

# A I T H E R

**WATER MARKETS REPORT**  
2017-18 REVIEW AND 2018-19 OUTLOOK



# AITHER

## WE VALUE WATER

### Background

Australian water management has undergone a significant period of reform over the past two decades. The establishment of water markets has been a key component of this reform story.

Water markets are now an established part of agricultural, urban and environmental water policy, management and investment in Australia.

The Aither Water Markets Report provides an overview of current water market activity in the southern Murray-Darling Basin, compares market outcomes with recent years and comments on the future outlook.

### About Aither

Aither works with businesses, governments and industry groups to enable improved decision making that reflects the value of scarce water resources. Our understanding of the value of water underpins our economics, policy and commercial advisory services in water markets, resources, infrastructure, and risk.

Our specialist water markets services include:

- design and analysis of water market policy
- transaction advisory and investment due diligence
- portfolio strategy, optimisation and performance
- water asset valuation services
- using custom-designed water management frameworks and market modelling tools

Aither's water markets team work across Australia and internationally with clients that require high quality information, insights and analysis to make better decisions and achieve improved outcomes. With an expert team of water economists, strategists, and policy and performance advisers, Aither provides the best available water sector advice.

If you would like to find out more about this report or have any feedback, please get in touch.

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# EXECUTIVE SUMMARY

## Facts at a glance - 2017-18

- Estimated value of total sMDB entitlement on issue: **\$15.9 billion**
- Aither Entitlement Index (AEI) 30 June 2018: **180.55 points** (up 29 per cent over 12 months)
- Value of total entitlement transfers: **\$347 million**
- Total volume of entitlement transfers (outside of irrigation corporations): **160 GL** (down 47 per cent on 2016-17)
- Entitlement market turnover: **2 per cent**
- Estimated value of commercial allocation trade: **\$189 million**
- Annual average sMDB allocation price: **\$100 to \$140 per ML**
- Average annual entitlement returns (sale of allocations): **Approx. 4 per cent**

## Summary of 2017-18

With affordable water allocations available across much of the southern Murray-Darling Basin (sMDB), 2017-18 was a profitable year for many irrigated industries – especially annual croppers. The 2017-18 year also saw significant entitlement price increases and the continued uptake of allocation forward and carryover lease products (which have been particularly attractive to permanent plantings enterprises).

### Allocation market

- Whilst prevailing water availability and climatic conditions continued to be a major driver of allocation markets across the sMDB in 2017-18, we are observing a step-change from the historical record in relation to irrigation demand and market behaviour.
- In 2017-18, increased water demand from the cotton industry set a new “floor” price for water allocation prices across the sMDB which was above what would be expected by considering the historical record.
- Furthermore, the growing demand for water from permanent plantings combined with cotton has changed the dynamics of how water allocations are transferred between systems across the sMDB.
- These changing dynamics have caused us to recalibrate Aither's water allocation price model to better account for these changes and model sMDB water allocation prices into the future.

### Entitlement market

- The cotton, almond, citrus and table grape industries are currently enjoying profitable commodity prices. Recent investment into these industries and the need to access reliable water has continued to drive competition to secure water entitlement at a time when only a few are keen to sell.
- Competition between growers in these industries as well as water funds has driven much of the entitlement price increases we observed through the Aither Entitlement Index (AEI) during 2017-18.

# EXECUTIVE SUMMARY

## Facts at a glance - Outlook

- Comparison of 2017-18 and 2018-19 opening season allocations to consumptive users (excluding carryover): **700 GL less water allocated at opening of 2018-19**
- Estimated 2018-19 total end of season volume of water available to sMDB consumptive users under dry scenario (including carryover): **4,000 to 4,800 GL**
- Current three-month rainfall and inflow outlook for sMDB: **Below average**
- Current sMDB allocation prices: **\$300 to \$400 per ML** – highest prices since the Millennium Drought
- Aither's modelled estimate of 2018-19 average annual sMDB allocation price (dry and extreme dry scenarios): **\$240 to \$315 per ML**

## Outlook for 2018-19 and beyond

### Allocation market

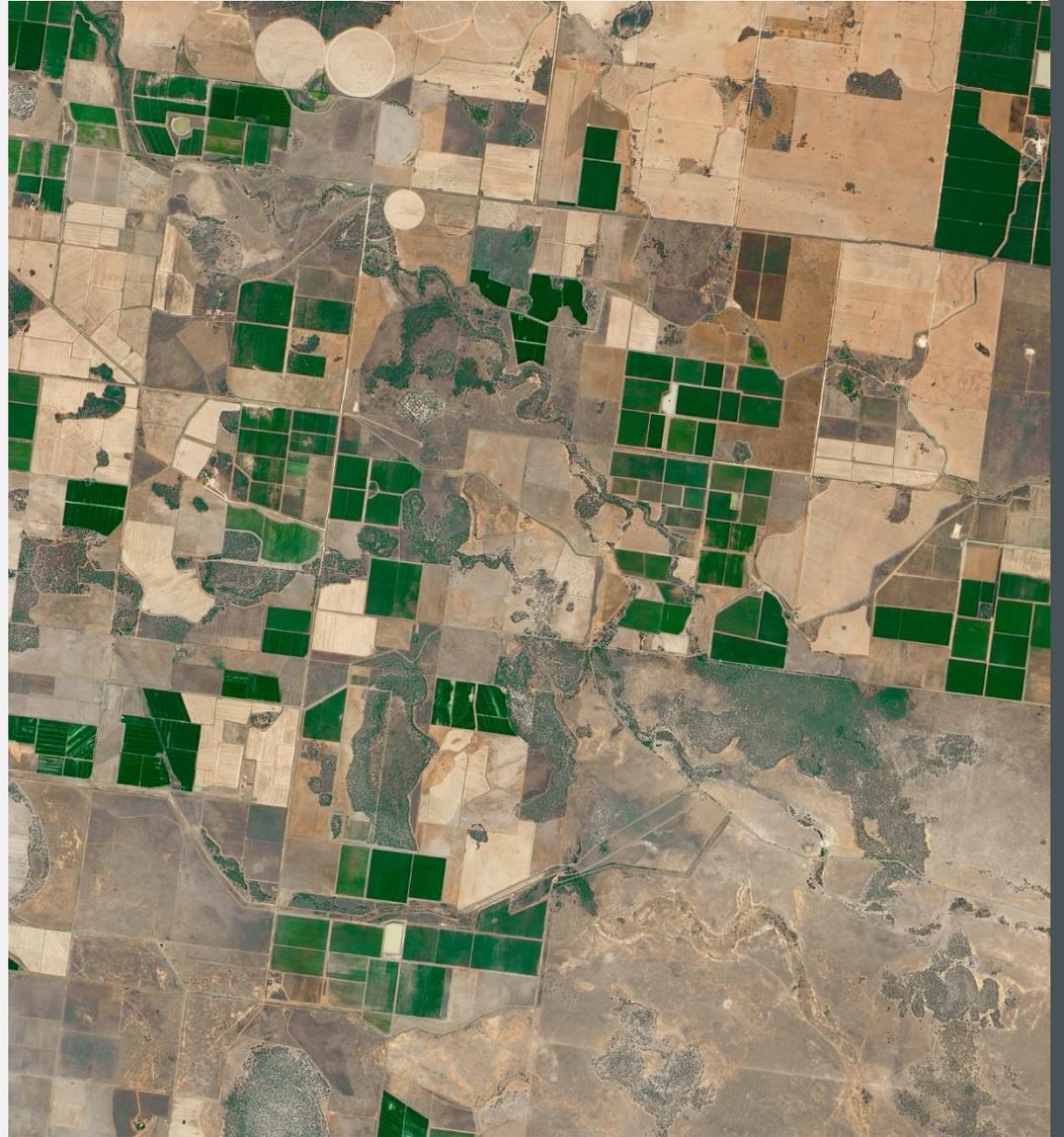
- Climatic conditions across the sMDB are dry. Based on Bureau of Meteorology outlooks, these dryland drought conditions are expected to remain across at least the first half of 2018-19. This is juxtaposed against good commodity prices which is putting upward pressure on allocation prices.
- Rainfall and inflows over September and October 2018 will be critical in determining annual cropping production decisions for 2018-19, and therefore sMDB allocation prices for this year and next.
- Planning for the 2019-20 water year and beyond will be important in determining allocation prices over the next 12 months. The largest risk for allocation prices over this period is carryover depletion during 2018-19. If this combines with limited inflows, there could be very low water availability in 2019-20.
- The economics of rice and pasture production for the 2018-19 water year are currently marginal. Beyond this year, we expect rice growers and dairy farmers to consider the impact that cotton and permanent plantings are likely to have on longer-term average allocation prices. This may result in significant adjustment in the dairy and rice industries over the next five years (or sooner if conditions remain dry).

### Entitlement market

- Entitlement price increases continued throughout 2017-18 (AEI up 29 per cent for the year) despite the lower gross annual returns achieved from selling water allocations over the last few years (2 to 4 per cent).
- The increasing value of entitlements reflects positive outlooks for several irrigated commodities, capital deployment by water funds and the reluctance of some entitlement owners to sell at this point in time.
- With expected higher annual returns to higher reliability entitlements in 2018-19, we will be closely monitoring whether entitlement prices continue to increase. If prices increase further, there will be a point where dairy farmers and rice growers sell entitlements and make longer-term adjustment decisions.
- Despite the positive economic conditions, there is a natural limit on the value of water entitlements in production. In the meantime, sellers will continue to test whether this point has been reached.

# 1.0

## INTRODUCTION



## 1.1 BACKGROUND

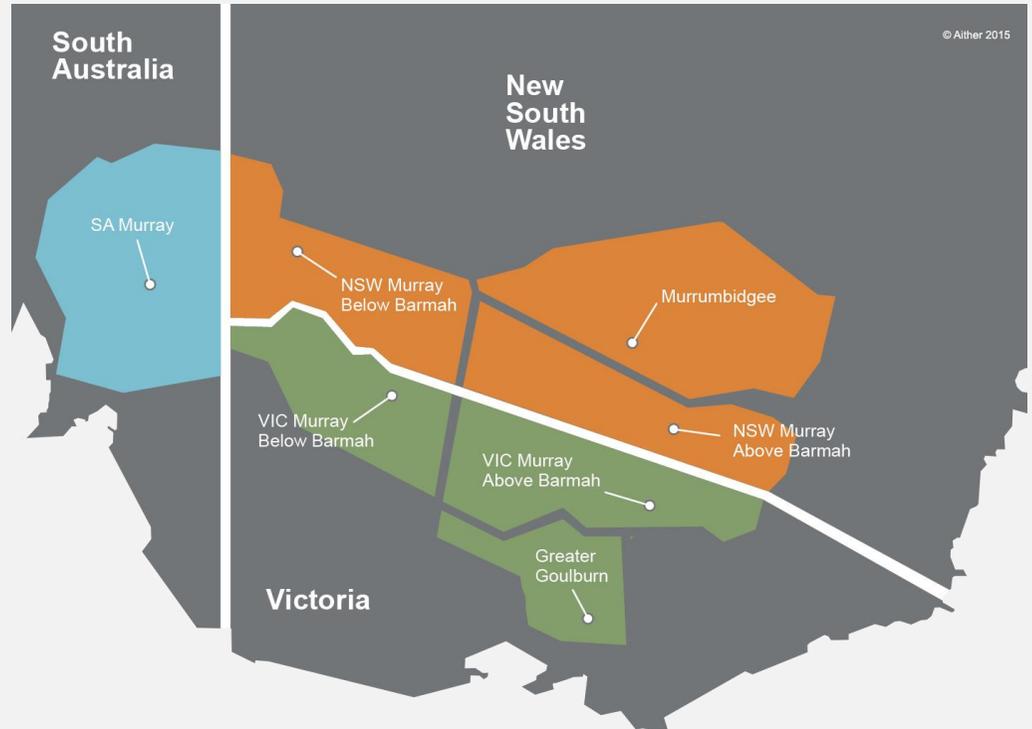
For the past five years Aither has published the Aither Water Markets Report. Aither publishes this report as a freely available annual market resource. The report provides the market with an overview of recent water market activity in the southern Murray-Darling Basin (sMDB) (Figure 1). The report also provides market insights and commentary on the future outlook.

Water availability and environmental water recovery programs have historically been particularly important in driving sMDB water markets. We have explained these market relationships and drivers in previous editions of the [Aither Water Markets Report](#).

Whilst these drivers remain important in explaining the sMDB water market, over the period of publishing the Aither Water Markets Report, we have observed rapid changes on the demand side.

Aither is of the view that this changing production landscape is driving a fundamental step-change in demand in the sMDB water market, the way participants are using the market and how we think about the future of the market.

The Aither Water Markets Report 2017-18 explores this story of change and explains what it means for the future.



Source: Aither, 2018.

