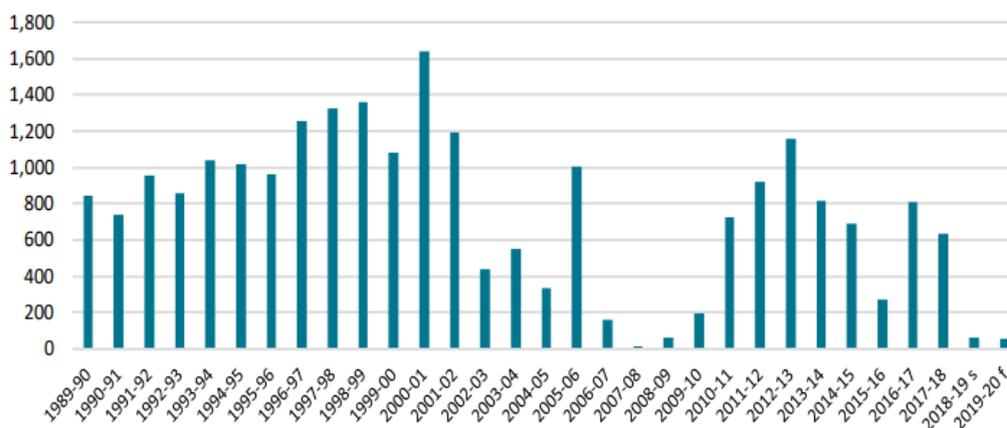
- **Horticulture:** Horticultural industries are expanding across NSW. There is significant growth in almond and other plantings in the southern MDB, whereas in the coastal regions, growth in fruit and macadamia nuts remains strong. The composition of the plantings has changed significantly over time. Wine grapes and citrus now represent a smaller proportion of total plantings as these industries restructured in response to market pressures, whereas large greenfield developments of almonds and, to a lesser extent, olives have emerged and grown in scale.¹²

Figure 6: Average cotton yield (NSW) and average water application rate (NSW), 2005-06 to 2017-18



Source: ABARES, Australian Crop Report 2019

Figure 7: Australian rice production (kt)¹³



Source: ABARES 2019

¹¹ https://www.mdba.gov.au/sites/default/files/pubs/2020-03-13-murray-darling-basin-authority-%28mdba%29-evaluation-cotton-final_0.pdf

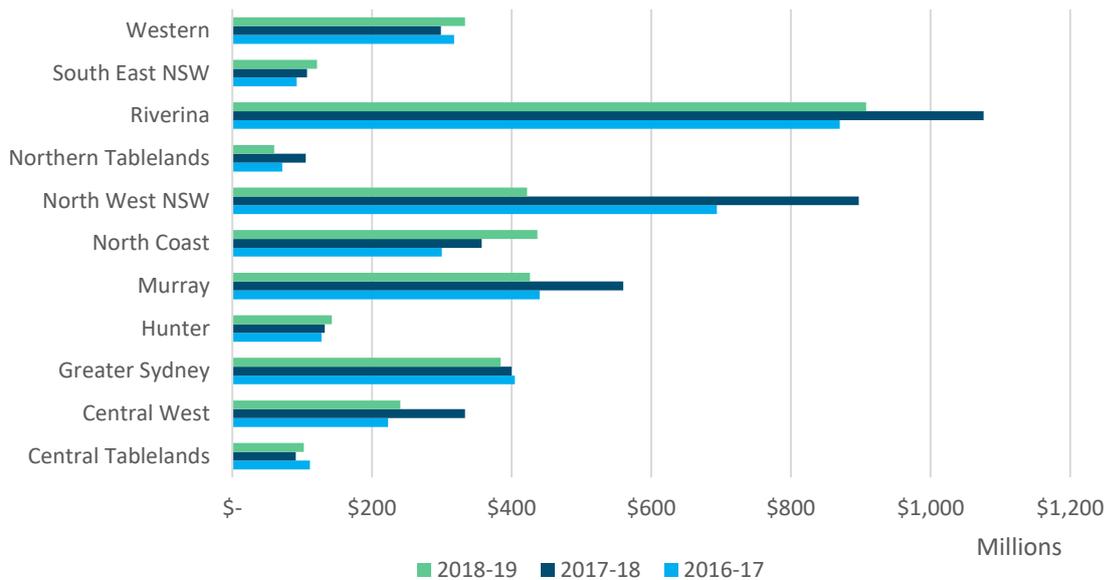
¹² https://www.mdba.gov.au/sites/default/files/pubs/2020-03-13-murray-darling-basin-authority-%28mdba%29-evaluation-horticulture-final_0.pdf

¹³ https://www.mdba.gov.au/sites/default/files/pubs/2020-03-13-murray-darling-basin-authority-%28mdba%29-evaluation-rice-final_0.pdf

5.4.2 GVIAP by region

The analysis of GVIAP by region confirms that the regions within the Murray-Darling Basin are generally the biggest (e.g., Riverina, North West, Central West and Murray). But the irrigation production in the coastal regions, while small, remains significant, ranging from \$120 million in South East NSW to \$437 million in North Coast NSW (see Figure 8).

Figure 8: GVIAP by region



5.5 Summary

Based on the analysis undertaken for this project, the annual production value that is being supported by water entitlements across NSW is valued in the billions of dollars.

GVIAP: On a GVIAP basis, the water entitlements are supporting production valued at between \$3.1 to \$4.4 billion per annum, or a five-year average of \$3.5 billion.

Producer surplus: On a producer surplus basis, the water entitlements are generating around \$2.45 billion in producer surplus benefit.

The value of production continues to increase per megalitre of water, with irrigators seeking to maximise the rent through improved production yield and transitioning from lower to higher-value production.

6. Water is a critical input to regional communities

The contribution of water to regional economies extends beyond the farm gate. This section provides an overview of the contribution that water makes to regional economies.

6.1 Introduction

Water scarcity is a persistent issue in Australia, given the relatively dry and variable climate and the emergence of climate change. As has been detailed in the preceding chapters, water access entitlements are a valuable commodity, particularly from an economic perspective for the irrigated agriculture sector, which accounts for around three-quarters of total use.

The value of water access entitlements extends well beyond the direct users. More broadly, water access entitlements and water resources provide a range of consequential public and private benefits, including flow-on benefits for regional economies, environmental outcomes, cultural outcomes for Aboriginal and Torres Strait Islander people, and economic and social outcomes for recreational and commercial fishers and the tourism industry.

Although more difficult to quantify, these values nonetheless need to be recognised when considering the value of water to regional communities.

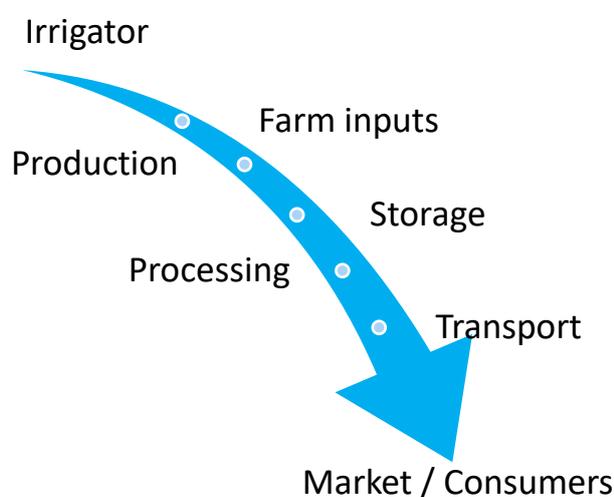
6.2 Value generation in the economy

The impact of irrigated agricultural activities extends beyond the farm gate because agricultural activities source many production inputs from the local area, and inputs for irrigated agriculture tend to be significantly higher than for dryland agriculture.

The supply chain for irrigated agriculture encompasses (Figure 9):

1. inputs to production, such as labour, fertilisers, chemicals, seed, fuel, capital equipment;
2. storage of the farmed product;
3. processing and transformation;
4. transport; and
5. markets and consumers.

Figure 9: Supply Chain, irrigated agriculture



From a farm-specific perspective, the purchases of inputs to support agricultural production generates flow-on economic benefits for the rest of the regional economy. These flow-on effects are of two types:

1. **Production-induced flow-on impacts** – where agricultural input purchases (e.g. fertiliser, chemicals, machinery repairs) generate economic activity in other regional businesses (e.g. farm suppliers, mechanics);
2. **Consumption-induced flow-on impacts** – where the earnings and wages of farm owners and their employees are spent in local businesses (e.g. groceries, clothing, other services).