**FIGURE 1** SOUTHERN MURRAY-DARLING BASIN WATER TRADE ZONES

## 1.2 HISTORICAL MARKET DRIVERS

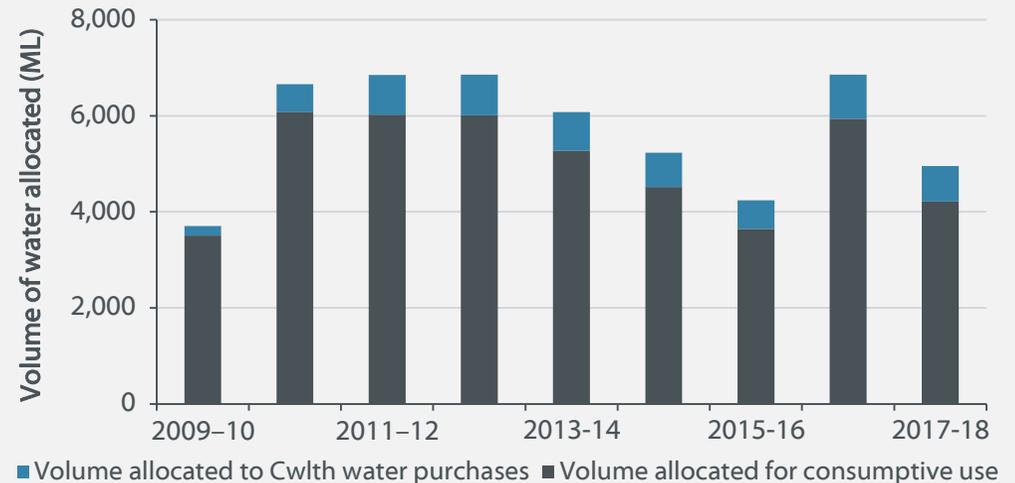
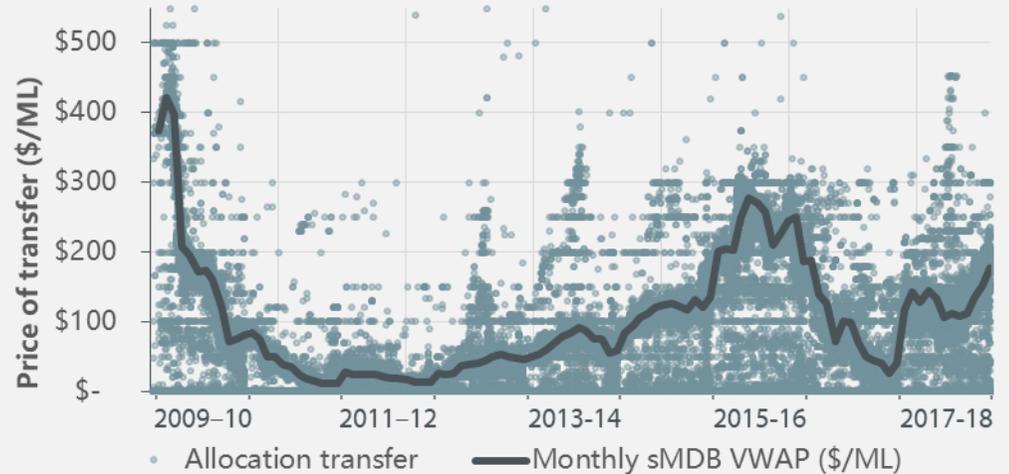
sMDB water allocation market prices are strongly influenced by the availability of irrigation of water.

In-crop rainfall is one determinant of water availability. However, rainfall generally only meets a portion of crop water requirements and is unlikely to be sufficient to meet total annual water requirements in all cases. It can also vary widely from year to year.

Therefore, the application of irrigation water is used to supplement rainfall. Allocations made to entitlements that are available for consumptive use are the primary supply-side factor in determining the availability of irrigation water.

On the basis that the supply of water is variable, water allocation prices can also vary significantly between and within years (Figure 2). In years of low water availability, allocation prices are generally high and vice versa.

Outside extremely low water allocation seasons, long-term changes in water demands from different irrigation industries have not been large aggregate drivers of water allocation prices over the last decade. However, as explored in Section 1.3 over page and across the remainder of this report, this is changing.



Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

**FIGURE 2** TOTAL VOLUME OF WATER ALLOCATED TO MAJOR SOUTHERN MURRAY-DARLING BASIN ENTITLEMENT TYPES AND WATER ALLOCATION PRICES, 2009-10 TO 2017-18

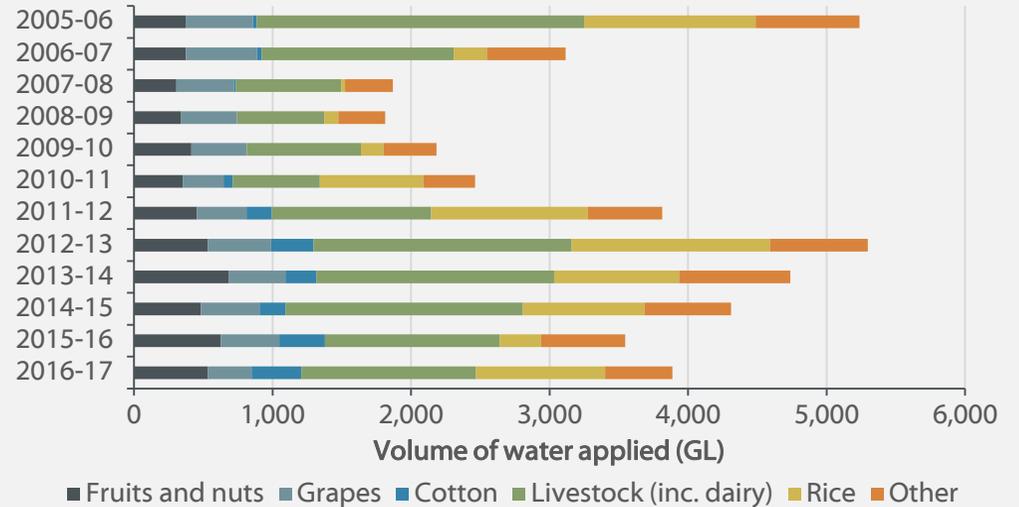
### 1.3 A CHANGING LANDSCAPE

As noted, there has been large new investment into almond, citrus, table grape and cotton production across the sMDB in recent years (Figure 3).

Growth in these industries is a clear sign that the sMDB is an attractive place for investment, however, as these industries continue to grow, they will require an increasing volume of irrigation water. This changing and increasing demand for water will change the dynamics of the sMDB water market.

It is therefore important that governments, water users and investors are aware of these changing dynamics and are considering:

- Market risk: How are water allocation and entitlement prices expected to change in the future?
- Deliverability risk: How will the growth of permanent plantings and resulting water demands below the Barmah Choke in the Murray system increase deliverability risk in the Sunraysia and Riverland regions?
- Regulatory risk: How implementation of the Basin Plan and other regulatory changes could influence future water market conditions?



Source: Aither, 2018. Based on ABS 2017.

**FIGURE 3 WATER USE BY IRRIGATED AGRICULTURE INDUSTRY SOUTHERN MURRAY-DARLING BASIN, 2005-06 TO 2016-17**

# 2.0

## ALLOCATION MARKETS



## 2.1 ALLOCATION TRADE ACTIVITY

Table 1A shows total 2017-18 allocation transfers across major southern Murray-Darling Basin (sMDB) zones. The analysis suggests Vic 7 Murray was a very large net exporter of water allocations. However, Table 1A includes \$0 and other non-commercial transactions (such as environmental or carryover transfers), which can be substantial in volume.

As we continue to reiterate, identifying non-commercial transfers is important to achieve an accurate picture of the market. Based on current public reporting practices of most state governments, it remains difficult to identify or categorise types of transfers with total certainty and timeliness.

In previous versions of this report, Aither has used transfers reported at \$0 per ML as a rough proxy for non-commercial transfers. After excluding \$0 allocation transfers from Table 1A, Table 1B suggests that water allocations were primarily transferred to commercial buyers in NSW Murrumbidgee and NSW Murray. There are two primary dynamics which explain this result:

1. Water allocations were bought by irrigators in the NSW Murrumbidgee to support the large cotton crop planted in 2017-18.
2. Water allocations are being transferred into the NSW Murray to support maturing permanent crop developments which may not yet have large coverage through owned or leased water entitlements.

**TABLE 1A ALLOCATION TRANSFER NUMBERS AND VOLUMES, MAJOR SOUTHERN MURRAY-DARLING BASIN ZONES (ALL REPORTED TRANSFERS), 2017-18**

Trading zone	Within		Into		Out of		Net change (ML)
	No.	Vol. (ML)	No.	Vol. (ML)	No.	Vol. (ML)	
Vic 1A Greater Goulburn	5,449	872,708	915	150,534	1,087	199,365	(48,832)
Vic 6 Murray (Dart to Barmah)	1,215	241,662	401	56,990	478	93,281	(36,292)
Vic 7 Murray (Barmah to SA)	4,565	498,908	1,340	311,883	1,016	941,198	(629,315)
NSW Murray	1,603	394,889	634	184,711	365	124,038	60,673
NSW Murrumbidgee	1,223	514,201	310	150,738	54	57,537	93,201
SA Murray	737	312,422	298	773,344	314	73,282	700,062
<b>Total</b>	<b>14,792</b>	<b>2,834,790</b>	<b>3,898</b>	<b>1,628,199</b>	<b>3,314</b>	<b>1,488,702</b>	<b>139,497</b>

Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

**TABLE 1B ALLOCATION TRANSFER NUMBERS AND VOLUMES, MAJOR SOUTHERN MURRAY-DARLING BASIN ZONES (EXCLUDING \$0 TRANSFERS), 2017-18**

Trading zone	Within		Into		Out of		Net change (ML)
	No.	Vol. (ML)	No.	Vol. (ML)	No.	Vol. (ML)	
Vic 1A Greater Goulburn	3,462	345,774	576	59,195	777	74,009	(14,813)
Vic 6 Murray (Dart to Barmah)	804	59,553	270	19,202	324	39,992	(20,790)
Vic 7 Murray (Barmah to SA)	3,218	319,044	985	92,945	751	131,876	(38,932)
NSW Murray	968	111,569	500	90,080	271	55,433	34,647
NSW Murrumbidgee	938	238,651	264	67,744	26	4,466	63,278
SA Murray	348	57,551	224	45,328	290	40,024	5,304
<b>Total</b>	<b>9,738</b>	<b>1,132,141</b>	<b>2,819</b>	<b>374,493</b>	<b>2,439</b>	<b>345,799</b>	<b>28,693</b>

Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

## 2.2 ALLOCATION DATA TRANSPARENCY

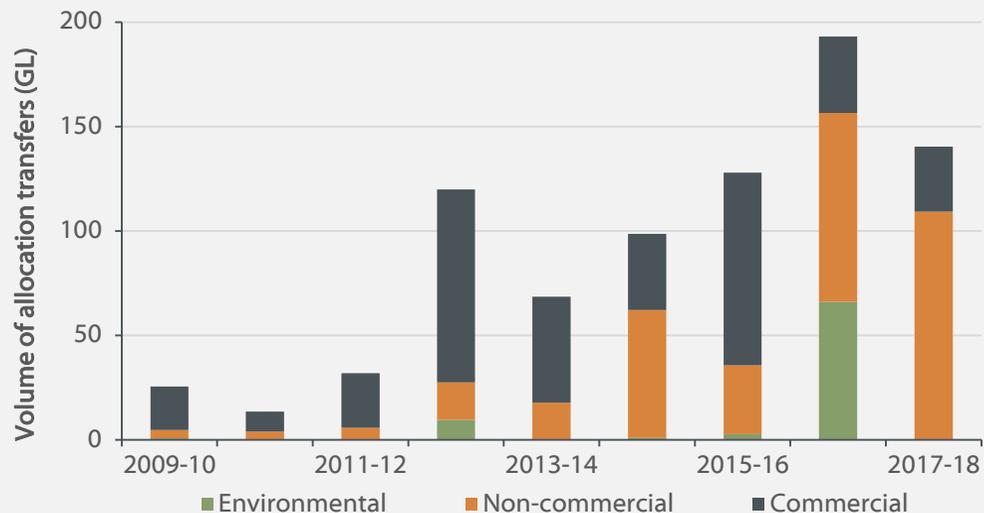
During the 2017-18 water year, the Victorian Government began to publish detailed allocation trade data regarding whether allocation transfers are environmental, commercial and non-commercial in nature.

As a result, it is now also possible to track the flow of allocation transfers between the various Victorian trading zones as well as identify the commercial breakdown of this trade.

Figure 4 presents data on volumes of allocation transfers out of Vic 1A Greater Goulburn and into Vic 7 Murray on an annual basis from 2009-10 onwards. From this data it is clear that allocation transfers between these zones are both increasing year on year and that a substantial and increasing proportion of the transfers are non-commercial in nature.

It is likely that a large amount of these transfers are being undertaken by agricultural enterprises who hold Vic 1A Greater Goulburn entitlements (both tagged and untagged) and are using them to supply operations in Vic 7 Murray.

The use of water from and carryover space in the Goulburn in this way is driving a change in the relationship between these two trading zones. As more water is transferred out of the Goulburn system, rules which cap the volume of water that can be transferred out of the Goulburn, are become increasingly binding.



Source: Aither, 2018. Based on Victorian water register 2018.

**FIGURE 4 ALLOCATION TRANSFERS OUT OF VIC 1A GREATER GOULBURN AND INTO VIC 7 MURRAY, 2009-10 to 2017-18**

## 2.3 ALLOCATION TRADE PRICES

Annual water allocation volume weighted average prices (VWAP) in 2017-18 were reasonably consistent across most connected sMDB zones – around \$120 to \$140 per ML (Table 2). SA Murray, NSW Murrumbidgee and Vic 1A Greater Goulburn were the exceptions to this trend, with the first two zones trading at a price premium and the latter trading at a price discount to the rest of the sMDB market (for further explanation see Section 2.4).

Annual VWAPs for water allocations in all major sMDB trading zones increased substantially from 2016-17 to 2017-18 (noting the transition from a very wet year to a drying cycle). Increases of around 150 to 200 per cent were observed in most instances, with a very large increase of 412 per cent in the case of NSW Murrumbidgee (Table 2).

Using allocation transfers reported at \$0 per ML as a proxy for non-commercial transfers and annual VWAPs reported in Table 2, we can estimate the total value of commercial sMDB allocation trade for 2017-18 at approximately \$189 million.

However, based on what we know about price disclosure issues (i.e. commercial allocation trades can be reported at \$0 and some carryover trade is reported at \$0 but it is in fact commercial), this figure may understate the total value of commercial trade.

TABLE 2 ANNUAL VOLUME WEIGHTED AVERAGE ALLOCATION PRICES, MAJOR SOUTHERN MURRAY-DARLING BASIN ZONES, 2015-16 TO 2017-18

Trading zone	VWAP 2015-16 (\$/ML)	VWAP 2016-17 (\$/ML)	VWAP 2017-18 (\$/ML)	Change in price 2016-17 to 2017-18 (%)
Vic 1A Greater Goulburn	\$224	\$47	\$99	112% ▲
Vic 6 Murray (Dart to Barmah)	\$223	\$47	\$115	145% ▲
Vic 7 Murray (Barmah to SA)	\$232	\$47	\$137	192% ▲
NSW Murray	\$213	\$47	\$127	169% ▲
NSW Murrumbidgee	\$202	\$27	\$138	412% ▲
SA Murray	\$232	\$58	\$152	162% ▲

Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

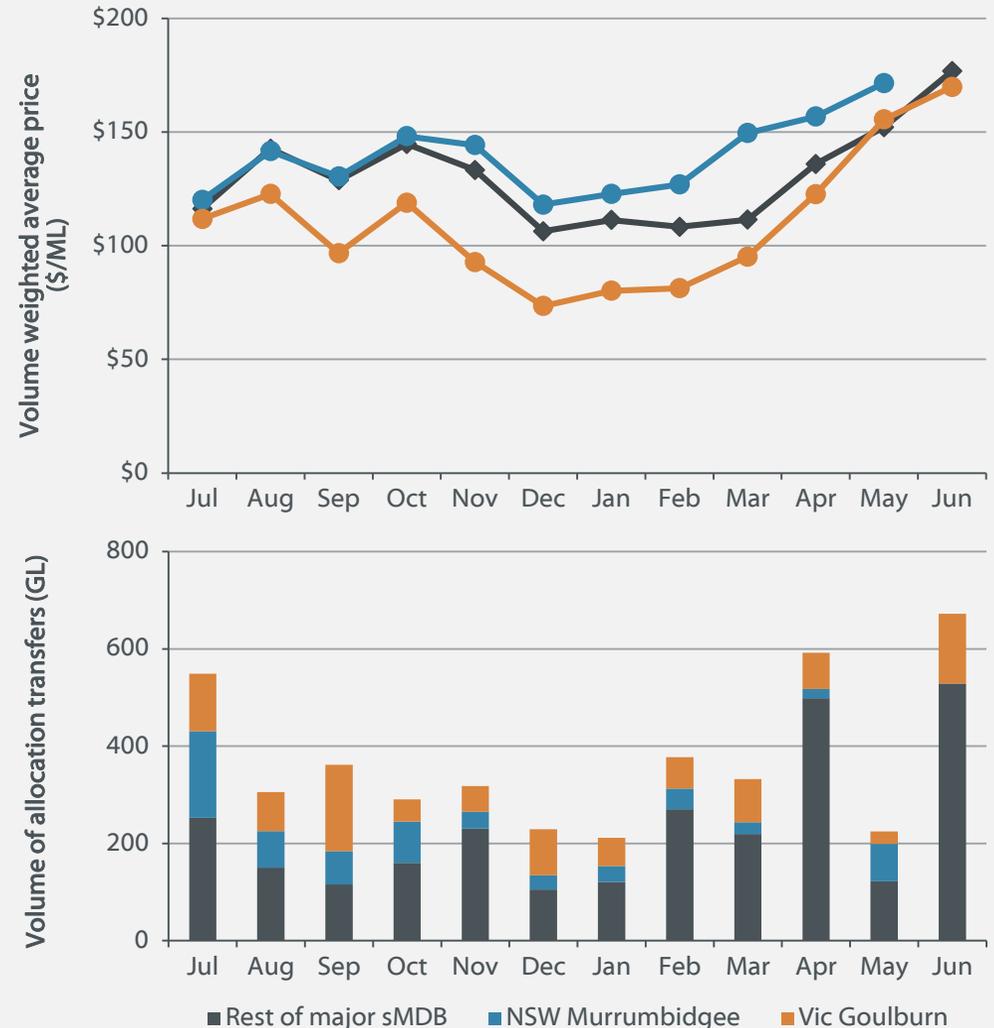
## 2.4 COMPARISON OF TRADE PRICES AND VOLUMES

Average sMDB allocation prices started the 2017-18 water year at approximately \$115 per ML (Figure 5). Prices closed the year at an annual high of around \$180 per ML. Price appreciation in the latter half of the year followed drying conditions and a poor outlook for 2018-19.

For the majority of 2017-18, water allocations in the NSW Murrumbidgee traded at a price premium to the rest of the connected sMDB. This price premium peaked at 34 per cent in March 2018.

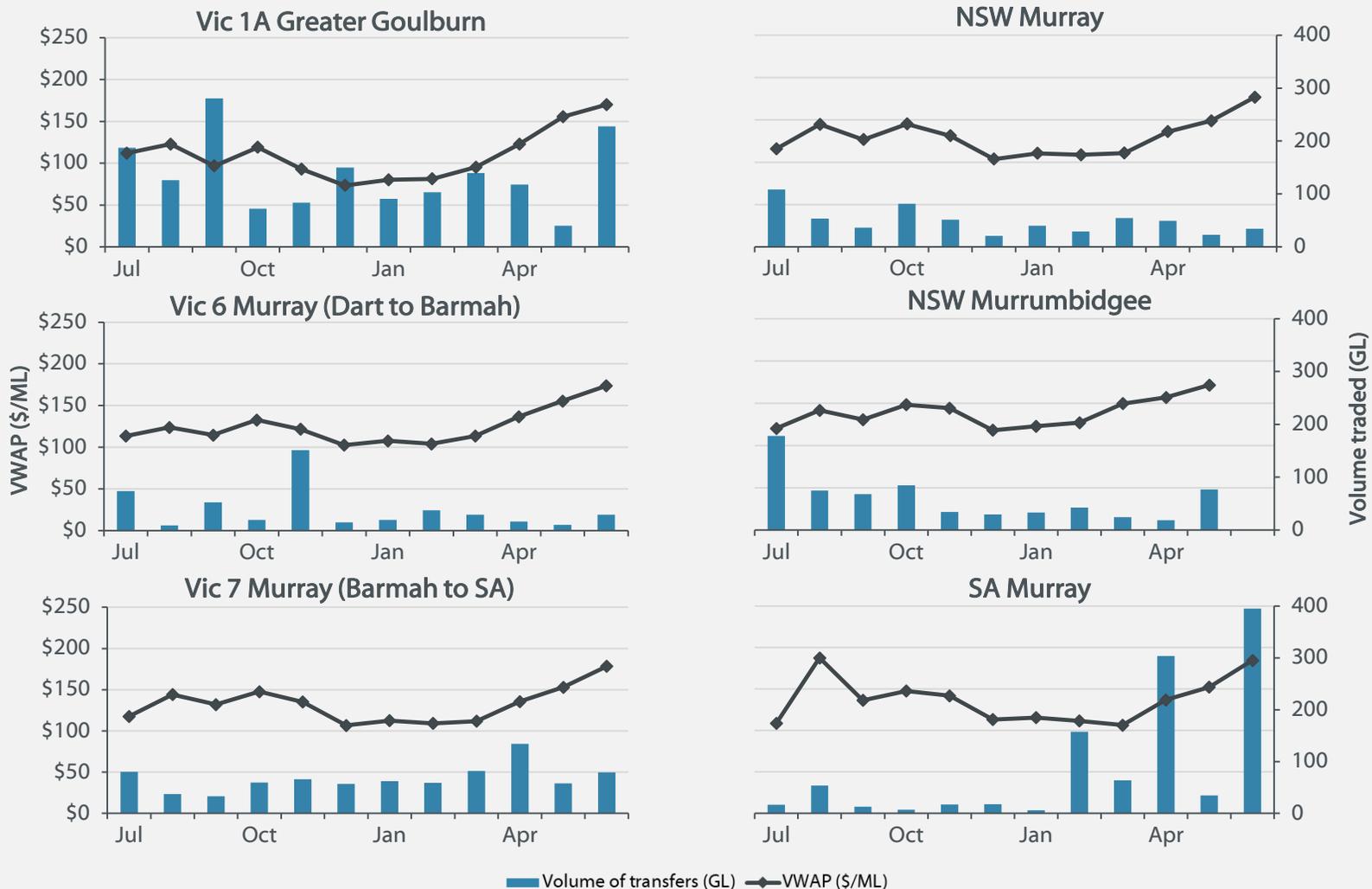
The premium for NSW Murrumbidgee in 2017-18 reflects a departure from the historical trend, in which NSW Murrumbidgee has typically traded at a discount. The premium in 2017-18 can be attributed to the substantial cotton crop planted in the Murrumbidgee, restriction of transfers into the Murrumbidgee and growers willingness to pay a premium in order to source the allocation water necessary for their crops.

In contrast, Vic 1A Greater Goulburn allocations traded at a significant price discount to the broader connected sMDB market throughout 2017-18. This discount reached a maximum of 31 per cent in December 2017. This discount similarly represents a break in the historical price trend for Vic 1A Greater Goulburn. This discount is being driven by restrictions on water allocations trading out of the Goulburn and lower demand for water by the Goulburn dairy industry.



Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

**FIGURE 5** MONTHLY VOLUME WEIGHTED AVERAGE ALLOCATION PRICES AND TRANSFER VOLUMES, MAJOR SOUTHERN MURRAY-DARLING BASIN ZONES, NSW MURRUMBIDGEE AND VIC 1A GREATER GOULBURN, 2017-18



Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

**FIGURE 6** MONTHLY VOLUME WEIGHTED AVERAGE ALLOCATION PRICES AND TRANSFER VOLUMES, MAJOR SOUTHERN MURRAY-DARLING BASIN ZONES, 2017-18

## 2.5 SEASONAL DRIVERS

### 2.5.1 WATER ALLOCATIONS MADE TO ENTITLEMENTS

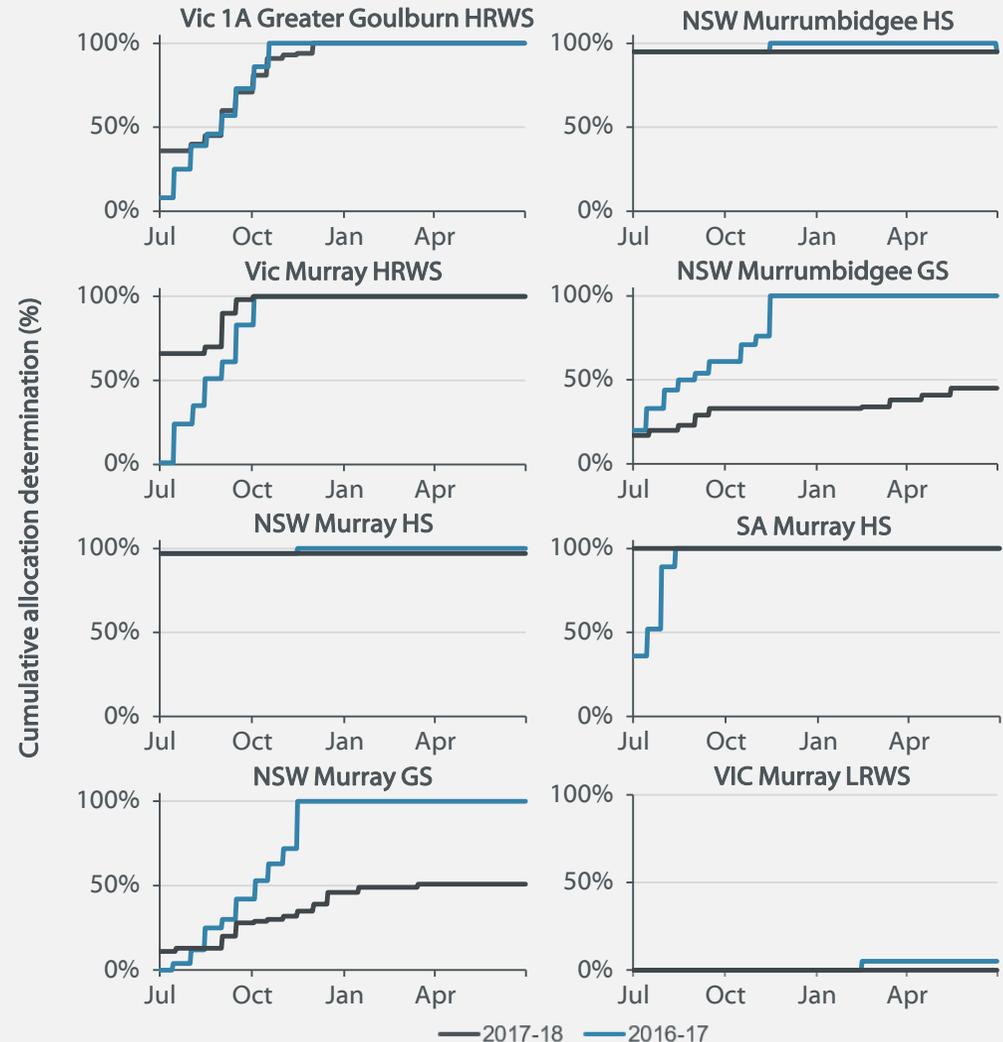
Whilst opening water allocations to many major sMDB entitlement types were higher in 2017-18 than in 2016-17, end of season water allocation determinations in 2017-18 were lower than, or equal to, 2016-17 – reflecting below average inflows across 2017-18 (Figure 7).