As discussed in section 5.4, the gross value of irrigated agricultural production averaged \$3.5 billion over the last five years. Illustrating the intensity of irrigation when compared to broadacre production, irrigation land comprises only a small proportion of agricultural land (less than 10%), but the value of irrigated production equates to around 30% of all agricultural production.

However, it is difficult to quantitatively value the flow-on production and consumption induced impacts accurately.

6.2.1 Business turnover impacts

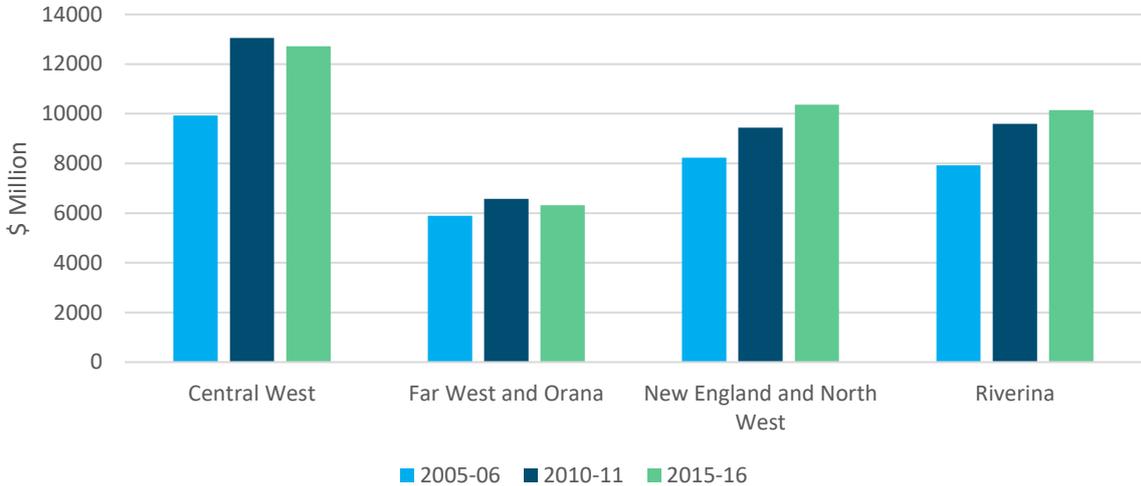
One way to do this is to compare the economic outcomes in drought and non-drought years, noting that the impacts of drought may also be a consequence of a downturn in dryland cropping in addition to the decline in irrigation production.

For example, analysis by Regional Australia, Northern Inland NSW, found that when you compare drought and non-drought years, business turnover in non-drought years on a per megalitre of water basis is significantly higher than in non-drought years¹⁴.

¹⁴ <https://www.rdani.org.au/files/pages/projects/past/murray-darling-basin/Economic-Importance-of-Water-Northern-Inland-NSW-docx.pdf>

This relationship can also be seen more broadly across the state. For example, Figure 10 shows that the incremental difference between a drought year (2005-06, millennium drought) and wetter years (2010-11 or 2015-16) is considerably greater than the total GVIAP for the region, highlighting that the flow-on benefits to the regional economy from irrigated agriculture are significant.

Figure 10: Gross Regional Product, 2005-06, 2010-11 and 2015-16



Source: Australian Government Department of Industry Innovation and Science, *Industry Insights*, 2018

6.2.2 Flow-on multipliers

Another way of considering the regional and broader economic contribution is by using multipliers. In this study, we have not developed specific multipliers for NSW regions, instead we have considered the multipliers developed for other projects that considered the flow-on costs and benefits of irrigated agricultural investment:

- ACIL Tasman (2009)¹⁵ used input-output analysis to derive multipliers for the purpose of an assessment titled *Regional economic effects of irrigation efficiency projects*. This study used a regional multiplier of 1.43 and a national multiplier of 2.58.
- RIRDC (2017)¹⁶ estimated the regional multiplier for agriculture to be 1.5 and the national multiplier to be 2.69.
- Centre for Agricultural and Regional Economics (2008), in a study on the *Economic Structure of the Cotton Regions and the Economic Impact of the Cotton Industry*, estimated the total flow-on regional multipliers for cotton production in the Northern NSW to be between 1.67 and 1.75¹⁷.

There is no one correct estimate of the impact, and a range of factors will influence the actual socio-economic outcomes over time. However, when using an illustrative multiplier of 1.5, this suggests

¹⁵ <https://www.pc.gov.au/inquiries/completed/murray-darling-water-recovery/submissions/subdr060-attachment1.pdf>

¹⁶ <https://www.parliament.nsw.gov.au/lcdocs/other/11389/Tabled%20document%20-%20Regional%20Economic%20Multiplier%20Impact,%20Potential%20Pollinator%20Defecits%20across%20Crops%20-%20Mr%20Stephen%20Targett.pdf>

¹⁷ http://www.insidecotton.com/jspui/bitstream/1/445/2/Roy_Powell_Cotton_Economies_Final.pdf

that if GVIAP were \$3.5 billion, then the flow-on regional impact would be \$1.75 billion, equating to a total direct and flow-on impact of \$5.25 billion from irrigated agricultural production that is supported by water access entitlements across the state.

6.3 Water's contribution to society and the environment

The annual contribution of irrigated agriculture that is made possible through water access entitlements is valued at several billion dollars, but there are also values that cannot be readily quantified such as cultural value, environmental value, recreational use that need to be acknowledged.

6.3.1 Cultural values

NSW is home to more than 50 of Australia's Aboriginal nations. Water is central to the cultural, social and spiritual identity of Australia's First Nations people, as well as to their livelihoods. First Nations people in NSW have a strong spiritual connection to water, and a moral obligation to care for it, as they have done for many thousands of years.

The NSW Government is taking action to improve the security, reliability, quality and resilience of the state's water resources. As part of this, new regional water strategies that will bring together the best and latest climate evidence with a wide range of tools and solutions to plan and manage the water needs in each NSW region over the next 20 to 40 years are prepared. This includes managing water for communities, industries, the environment and Aboriginal people so that water resources are sustainable.¹⁸

There are several types of cultural water in NSW, including Native Titles and Aboriginal Cultural Water Access Licences. The NRAR is responsible for the compliance and enforcement of water regulation to help protect cultural water.

6.3.2 Environment

NSW rivers and lakes support a unique Australian habitat. The MDBA reports that our rivers and lakes are critical to more than 120 waterbird species, 46 native fish species, plants and animals, and internationally-recognised and protected wetlands.

Water for the environment is specifically allocated and managed to improve the health of rivers, wetlands and floodplains is known as water for the environment. Water for the environment has helped to restore, maintain and improve river and wetland sites across New South Wales over the past 20 years. During dry times, water for the environment is used strategically to provide refuge sites for key plant and animal species ensuring their survival in the longer term.

Water releases trigger a surge in the number of insects and micro-organisms within a wetland. Frogs emerge to feed and become food for waterbirds, fish, turtles and other reptiles. Plants reproduce and set seed, providing food, shelter and nesting materials for animals. Wetland plants also filter the water, capturing sediment and returning it to the floodplain floor ready to feed the next generation

¹⁸ https://www.industry.nsw.gov.au/data/assets/pdf_file/0007/314467/nsw-water-management-for-aboriginal-people-fact-sheet.pdf

of wetland plants. Native fish respond to the conditions and begin to breed. Fish are an essential part of a healthy river. Supporting native fish supports the recreational fishing and tourism industries.

Specific sites are targeted to support waterbird and woodland bird breeding events. Birds play an important role in the riverine environment, controlling pest insects and helping pollination. Bird watching and bushwalking support tourism in local communities.

Environmental flows help to recharge ground water systems. Rivers and wetlands also cool the land around them. They help to slow fast-flowing flood waters and filter the water running through them. Flows spread out onto the floodplain, depositing sediments which in turn enrich the soil and increase productivity for agriculture.¹⁹

The NRAR is responsible for the compliance and enforcement of water regulations to help protect environmental outcomes.