The total volume of allocations made to major sMDB entitlement types in 2017-18 was approximately 4,957 GL (including allocations made to entitlements held by the environment, but not including carryover into 2017-18). This represents a decrease of approximately 28 per cent from 2016-17.

The timing of allocations is an important driver of production decisions and allocation prices because the later in the year that water is allocated the more pressure there is on water users to secure water from the market at the beginning of the irrigation season, rather than wait for allocations to their entitlements.

Higher opening water allocations combined with large carryover volumes primed annual cropping enterprises for a year of high production in 2017-18.

The fact that end of season allocations to New South Wales General Security entitlements were lower than the previous year didn't necessarily impact production decisions in 2017-18, but lower overall water availability put upward pressure on 2017-18 allocation prices as irrigators secured additional water to finish off crops, settle accounts and bought allocation in preparation for a drier 2018-19 (see Figure 5).



Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

**FIGURE 7** WATER ALLOCATION DETERMINATIONS MADE TO MAJOR SOUTHERN MURRAY-DARLING BASIN ENTITLEMENT TYPES, 2016-17 AND 2017-18

### 2.5.2 RAINFALL

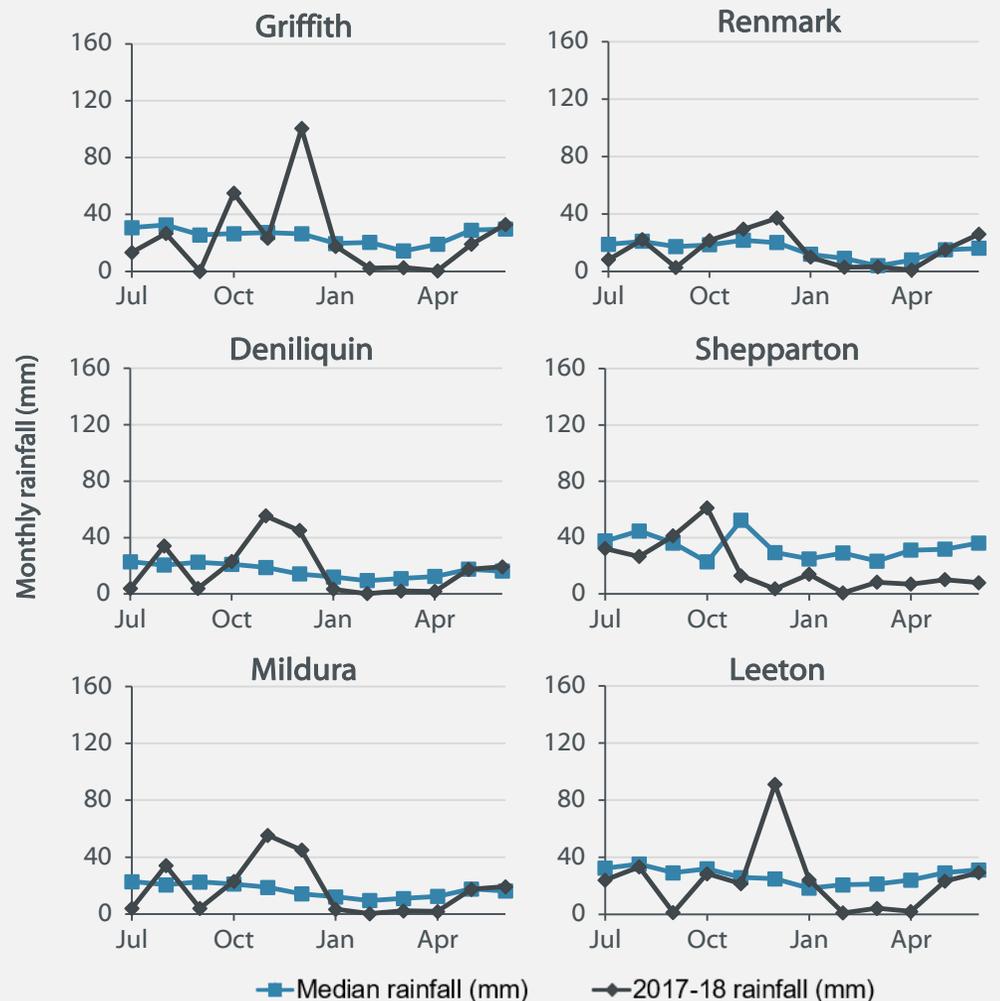
Irrigation water requirements vary based on crop type, climatic conditions, soil type and irrigation management practices. In the sMDB, irrigators use water allocations as a controllable water supplement to in-crop rainfall.

In very wet years, water allocation prices drop due to both an increase in water availability (supply) and a decrease in water allocation demand (more in-crop rainfall). The opposite is the case in dry years.

In 2017-18, strong commodity prices, higher opening allocations and large volumes of carryover presented attractive conditions for annual cropping enterprises to commit to large programs. These enterprises use irrigation water, but to a certain extent also rely on rainfall.

With the exception of December 2017, many annual cropping regions throughout the sMDB experienced below median rainfall throughout the entire second half of the 2017-18 irrigation season (Figure 8). This low level of rainfall combined with larger annual cropping programs, contributed to an increased need to irrigate and therefore an upward pressure on allocation prices in most trading zones.

Dry conditions in 2017-18 also influenced water use by permanent planting enterprises, with below average rainfall and above average temperatures increasing expected water requirements from January to March 2018.



Source: Aither, 2018. Based on Bureau of Meteorology 2018.

**FIGURE 8** MONTHLY OBSERVED AND MEDIAN RAINFALL ACROSS MAJOR SOUTHERN MURRAY-DARLING BASIN REGIONS, 2017-18

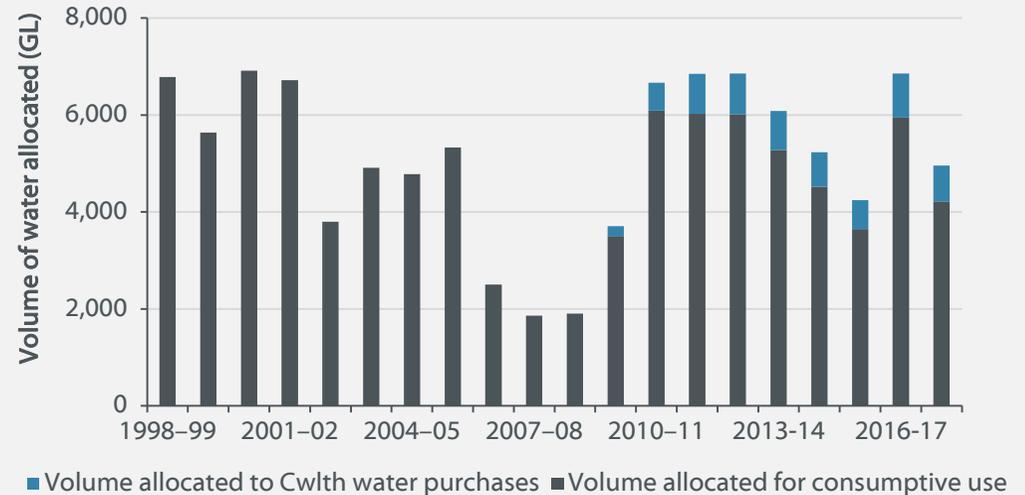
## 2.6 LONGER-TERM COMPARISONS

### 2.6.1 WATER ALLOCATED TO ENTITLEMENTS

After returning to a historically high level of water availability in 2016-17 (Figure 9), the 2017-18 water year saw a decrease in water availability with only 4,214 GL available for consumptive users across the sMDB compared to 5,942 GL in 2016-17 (a 29 per cent decrease).

In 2017-18, approximately 15 per cent of total allocations were allocated to entitlements purchased by the Australian Government for the environment. Across the past five water years, this percentage has remained relatively consistent. Based on the weighting of the purchases towards higher reliability entitlements, allocations to the Australian Government portfolio are generally proportionally higher in drier years.

Carryover is not formally captured in this analysis, but is an important component of the water availability story (i.e. carryover can add more than a thousand gigalitres of available water to the opening allocation determinations).



Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

**FIGURE 9** TOTAL VOLUME OF WATER ALLOCATED TO MAJOR SOUTHERN MURRAY-DARLING BASIN ENTITLEMENT TYPES, 1998-99 TO 2017-18

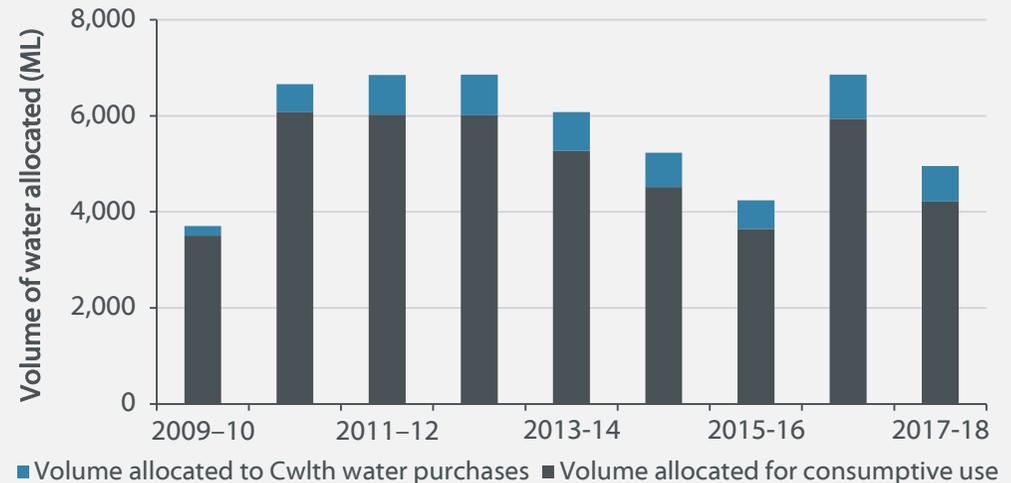
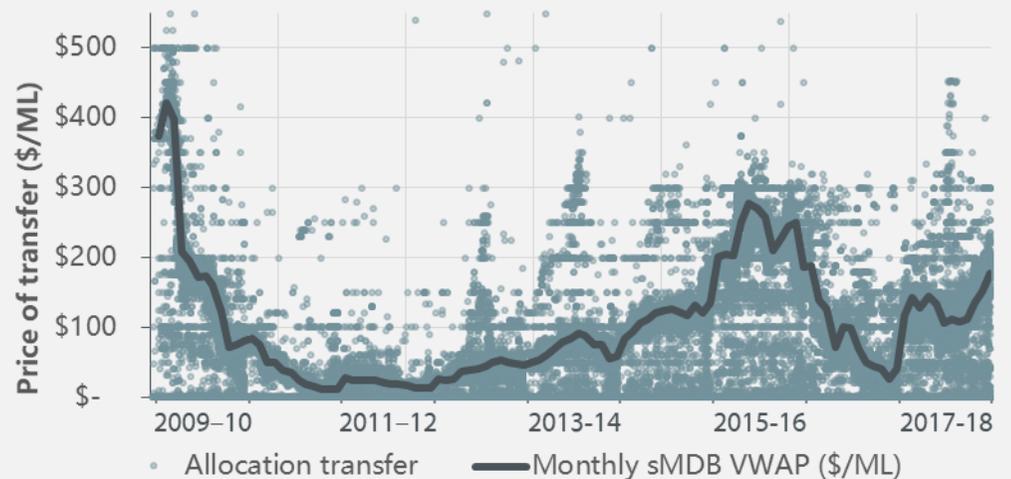
### 2.6.2 WATER ALLOCATION PRICE TRENDS OVER TIME

sMDB water allocation market prices are strongly influenced by the supply of water. On the basis that the supply of water is variable, water allocation prices can vary significantly between and within years (Figure 10).

With allocation prices having significantly declined in 2016-17, the 2017-18 water year saw a sharp return to higher prices (Figure 10). As previously noted, these price increases are primarily related to the decreased volume of water available in the 2017-18 water year, the substantial cotton crop that was grown in the NSW Murrumbidgee and drier conditions which characterised the period.

Between 2011-12 and 2015-16, reported allocation trade prices generally grouped closely around the monthly sMDB allocation VWAP (Figure 10). A larger distribution of prices and higher price volatility has been observed over the last few years.

This is being driven by a range of factors including allocation forwards being captured in price reporting on state registers as allocation transfers and a movement away from a 'single' allocation price across the sMDB as transfer constraints become binding isolating certain trading zones (such as the NSW Murrumbidgee and Vic Goulburn).



Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

**FIGURE 10** TOTAL VOLUME OF WATER ALLOCATED TO MAJOR SOUTHERN MURRAY-DARLING BASIN ENTITLEMENT TYPES AND WATER ALLOCATION PRICES, 2009-10 TO 2017-18

**3.0**

**ENTITLEMENT  
MARKETS**



### 3.1 ENTITLEMENT TRADE ACTIVITY AND PRICES

For the 11 major water entitlement types covered in this report, there was a total volume of approximately 160 GL transferred between on-river market participants in 2017-18 (Table 3) – which by volume is approximately 47 per cent less than was transferred in 2016-17. By volume, the most actively traded entitlement types in 2017-18 were NSW Murrumbidgee GS and Vic 1A Greater Goulburn HRWS.

The analysis presented in Table 3 does not include transfers that is reported 'within' New South Wales irrigation corporation licences. We have excluded these transfers as they are not reported on the New South Wales water register and when they are reported through the Bureau of Meteorology, they are done so without prices.

The inclusion of entitlement transfers within irrigation corporation licences increases the total volume of sMDB entitlement transfers for 2017-18 by another 166 GL (or approximately 100 per cent more) – see Figure 13.

Water entitlement prices in the southern Murray-Darling Basin have increased rapidly over the last 4 to 5 years. Annual VWAP prices reported for essentially all sMDB entitlement types continued this trend by increasing between 2016-17 and 2017-18 (Table 3). The most significant increases in prices were for Victorian Low Reliability Water Shares (LRWS) which saw increases of more than 30 per cent.

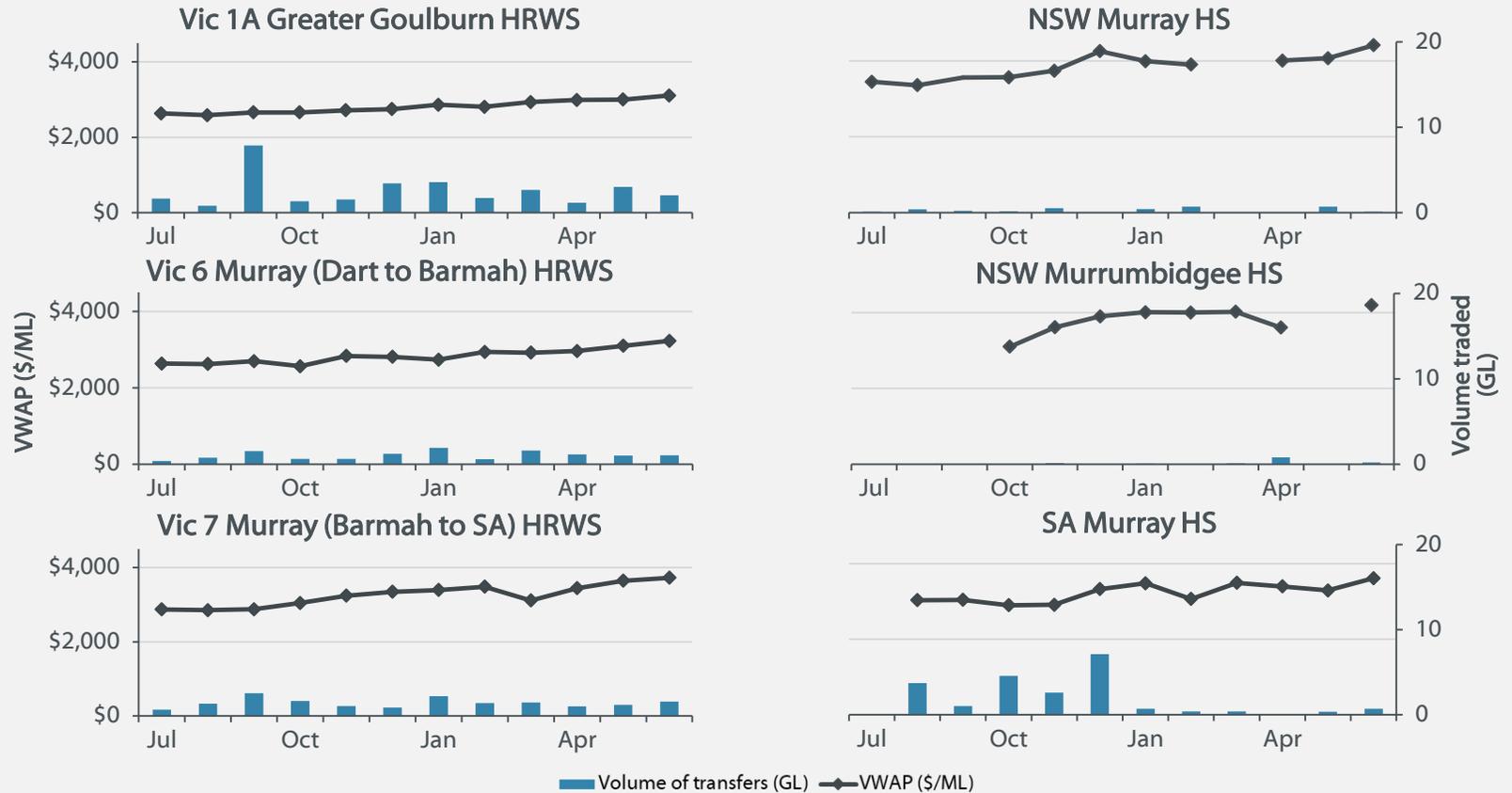
TABLE 3 ANNUAL TRANSFER VOLUMES AND VOLUME WEIGHTED AVERAGE PRICES, MAJOR SOUTHERN MURRAY-DARLING BASIN ENTITLEMENT TYPES, 2016-17 AND 2017-18

Entitlement type	No.	Volume (ML)	Annual VWAP (\$/ML)		Change in price (%)
			2016-17	2017-18	
Vic 1A Greater Goulburn HRWS	709	31,054	\$2,587	\$2,765	7% ▲
Vic 1A Greater Goulburn LRWS	302	14,590	\$247	\$345	40% ▲
Vic 6 Murray (Dart to Barmah) HRWS	193	12,492	\$2,592	\$2,798	8% ▲
Vic 6 Murray (Dart to Barmah) LRWS	83	5,494	\$250	\$362	45% ▲
Vic 7 Murray (Barmah to SA) HRWS	820	18,675	\$2,915	\$3,142	8% ▲
Vic 7 Murray (Barmah to SA) LRWS	98	4,063	\$261	\$344	32% ▲
NSW Murray HS	67	3,450	\$3,398	\$3,829	13% ▲
NSW Murray GS	48	6,914	\$1,227	\$1,389	13% ▲
NSW Murrumbidgee HS	17	1,361	\$3,550	\$4,104	16% ▲
NSW Murrumbidgee GS	55	40,711	\$1,501	\$1,619	8% ▲
SA Murray HS	234	21,577	\$2,986	\$2,979	0% —
<b>Total</b>	<b>2,626</b>	<b>160,381</b>			

Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

### 3.2 COMPARISON OF TRADE PRICES AND VOLUMES

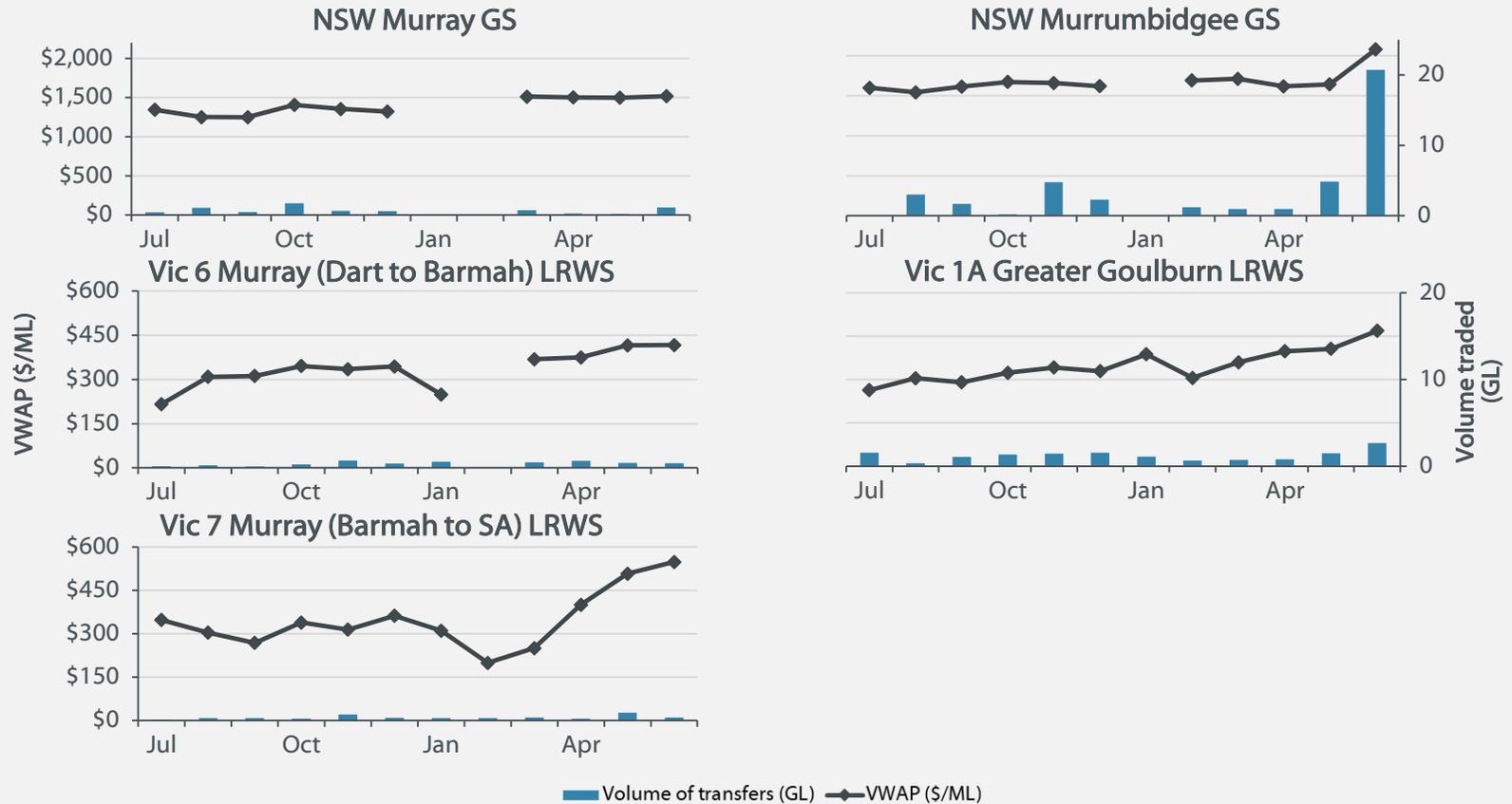
#### 3.2.1 HIGHER RELIABILITY ENTITLEMENT TYPES



Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

FIGURE 11 MONTHLY VOLUME WEIGHTED AVERAGE PRICES AND ENTITLEMENT TRANSFER VOLUMES, MAJOR SOUTHERN MURRAY-DARLING BASIN HIGHER RELIABILITY ENTITLEMENT TYPES, 2017-18

3.2.2 LOWER RELIABILITY ENTITLEMENT TYPES



Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

FIGURE 12 MONTHLY VOLUME WEIGHTED AVERAGE PRICES AND ENTITLEMENT TRANSFER VOLUMES, MAJOR SOUTHERN MURRAY-DARLING BASIN LOWER RELIABILITY ENTITLEMENT TYPES, 2017-18

### 3.3 TOTAL ENTITLEMENT MARKET SIZE AND VALUE

By volume and value, the majority of the Australian water entitlement market is contained within the sMDB. The 2017-18 estimated total value of major entitlements types on issue in the sMDB is approximately \$15.9 billion (based on 2017-18 annual prices reported in state registers not current fair market price valuations which are substantially higher than these VWAP prices).

As per Table 4, major entitlement types held for consumptive use in the sMDB have an estimated combined value of around \$13.6 billion (based on 2017-18 annual prices and excluding the Commonwealth Environmental Water Holder portfolio). Reflecting rapid price increases over the past four years, Aither estimates that the combined value of major entitlement types held for consumptive use have more than doubled since 2013-14 – when we estimated the value of combined sMDB consumptive entitlements were worth approximately \$6.3 billion.

The estimated 2017-18 value of entitlements held by the Australian Government in the sMDB as listed in Table 4 is approximately \$2.2 billion. In line with the broader market, the value of this portfolio has more than doubled in value since 2013-14.

TABLE 4 ENTITLEMENTS ON ISSUE, ANNUAL PRICES AND ESTIMATES OF MARKET SIZE, MAJOR SOUTHERN MURRAY-DARLING BASIN ENTITLEMENT TYPES, 2017-18

Entitlement type	Total entitlement on issue (ML)	Estimated environmental entitlements (Cwth purchase) (ML)	VWAP 2017-18 (\$/ML)	Estimated value of consumptive (million)	Estimated value of Cwth purchase (million)
Vic 1A Greater Goulburn HRWS	950,107	216,000	\$2,765	\$2,030	\$597
Vic 1A Greater Goulburn LRWS	426,720	17,000	\$345	\$141	\$6
Vic 6 Murray (Dart to Barmah) HRWS	308,273	65,000	\$2,798	\$681	\$182
Vic 6 Murray (Dart to Barmah) LRWS	126,975	6,000	\$362	\$44	\$2
Vic 7 Murray (Barmah to SA) HRWS	912,942	194,000	\$3,142	\$2,259	\$610
Vic 7 Murray (Barmah to SA) LRWS	173,256	6,000	\$344	\$58	\$2
NSW Murray HS	194,458	16,000	\$3,829	\$683	\$61
NSW Murray GS	1,675,186	204,000	\$1,389	\$2,044	\$283
NSW Murrumbidgee HS	360,297	6,000	\$4,104	\$1,454	\$25
NSW Murrumbidgee GS	1,893,240	127,000	\$1,619	\$2,860	\$206
SA Murray HS	548,287	86,000	\$2,979	\$1,377	\$256
<b>Total</b>	<b>7,569,741</b>	<b>943,000</b>		<b>\$13,631</b>	<b>\$2,230</b>

Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

### 3.4 ENTITLEMENT MARKET TURNOVER, LIQUIDITY AND RETURNS

In 2017-18, the market turnover value of major sMDB entitlement types was approximately \$347 million (excluding transfers within irrigation corporations) – which is significantly lower than in 2016-17 despite increases in entitlement market prices (Table 5).