6.3.3 Recreation

Water resources play an important role in supporting tourism and recreation. In 2020, Marsden Jacob was engaged to prepare case studies to support an Independent Panel that was engaged to assess economic and social conditions in the Murray-Darling Basin. The case studies considered how water resources support a range of recreational outcomes such as recreational fishing and boating.

The analysis identified that some of the main benefits associated with recreational fishing are more intrinsic values like relaxation, being outdoors, and spending time with friends and family. These values are almost certainly positively related to the ecological condition of rivers and wetlands, and as important as fish populations for some anglers.²⁰

The analysis found that the primary motivation for most recreational fishers is the enjoyment of the fishing experience in a relaxed, natural environment²¹. Some 96 per cent of recreational fishers in Australia are motivated by a connection to the environment. Recreational fishing can also promote social wellbeing, increase environmental awareness and provides health and economic benefits²².

Environmental condition, therefore, plays a crucial role to the quantity and quality of recreational fishing experiences. The National Recreational Fishing Survey 2003 was the last major analysis of recreational fishing activity nationally. The result of the NRFS highlighted the main factors that drive recreational fishing included 'to relax and unwind', 'to spend time with family', 'fishing for sport' and 'to be outdoors'. All these factors show that recreational fishing is more about intrinsic value rather than economic attraction (i.e. not commercial fishing). More recent and localised analyses, such as VFA surveys, have made similar findings.

¹⁹ <https://www.environment.nsw.gov.au/topics/water/water-for-the-environment/about-water-for-the-environment/what-is-it>

²⁰ https://www.mdba.gov.au/sites/default/files/pubs/2020-03-12-murray-darling-basin-authority-%28mdba%29-evaluation-recreational-fishing-final_0.pdf

²¹ Arlinghaus, R., On the apparently striking disconnect between motivation and satisfaction in recreational fishing: the case of catch orientation of German anglers. *North American Journal of Fisheries Management*, 2006. 26(3): p. 592-605.

²² Young, M.A., S. Foale, and D.R. Bellwood, Why do fishers fish? A cross-cultural examination of the motivations for fishing. *Marine Policy*, 2016. 66: p. 114-123

Recreational fishing has the potential to significantly stimulate economic development, especially through increased tourism. As fish caught are typically not part of a direct market transaction, the economic contribution requires alternative approaches in order to find its value. For instance, the sector supports various economic activities related to fishing, such as travel, accommodation, boat rental, motor construction or repair, bait and tackle supply, infrastructure, restaurants, etc.²³

The NSW Water Strategy²⁴ acknowledges the important role that water plays in driving the tourism economy in regional NSW. The strategy identifies that *“water holds significant opportunities for tourism and recreation in NSW, particularly in recreational fishing, marine-based tourism and swimming. NSW offers a highly unique fishing experience, with a range of freshwater Australian sportfish such as Murray Cod, Golden Perch and Australian Bass. Many of our native species cannot be found in wild populations anywhere else in the world. In 2017/18, an estimated \$2.2 billion was spent on recreational fishing trips. This expenditure generates about \$3.4 billion of economic activity in NSW each year”*.

The strategy further includes some specific examples. *“Marine based tourism, such as canoe and kayak trails on the Clarence River, Murrumbidgee River, Macquarie River, Tumut River and Hawkesbury Nepean River System offer opportunities for tourists to enjoy various destinations and adventure experiences. Naturally heated thermal baths in towns such as Lightning Ridge, Burren Junction and Walgett, fed by bore water from the Great Artesian Basin, offer a distinctive experience in north west NSW”*.

6.4 Summary

In addition to the direct production value that water access entitlements are supporting across the state (valued annually at around \$3.5 billion for irrigated agriculture alone), water access entitlements and water resources more broadly are supporting a range of public and private benefits. These benefits include:

- Flow-on benefits to regional economies valued at \$1.75 billion, based on a regional multiplier of 1.5.
- Environmental outcomes that governments are spending billions of dollars to preserve and improve
- Cultural outcomes for Aboriginal and Torres Strait Islander people
- Economic and social outcomes for recreational fishers (\$3.4 billion of economic activity), commercial fishers, and the tourism industry.

Although many of these values are challenging to quantify in a dollar sense, these values nonetheless need to be recognised when considering the value of water to regional communities, and the importance of the compliance requirements to be effectively implemented to help ensure that these values are protected and not eroded by water access entitlement users.