Turnover in entitlement markets outside of irrigation corporations has significantly declined in 2017-18. As a result of this decline in transfer volumes, 2017-18 market turnover for major sMDB entitlement types as a group is lower than in 2016-17 (6 per cent market turnover in 2016-17 compared to 2 per cent in 2017-18).

However, turnover for individual entitlement types in 2017-18 was varied, with SA Murray HS and Vic 6 Murray HRWS and LRWS having the highest turnover at 5 per cent. If transfers within irrigation corporations was included in our analysis, our estimate of market turnover for New South Wales systems as reported in Table 5 would approximately double.

The sale of water allocations made to entitlements can deliver a financial return to entitlement holders. In 2017-18, average gross annual returns were between 3 and 5 per cent – or more than double that observed in 2016-17 (primarily owing to higher average annual allocation prices in 2017-18 and despite increasing entitlement prices).

TABLE 5 ENTITLEMENT MARKET TURNOVER, LIQUIDITY AND RETURNS, MAJOR SOUTHERN MURRAY-DARLING BASIN ENTITLEMENT TYPES, 2017-18

Entitlement type	No.	Volume (ML)	Estimated turnover value (million)	Estimated market liquidity (%)	Average annual gross return (%)
Vic 1A Greater Goulburn HRWS	709	31,054	\$86	4%	4%
Vic 1A Greater Goulburn LRWS	302	14,590	\$5	4%	No allocation
Vic 6 Murray (Dart to Barmah) HRWS	193	12,492	\$35	5%	4%
Vic 6 Murray (Dart to Barmah) LRWS	83	5,494	\$2	5%	No allocation
Vic 7 Murray (Barmah to SA) HRWS	820	18,675	\$59	3%	4%
Vic 7 Murray (Barmah to SA) LRWS	98	4,063	\$1	2%	No allocation
NSW Murray HS	67	3,450	\$13	2%	3%
NSW Murray GS	48	6,914	\$10	0.5%	5%
NSW Murrumbidgee HS	17	1,361	\$6	0.4%	3%
NSW Murrumbidgee GS	55	40,711	\$66	2%	4%
SA Murray HS	234	21,577	\$64	5%	5%
<b>Total</b>	<b>2,626</b>	<b>160,381</b>	<b>\$347</b>	<b>2%</b>	

Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

### 3.5 AITHER ENTITLEMENT INDEX

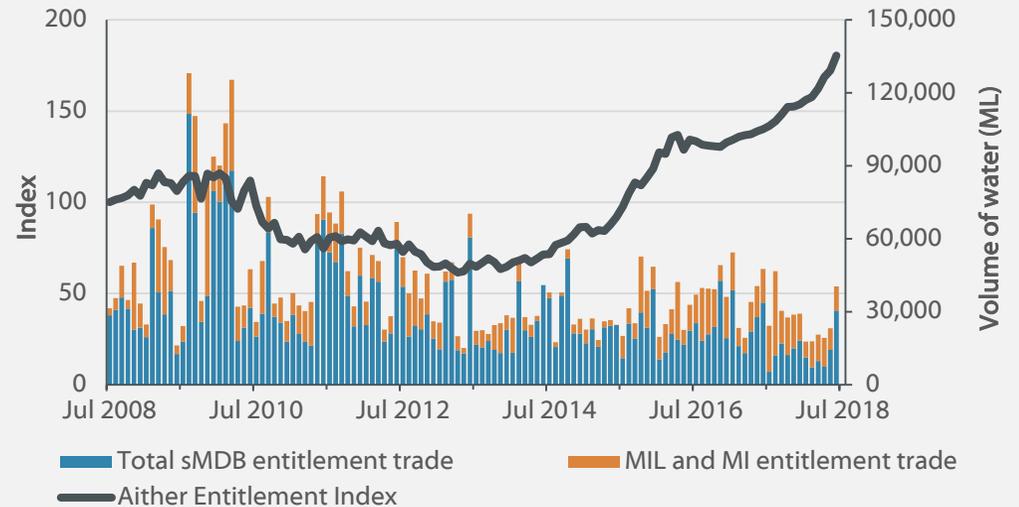
The Aither southern Murray-Darling Basin Entitlement Index (AEI) tracks the relative performance of a group of major water entitlement types across the southern Murray-Darling Basin, providing a simple overall snapshot of how major water entitlements are performing (Figure 13).

Updated monthly and freely available at Aither's website, irrigators, investors, banks, and owners of water can use the AEI to benchmark the capital value performance of their water portfolios over time.

Across the 2017-18 water year, the AEI increased by 29 per cent and has experienced over a year of consecutive month on month gains – including the most recent month of July 2018 which saw an increase of approximately 4 per cent from June 2018.

Over the past five years, a 24 per cent Compound Annual Growth Rate (CAGR) has been observed through the AEI. Since inception of the AEI (10 years ago), a 6 per cent CAGR has been observed.

At the same time as rapid increases in sMDB water entitlement values, volumes of transfers in entitlement markets outside of the irrigation corporations has significantly declined (Figure 13). In contrast, turnover within irrigation corporations has increased over the past few years.

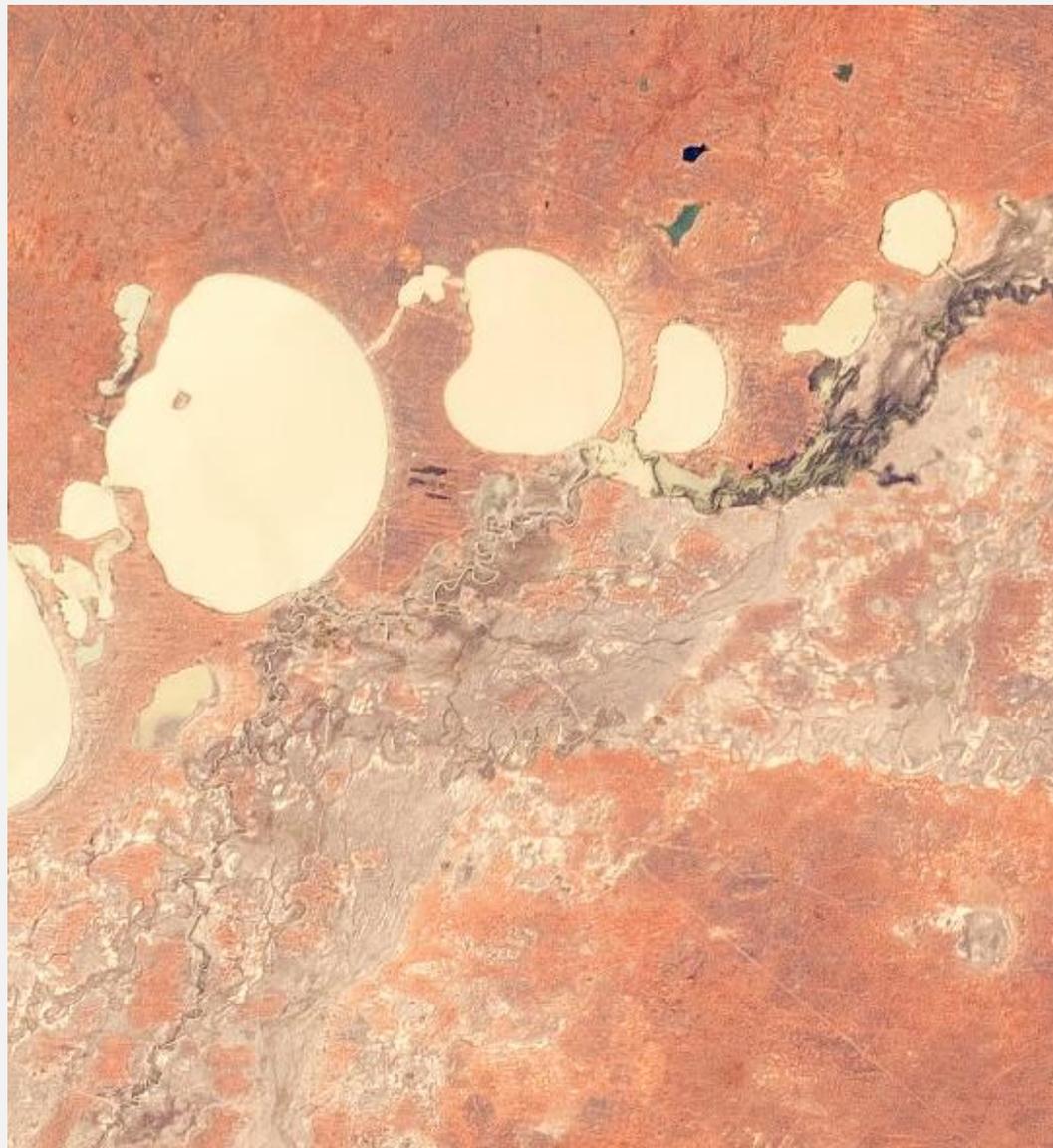


Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018 and BoM 2018.

**FIGURE 13** AITHER SOUTHERN MURRAY-DARLING BASIN ENTITLEMENT INDEX, 2008-09 TO 2017-18

# 4.0

## OUTLOOK



## 4.1 OPENING SEASON ALLOCATIONS TO ENTITLEMENTS

In 2018-19, opening season allocations to major sMDB entitlement types were significantly lower than in 2017-18 (Table 6). The exception to this was New South Wales High Security and SA Murray HS entitlement types, which received the same opening season allocations in 2018-19 as in 2017-18.

The lower 2018-19 opening season allocations are the equivalent to a reduction of approximately 700 GL of water available to consumptive users on 1 July 2018 compared to 1 July 2017 (not accounting for carryover), an approximate 29 per cent reduction.

Whilst the exact volume of 2017-18 carryover is not published in a centralised manner across all sMDB state governments, Aither understands that from 2017-18 to 2018-19, consumptive users carried over between approximately 1,500 and 1,600 GL of water allocations (based on broad estimates published by state governments).

This estimated volume of carryover, combined with opening season allocations, provided sMDB irrigators (consumptive users) with more than 3,200 GL of water in accounts in the first week of the current water year (2018-19). To put this in perspective, at the same point in time in 2017-18, consumptive users has access to more than 4,000 GL of available water.

TABLE 6 OPENING SEASON WATER ALLOCATIONS TO ENTITLEMENTS, 2017-18 AND 2018-19

Entitlement type	2017-18	2018-19
Vic 1A Greater Goulburn HRWS	36%	32%
Vic 1A Greater Goulburn LRWS	0%	0%
Vic Murray HRWS	66%	41%
Vic Murray LRWS	0%	0%
NSW Murray HS	97%	97%
NSW Murray GS	11%	0%
NSW Murrumbidgee HS	95%	95%
NSW Murrumbidgee GS	17%	3%
SA Murray HS	100%	100%

Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

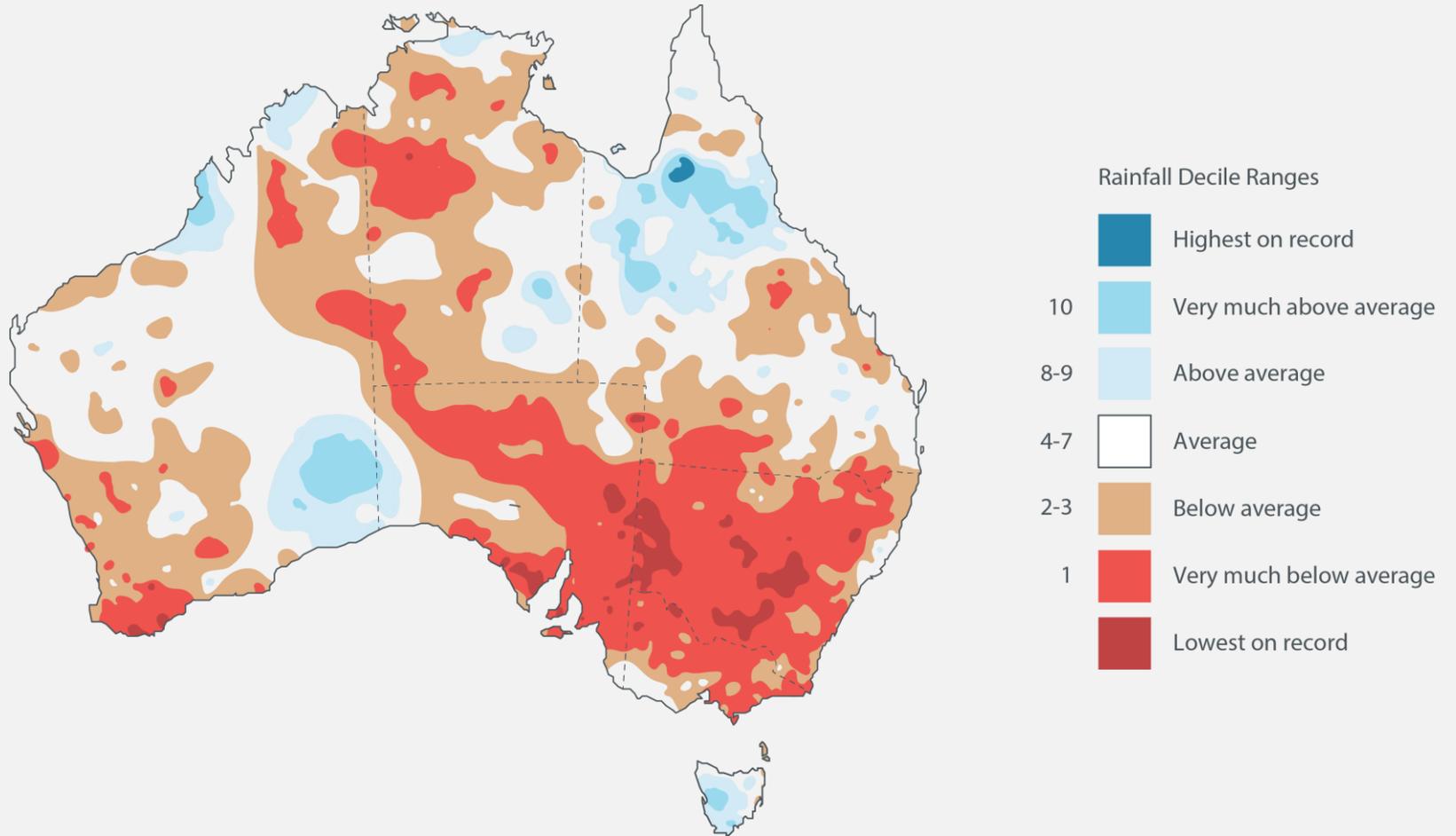
## 4.2 ALLOCATION MARKET OUTLOOK

### 4.2.1 MARKET CONDITIONS AND DRIVERS

At time of writing (mid-August 2018), water allocations across the sMDB are trading at between approximately \$300 and \$400 per ML – which are the highest prices since the millennium drought. However, as with the start of most water years, price spreads are large and sell-side depth on spot allocation markets is shallow.

Current sMDB water allocation prices are being driven by the following factors:

- Climatic conditions across the sMDB are dry (Figure 14 over page) and are expected to remain so across the 2018-19 water year. These conditions and uncertainty over water availability are juxtaposed against good economic conditions for and strong demand from many irrigation industries (cotton, nuts, citrus and table grapes). This situation of uncertain low water supply and high demand is driving historically high prices at the beginning of 2018-19.
- As is the case at this point in most water years, many annual cropping irrigators and other water owners, including investors, are waiting and considering at what price they sell – with irrigators comparing the returns from production against the value of the water on the market, and investors trying to pick the top of the market for the year.
- Rainfall and inflows over September and October 2018 will be critical to driving annual cropping production decisions for 2018-19, and therefore allocation prices for this year and more importantly next year.
- At present, many industries are enjoying strong commodity prices, so, on the demand side, annual cropping irrigators in the sMDB would like to commit to the biggest programs for 2018-19 that they can. Confidence in the availability and cost of water will ultimately drive production decisions for annual croppers.
- Based on current market conditions and unless there is a climatic reversal towards wet conditions, annual crop production in 2018-19 is unlikely to be as large as it was in 2017-18.
- Aither understands that approximately 30,000 ha of cotton was sold forward in the Murrumbidgee which will require more than 300 GL of irrigation water (which is approximately 50 per cent of current consumptive allocations in this region – excluding groundwater). Unless allocations to New South Wales General Security entitlements increase soon or major substitution can occur towards groundwater, cotton irrigators may be unwilling to commit to larger programs.
- At allocation prices above approximately \$200 per ML, many rice growers are expected to become sellers of water allocations rather than irrigate. As sMDB allocation prices are substantially above this mark and despite the favourable rice price announced for this year, rice growers that have not already substituted some or all of their programs to cotton are expected to return water to markets, particularly once their planting window passes across late August and September.
- Permanent plantings in the sMDB may require more water this year than last year as soil moisture is low, the rainfall outlook is poor, area of planting has increased and maturing trees are requiring more water. The requirements of these enterprises to buy allocation water either to use this year or to carryover into the next will also drive allocation market prices.
- Inter-valley trade rules emerged as the key regulatory driver of allocation markets during the 2017-18 water year. To the extent current trade constraints remain binding and patterns of annual production remain similar, we expect to see a similar pattern of trade constraints and therefore allocation price discounting and premiums during 2018-19.
- The profitability of the dairy industry and its ability to supply the connected sMDB water allocation market through the Vic Goulburn, will also be important in 2018-19 as this trade is becoming important to meet the water requirements of permanent plantings in the Sunraysia region and provide much needed cash for the dairy industry.



Source: Aither, 2018. Based on BoM 2018.

**FIGURE 14** AUSTRALIAN RAINFALL DECILES, 1 FEBRUARY TO 31 JULY 2018

#### 4.2.2 ALLOCATION PRICE FORECAST

In previous reports, we have used our water allocation price model to estimate annual allocation prices for the sMDB. For this edition of the report, we have applied an updated version of this same model to estimate 2018-19 average annual sMDB water allocation prices.

##### ALLOCATION PRICE MODEL UPDATES

The rapid growth of cotton in the Murrumbidgee has changed the annual demand prolife and willingness to pay for water allocations across the sMDB. We expect this new demand for cotton, if it continues, to set a new “floor” for water allocation prices in this region. That is, we are observing a step-change from the historical record.

The step-change in water use by cotton in the sMDB as well as rapid growth in permanent plantings has caused us to recalibrate our water allocation price model to better account for these changes and impacts on future water allocation prices in the sMDB. We have:

- adjusted the historical record to account for cotton and permanent planning demand changes and the impact this is having on willingness to pay for allocations
- split our model apart so that we are now able to separately model allocation prices in both the NSW Murrumbidgee and other connected sMDB regions.

#### PERFORMANCE OF MODEL FOR 2017-18

For last year’s Aither Water Markets Report edition, and using our previous model calibration, we estimated that if observed rainfall was substantially lower than median, an average annual allocation price for the sMDB in 2017-18 of between \$100 and \$120 per ML would be expected.

Despite there being no a single price for water allocations across the sMDB in 2017-18, the approximate average annual price for the connected sMDB was around \$130 per ML, which is slightly higher than Aither’s estimates based on outlooks available at the time. Rerunning our previous model calibration with observed climatic data for 2017-18, the model estimates a price of approximately \$125 per ML

for that year – which is closer to the actual observed price (Figure 15).

Whilst running our previous model calibration with complete data for 2017-18 returns a modelled allocation price which is close to what was actually observed, it is does not fully account for the recent increased demand in the NSW Murrumbidgee from cotton and therefore tends to underestimate the price in this region.

We updated our model calibration to account for this issue. Estimates generated using the updated model calibration are more acuate as a result of making adjustments to account for recent production changes and modelling prices across both the NSW Murrumbidgee and connected sMDB regions separately.



Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

**FIGURE 15** COMPARISON OF OBSERVED AND MODELLED AVERAGE ANNUAL ALLOCATION PRICES, 2017-18

### PRICE FORECAST FOR 2018-19

From a supply perspective, in 2018-19 we expect between approximately 2,500 and 3,300 GL of water to be available for consumptive use from allocations to entitlements across major sMDB surface water systems – this is based on conservative (low) expectations about end of season allocations to entitlements and does not include carryover adjustments. This would place 2018-19 as one of the lowest since 2007-08 on the basis of water allocated to consumptive entitlements (see Figure 10 for reference).

With the addition of consumptive carryover into 2018-19 (estimated at slightly more than 1,500 GL), Aither's water availability estimate increases to between 4,000 and 4,800 GL of water available for consumptive use across all major surface water sMDB systems in 2018-19.

Based on allocation scenarios adopted from state authority outlooks, we have used our updated model calibration to estimate 2018-19 average annual sMDB allocation prices under a range of scenarios. At this point in time, wet and average scenarios are not realistic forecasts.

Under a dry scenario, our allocation model estimates a 2018-19 average annual sMDB allocation price of approximately \$240 per ML. Under an extreme dry scenario, we estimate a price of approximately \$315 per ML. Current state government forecasts are tracking between dry and extreme dry scenarios.

Aither's 2018-19 allocation price estimates are presented in more detail in Figure 16.

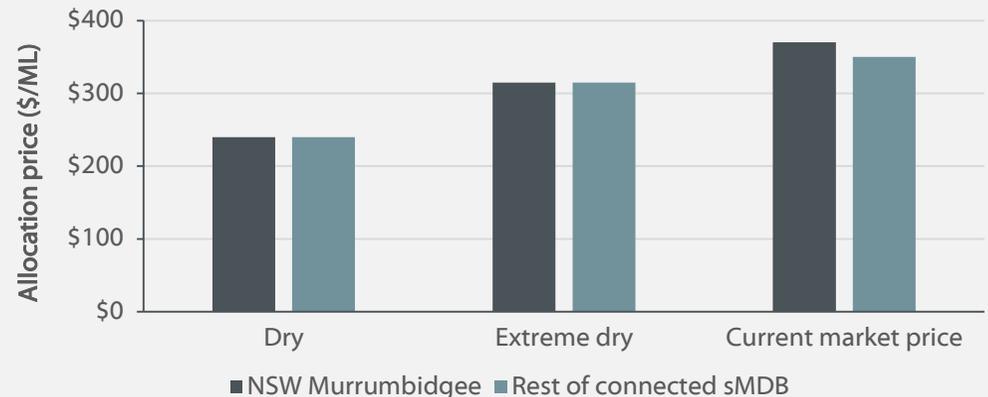
If conditions remains dry, current allocation prices (\$300 to \$400 per ML) should hold or could increase as the 2018-19 season develops. However, this could change if we see a rainfall event similar to what occurred in 2016-17 or if annual cropping commitments are significantly lower than expected. We are already seeing a lower price and softer market emerging the Vic Goulburn system.

### 12 MONTH MARKET OUTLOOK

Planning for the 2019-20 water year and beyond will be important in determining allocation prices over the next 12 months. The largest risk for allocation prices over this period is carryover depletion during 2018-19 as a result of a large annual cropping commitments to cash in on strong commodity prices.

If this occurs and inflows do not replenish storages, competition for carryover into 2019-20 will be strong and allocation prices could further increase during the 2018-19 irrigation season. The continued profitability and the willingness to pay of the cotton and permanent planting industries will be important in determining the allocation price path under this type of scenario.

To the extent that there is sufficient underlying water available to meet the needs of permanent plantings, the willingness of cotton to pay for allocations should put a ceiling on allocation prices in the \$300 to \$350 per ML range. If there is the chance that there is not sufficient water available for permanent plantings, allocation prices higher than this are expected as permanent plantings compete against each other for carryover and underlying supply.



Source: Aither, 2018.

**FIGURE 16** MODELLED AVERAGE ANNUAL ALLOCATION PRICES COMPARED TO CURRENT ALLOCATION PRICES, 2018-19

### 4.3 ENTITLEMENT MARKET OUTLOOK

Entitlement price increases continued throughout 2017-18 despite the lower gross annual returns achieved from selling water allocations over recent years (Figure 16) and pressure from buyers seeking lower lease rates on higher reliability entitlements.

Increasing entitlement values reflect the positive conditions for several irrigated commodities (cotton, almonds, citrus and table grapes), capital deployment by funds and the reluctance of some owners to sell at this point.

As a result of the rapid growth in entitlement values, the sentiment of some buyers is that the entitlement market continues to be fully or over valued. Despite this, there are few signs that prices are dropping, or that competition for every parcel that comes to market is weakening.

Current buyers fall into the following groups, and it is the sentiment of these groups that will drive additional growth in prices:

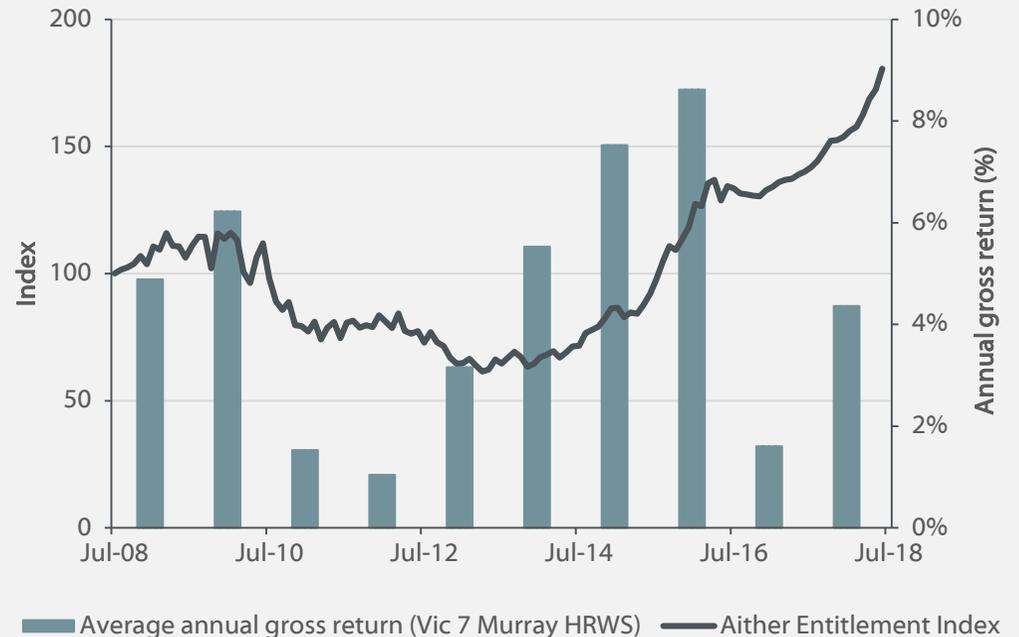
- Enterprises toping up smaller water portfolios on the basis of commodity prices.
- Water funds and investors continuing to see value in entitlements on the basis of lease products and forward contracts.
- Large institutional investors that are making strategic purchases on the basis of risk management and underpinning long-term permanent developments, rather than considering annual returns to entitlements.