²³ https://www.mdba.gov.au/sites/default/files/pubs/2020-03-12-murray-darling-basin-authority-%28mdba%29-evaluation-recreational-fishing-final_0.pdf

²⁴ https://water.dpie.nsw.gov.au/_data/assets/pdf_file/0007/409957/nsw-water-strategy.pdf

7. Conclusions

Based on the analysis undertaken for this project, both the market value of NSW water entitlements and the annual production value that they are supporting is valued in the billions of dollars.

The value of water is increasing and is anticipated to increase into the future. At the state level, the 1-year volume-weighted average price (VWAP) of NSW entitlements is just under \$1,800 per ML. The 5-year VWAP is around \$1,280 per ML.

Valued by reference to water market trades, Marsden Jacob estimates that the total market value of NSW water entitlements is around \$29 billion.

We further estimate that NSW water entitlements are supporting irrigation producer surplus valued between \$2.45 and \$3.5 billion in an average year. We note that these estimates are conservative because water entitlements are also being used to support various industrial production activities such as mining, industrial processes, and even some manufacturing. The producer surplus values associated with these industries are not factored into these values.

Irrigated production supports many regional economies, and the regional contribution of water extends well beyond economic outcomes (including supporting cultural values and recreational activities). Quantifying the impact is difficult. However, using an illustrative flow-on multiplier of 1.5 suggests that if GVIAP were \$3.5 billion, then the flow-on regional impact from irrigated agricultural production alone would be \$1.75 billion, equating to a total direct and flow-on impact of \$5.25 billion that is supported by water access entitlements across the state.

We note that the estimates of the production supported by water entitlements are conservative because water entitlements also support various industrial production activities that commonly have elevated use value, such as mining, processing (e.g., abattoirs, gins, mills), and even some manufacturing.

Considering that the value of the entitlements and the water-based production is billions of dollars, and is increasing, effective monitoring and compliance is needed to maintain system integrity.

Appendix 1: List of Water Sharing Plans

Table 11: Water Sharing Plans and entitlements on issue considered in this report, by zone and region

Zone/Region/WSP	Total ML on issue
Coastal area	1,070,231
Central Coast	18,431
Central Coast Unregulated Water Sources 2009	14,272
North Coast Coastal Sands Groundwater Sources 2016	790
North Coast Fractured and Porous Rock Groundwater Sources 2016	3,369
Far North Coast	104,625
Brunswick Unregulated and Alluvial Water Sources 2016	2,528
North Coast Coastal Sands Groundwater Sources 2016	2,601
North Coast Fractured and Porous Rock Groundwater Sources 2016	12,689
Richmond River Area Unregulated, Regulated and Alluvial Water Sources 2010	79,327
Tweed River Area Unregulated and Alluvial Water Sources 2010	7,481
Greater Metropolitan	235,297
Greater Metropolitan Region Groundwater Sources 2011	86,516
Greater Metropolitan Region Unregulated River Water Sources 2011	148,781
Hunter	494,123
Hunter Regulated River Water Source 2016	198,803
Hunter Unregulated and Alluvial Water Sources 2009	204,468
North Coast Coastal Sands Groundwater Sources 2016	3,023
North Coast Fractured and Porous Rock Groundwater Sources 2016	77,318
Paterson Regulated River Water Source 2019	10,511
North Coast	152,405
Bellingen River Area Unregulated and Alluvial Water Sources 2008	2,496
Clarence River Unregulated and Alluvial Water Sources 2016	38,903
Coffs Harbour Area Unregulated and Alluvial Water Sources 2009	3,081
Hastings Unregulated and Alluvial Water Sources 2019	15,047
Lower North Coast Unregulated and Alluvial Water Sources 2009	51,561
Macleay River Unregulated and Alluvial Water Sources 2016	13,408
Nambucca Unregulated and Alluvial Water Sources 2016	4,877
North Coast Coastal Sands Groundwater Sources 2016	4,756
North Coast Fractured and Porous Rock Groundwater Sources 2016	18,277
South Coast	65,351
Bega and Brogo Rivers Area Regulated, Unregulated and Alluvial Water Sources 2011	41,516
Clyde River Unregulated and Alluvial Water Sources 2016	1,070
Deua River Unregulated and Alluvial Water Sources 2016	1,448
Murrah-Wallaga Area Unregulated and Alluvial Water Sources 2010	4,135
Snowy Genoa Unregulated and Alluvial Water Sources 2016	3,632