With expected higher annual returns to higher reliability entitlements in 2018-19, we will be closely monitoring whether entitlement prices continue to increase.

If entitlement prices increase further, there will be a point where dairy farmers and rice growers sell entitlements and make longer-term adjustment decisions. This will increase sell side depth in the market but may not have a

material impact on price as there will likely be buyers for these water entitlements.

Despite the positive economic conditions, there is a natural limit on the value of water entitlements in agricultural production. In the meantime, sellers will continue to test whether this point has been reached.



Source: Aither, 2018. Based on Victorian, New South Wales and South Australian water registers 2018.

**FIGURE 17** AITHER SOUTHERN MURRAY-DARLING BASIN ENTITLEMENT INDEX GROSS ANNUAL RETURN, 2008-09 TO 2017-18

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# ABOUT AUSTRALIA'S WATER MARKETS

## Background

Australia's water markets are comprised of two distinct but related markets – the entitlement market, and the allocation market. There is no single national market for these products, but rather a number of individual separate markets. Where hydrological connectivity exists, such as in the southern Murray-Darling Basin, trade between these markets is possible.

- Water entitlements are ongoing rights to receive a share of available water resources in a consumptive pool. They are analogous to a land property right, are generally secure and mortgageable in the same way, and have substantial value. Each catchment typically has a small number of entitlement 'classes', and generally all entitlements within a given class are homogenous.
- Water allocations are the volumes of water allocated to water entitlement holders during the water year (1 July to 30 June). They are a physical good analogous to a commodity, and are extracted from water courses and applied as inputs to production or the environment. Their value per unit varies within and between years.

## ENTITLEMENT MARKET

### PURPOSE, USE AND OPERATION

An entitlement specifies an annual volumetric share of available resources in a given catchment or water system, which the holder will receive as water allocations, subject to rainfall, inflows, water held in storage and other factors. The entitlement market enables trade in the ongoing right to receive these water allocations. Entitlements can be held by virtually any party in any location.

The entitlement market is largely used by irrigated agricultural producers, but is increasingly being used by investors, water utilities (including urban suppliers) and environmental water holders. These users use the market to modify their long-term arrangements for facilitating production, or meeting environmental requirements, or urban demand.

Similar to the allocation market, state government agencies govern the operation of the entitlement market, including rules and regulations regarding how and where trade can occur. Depending on the jurisdiction, other agencies (such as land titles or property registration agencies) will be involved, given entitlements' nature as a secure property right. Third-parties (such as exchanges, brokers and conveyancers) often play a role in facilitating entitlement trade.

### KEY DRIVERS OF MARKET OUTCOMES

The value of water entitlements is largely determined by their reliability characteristics, which differ between each entitlement class. Higher reliability entitlements provide greater water allocations over the long-term, and more consistently provide water allocations each year.

Trade in entitlements is related to longer-term production decisions and the characteristics of different irrigated agricultural enterprises, including their tolerance for risk. Producers who may be expanding or contracting production drive market activity, as do investors or larger scale enterprises that may hold entitlements and facilitate new models of irrigation farming based on trading annual allocations rather than holding entitlements. Purchases of water on behalf of the environment have also driven market activity in recent years.

# ABOUT AUSTRALIA'S WATER MARKETS

## ALLOCATION MARKET

### PURPOSE, USE AND OPERATION

The allocation market provides the ability to trade physical water between parties for use, further trade, or carryover. Allocation trade can generally only occur between parties that are hydrologically connected such that water can be delivered between them (or substituted by other water from a shared storage).

The water allocation market is mainly used by irrigated agricultural producers (including rice, dairy, horticulture, cotton and others), and environmental water managers. Irrigators use the market to sell water excess to requirements, or buy additional water for use during dry periods or when temporarily expanding production. Environmental water holders may similarly buy or sell when they have short-term surpluses or deficits.

State government regulators determine annual allocations based on entitlement characteristics (which determine priority and how much water is allocated to individuals), and market rules to manage issues such as connectivity between systems and transmission losses. State government, either directly or via their water utilities, play a key role in facilitating allocation trade, including ensuring compliance with rules and regulations, and by approving and processing trades. Parties seeking to trade allocations may utilise intermediaries such as water exchanges and brokers.

### KEY DRIVERS OF MARKET OUTCOMES

The amount of water allocated to entitlement holders each year is a key driver of allocation market outcomes (including prices and volumes traded), because it strongly influences the total amount of water available for use or trade. When allocations are low, water is scarce and prices are high. The opposite is true when allocations are high. Allocation levels reflect broader water availability, including rainfall and inflows in relevant catchments, and volumes held in storages. Other key drivers in allocation markets include conditions in markets for irrigated agricultural products, and conditions in substitute input markets.

# RECENT PUBLIC REPORTS ON WATER MARKETS



## REVIEW OF WATER TRADING:

The Independent Pricing and Regulatory Tribunal (IPART) engaged Aither to undertake a strategic review of the impact that its regulatory frameworks may have on water markets in New South Wales. The primary scope of the review was to assess the impact that IPART's regulatory approach (licensing and pricing) has on water markets and trade in New South Wales, including whether the current framework facilitates or impedes efficient trade.

[See more](#)



## MARKET IMPACTS OF ON-FARM WATER USE EFFICIENCY:

Aither was engaged by the Department of Environment, Land, Water and Planning (DELWP) to report on whether any future on-farm water use efficiency (WUE) programs with entitlement transfer across the southern Basin may be expected to have water market effects, and the implications of this, particularly in relation to socio-economic neutrality and the potential for stranded assets.

[See more](#)



## WATERGUIDE:

Aither, the Australian Department of Foreign Affairs and Trade (DFAT), and Australian Water Partnership (AWP) have collaborated to develop and publish WaterGuide, an organising framework for improving water resource management and use in response to scarcity. WaterGuide can be used by to diagnose strengths, weaknesses and gaps in current water planning, allocation and use arrangements, and design a roadmap for improved water policy and management.

[See more](#)

If you would like to find out more about these or reports of Aither publishes on this topic, please visit our website for more information [www.aither.com.au](http://www.aither.com.au)

## DATA CLEANING METHOD

There are limitations associated with water trade information reported in the state-based registers, specifically the timeliness and accuracy of reported prices. To filter out outlier prices and generate robust statistics about market activity, Aither uses a proprietary and tested data cleaning method. Aither uses its data cleaning programs to analyse Aither's southern Murray-Darling Basin water trade database which includes over 300,000 individual allocation and entitlement trade records.

There continues to be potential for further improvements in water markets data and in the efficient operation of water markets. In addition, state water registers remain unable to separately report transfers between environmental holdings or related parties, which complicates analysis of allocation and entitlement trade volume and price.

## ROUNDING ERRORS

Rounding errors may result in slightly different numbers being presented in this report as can be calculated from raw data and calculations.

## IRRIGATION CORPORATION TRADE DATA

A significant volume of water trade occurs within irrigation corporations, for which detailed data – especially in relation to prices of trades – is not generally publicly available in a timely manner. Due to these data availability and transparency issues, Aither has excluded trades within irrigation corporations from all analysis within this report unless explicitly identified.

## AITHER ENTITLEMENT INDEX

Like indices used in commodity and equity markets, the Aither southern Murray-Darling Basin Entitlement Index (AEI) provides a simple overall snapshot of how the major water entitlements in the sMDB are performing. Updated monthly and freely available, water market participants can use the AEI to benchmark the capital value performance of water portfolios and investments over time.

The following dot points explain the AEI scope and method.

- **Scope:** The AEI tracks the performance (capital value) of a group of major water entitlement types across the sMDB. The AEI covers the following entitlement types: NSW Murray HS; NSW Murray GS; NSW Murrumbidgee HS; NSW Murrumbidgee GS; VIC 7 Murray (Barmah to SA) HRWS; VIC 7 Murray (Barmah to SA) LRWS; VIC 1A Greater Goulburn HRWS; VIC 1A Greater Goulburn LRWS; VIC 6 Murray (Dart to Barmah) HRWS; VIC 6 Murray (Dart to Barmah) LRWS; SA Murray (Class 3) HS.
- **Timing:** The AEI is calculated on a monthly basis and is indexed to 100 in July 2008. The index commenced from this date as this is when sufficiently reliable data became available.
- **Prices:** Historical monthly entitlement prices are calculated as volume weighted averages from state water register data. Since June 2015, Aither has used prices based on monthly entitlement valuations that we undertake in-house.
- **Index method:** The computation of the AEI uses a Tornqvist-Theil Price Index method. The AEI is not an accumulation index.

## TABLE NOTES

**Table 1A:** All reported trades are included in all calculations. Total net trade calculations will not necessarily equal zero because some connected systems are not included in this analysis. Victorian data includes an adjustment for pooled accounts and reflects information available on the public Victorian Water Register.

**Table 1B:** Trades with a reported price greater than \$0 per ML are included in all calculations. Total net trade calculations will not necessarily equal zero because some connected systems are not included in this analysis. Victorian data includes an adjustment for pooled accounts and reflects information available on the public Victorian Water Register.

**Table 2:** Aither has applied a cleaning methodology to remove outlier and \$0 trades before calculating volume weighted average prices.

**Table 3:** Outlier entitlement trades have been excluded from price calculations. All reported trades are included in calculations of number and volumes of trade regardless of reported price. Trade within irrigation corporations is not included in calculations in this table.

**Table 4:** Estimated environmental entitlements are based on Commonwealth Government water purchases. Size of market calculations are based on total entitlement on issue minus estimated environmental entitlements multiplied by the volume weighted average price for a given entitlement type.

**Table 5:** All reported trades are included in calculations of number and volumes of trade. Estimated turnover value calculations are based on total volume transferred multiplied by annual volume weighted average price for a given entitlement type. Liquidity calculations exclude water allocated to entitlements held by environmental water holders (see note in Table 4). Returns are presented in gross terms; they do not account for any fees or charges associated with holding entitlements or trading allocations. In zones which received 0 per cent water allocation for the 2016-17 water year, no returns are recorded because it was not possible to trade water allocations not received (carryover water would be an exception, but this has been excluded for simplicity). Return calculations do not include capital appreciation. Trade within irrigation corporations is not included in calculations in this table.

## FIGURE NOTES

**Figure 1:** For the purposes of this report and Aither's analysis, we have defined the southern Murray-Darling Basin as comprising of the Vic Goulburn, Vic Murray, NSW Murray, NSW Murrumbidgee and SA Murray.

**Figure 2:** Outlier allocation trades have been excluded from price calculations. Scatter plot data points include all reported trade. Water allocated to Commonwealth Government water purchases are based on announced allocations to reported holdings of the Commonwealth Environmental Water Holder. Calculations in this figure exclude carryover volumes or adjustments.

**Figure 3:** Historical water use statistics are based on ABS data which are understood to be a lower bound estimate and there is uncertainty around exact water use volumes for every system, industry and year. Please reference the ABS data source for further information (see reference section).

**Figure 4:** Only approved transfers are included in this figure. Figure does not include water used against tagged licences it only includes allocation transfers reported on the Victorian register. Aither's breakdown of different trades types is based on the Victorian government's reporting. We understand the breakdown is based on \$0 trades being reported as non-commercial etc.

**Figure 5:** Aither has applied a cleaning methodology to remove outlier and \$0 trades before calculating volume weighted average prices. No trades are excluded on the basis of reported price from volume calculations. Only 'within' and 'into' allocation trades have been included in volume and price calculations. 'Out of' allocation trades have been excluded on the basis that it would double count trades between zones.

**Figure 6:** Aither has applied a cleaning methodology to remove outlier and \$0 trades before calculating volume weighted average prices. No trades are excluded on the basis of reported price from volume calculations. Only 'within' and 'into' allocation trades have been included in volume and price calculations. 'Out of' allocation trades have been excluded on the basis that it would double count trades between zones.

**Figure 8:** Weather stations used are as follows: Albury Airport AWS 72160; Deniliquin Airport AWS 74258; Mildura Airport 76031; Renmark Irrigation 24003; Shepparton Airport 81125; and Yanco Agricultural Institute (Leeton) 74037.

**Figure 9:** Water allocated to Commonwealth Government water purchases are based on announced allocations to reported holdings of the Commonwealth Environmental Water Holder. Calculations in this figure exclude carryover volumes or adjustments.

**Figure 10:** Outlier allocation trades have been excluded from price calculations. Scatter plot data points include all reported trade. Water allocated to Commonwealth Government water purchases are based on announced allocations to reported holdings of the Commonwealth Environmental Water Holder. Calculations in this figure exclude carryover volumes or adjustments.

**Figure 11:** Aither has applied a cleaning methodology to remove outlier and \$0 trades before calculating volume weighted average prices. No trades are excluded on the basis of reported price from volume calculations. Trade within irrigation corporations is not included in calculations in this figure.

**Figure 12:** Aither has applied a cleaning methodology to remove outlier and \$0 trades before calculating volume weighted average prices. No trades are excluded on the basis of reported price from volume calculations. Trade within irrigation corporations is not included in calculations in this figure.

**Figure 13:** No trades are excluded on the basis of reported price from volume calculations. Trade within irrigation corporations – specifically Murray Irrigation Limited and Murrumbidgee Irrigation – is included in calculations in this figure.

**Figure 17:** Returns are calculated on the basis of Vic 7 Murray HRWS being representative of the broader market. Returns are presented in gross terms; they do not account for any fees or charges associated with holding entitlements or trading allocations. Return calculations do not include capital appreciation.

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