Zone/Region/WSP	Total ML on issue
South Coast Groundwater Sources 2016	3,619
Towamba River Unregulated and Alluvial Water Sources 2010	2,631
Tuross River Unregulated and Alluvial Water Sources 2016	7,303
Northern inland	3,527,443
Barwon, Darling and West	250,912
Barwon-Darling Unregulated River Water Source 2012	188,671
Darling Alluvial Groundwater Sources 2020	933
Intersecting Streams Unregulated River Water Sources 2011	35,233
North Western Unregulated and Fractured Rock Water Sources 2011	123
NSW Great Artesian Basin Groundwater Sources 2020	449
NSW Great Artesian Basin Shallow Groundwater Sources 2020	457
NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020	3,512
NSW Murray Darling Basin Porous Rock Groundwater Sources 2020	21,534
Border Rivers	492,083
NSW Border Rivers Alluvial Groundwater Sources 2020	17,435
NSW Border Rivers Regulated River Water Source 2021	384,719
NSW Border Rivers Unregulated River Water Sources 2012	41,839
NSW Great Artesian Basin Groundwater Sources 2020	34,974
NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020	13,116
Gwydir	804,306
Gwydir Alluvial Groundwater Sources 2020	29,991
Gwydir Regulated River Water Source 2016	711,262
Gwydir Unregulated River Water Sources 2012	52,014
NSW Great Artesian Basin Groundwater Sources 2020	5,277
NSW Great Artesian Basin Shallow Groundwater Sources 2020	5,762
Lachlan	15,915
NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020	15,915
Macquarie-Castlereagh	1,095,048
Castlereagh Unregulated River Water Sources 2011	20,596
Macquarie-Bogan Unregulated Rivers Water Sources 2012	156,138
Macquarie-Castlereagh Groundwater Sources 2020	114,420
Macquarie-Cudgegong Regulated Rivers Water Source 2016	696,368
NSW Great Artesian Basin Groundwater Sources 2020	24,687
NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020	72,366
NSW Murray Darling Basin Porous Rock Groundwater Sources 2020	10,474
Murrumbidgee	3,494
NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020	3,494
Namoi	865,686
Namoi Alluvial Groundwater Sources 2020	249,544
Namoi and Peel Unregulated Rivers Water Sources 2012	172,139
NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020	11,030

Zone/Region/WSP	Total ML on issue
NSW Murray Darling Basin Porous Rock Groundwater Sources 2020	27,142
Peel Regulated River Water Source 2010	30,112
Upper Namoi and Lower Namoi Regulated River Water Sources 2016	375,719
Southern inland	8,012,455
Barwon, Darling and West	340,665
Lower Murray-Darling Unregulated River Water Source 2011	3,387
New South Wales Murray and Lower Darling Regulated Rivers Water Sources 2016	337,278
Lachlan	995,093
Belubula Regulated River Water Source 2012	26,674
Lachlan Alluvial Groundwater Sources 2020	281,439
Lachlan Regulated River Water Source 2016	638,393
Lachlan Unregulated River Water Sources 2012	48,588
Murray	2,674,812
Murray Alluvial Groundwater Sources 2020	187,255
Murray Unregulated River Water Sources 2011	41,178
New South Wales Murray and Lower Darling Regulated Rivers Water Sources 2016	2,446,379
Murrumbidgee	4,001,885
Murrumbidgee Alluvial Groundwater Sources 2020	335,874
Murrumbidgee Regulated River Water Source 2016	3,578,021
Murrumbidgee Unregulated River Water Sources 2012	87,990
NSW Total	12,610,130

Contact us

Rod Carr
Director

 rcarr@marsdenjacob.com.au

 0418 765 393

Marsden Jacob Associates Pty Ltd

 03 8808 7400

 Marsden Jacob Associates

 economists@marsdenjacob.com.au

 www.marsdenjacob.com.au