Southern Murray–Darling Basin

Summary

- The southern Murray–Darling Basin (sMDB) connected system remains Australia's most active—and important—water market. Around 89 per cent of Australian surface water allocation trade occurred in this area in 2015–16.

- Dry conditions prevailed throughout most of 2015–16 with lower storage volumes and allocations relative to 2014–15 (Figure 1). This resulted in high allocation prices, peaking near $300 per ML in some regions in November 2015. A shift to wetter conditions late in the water year saw prices decline sharply to around $185 per ML.

- In 2015–16 a number of trade restrictions were binding leading to differences in water allocation prices between regions. Most notably, the Murrumbidgee inter-valley trade (IVT) limit prevented trade out of the Murrumbidgee for significant parts of the year. As a result water allocation prices in the Murrumbidgee were significantly lower than those in the Murray.

- In 2015–16 there was significant net trade (187 GL) into the Victorian Murray with water allocation exported from the Murrumbidgee and NSW Murray. In recent years there has been increased demand for water in the Victorian Murray due to an expansion in horticultural crops. If current trade restrictions continue, it is likely that water prices in the downstream Murray trading zones will often trade at higher prices than other zones in future.

- In 2015–16 water entitlement prices across the southern MDB increased by around 50 per cent on average relative to 2014–15. This was the largest annual increase since at least 2007–08. The largest price rises were observed for the higher reliability entitlement types.

Figure 1 Average allocation price against total storage volume, southern Murray–Darling Basin, 1 July 2007 to 30 June 2016
Region overview

The southern Murray–Darling Basin is a group of connected river systems in south-eastern Australia. It includes the Murray River and its tributaries (Map 1). In this report, the sMDB is defined as including the Murray, Murrumbidgee and Lower Darling systems in southern New South Wales; the Murray, Goulburn, Broken, Loddon, Campaspe, Ovens and Wimmera-Avon systems in northern Victoria; and the Murray and Eastern Mount Lofty Ranges systems in South Australia.

Table 1 Overview of the southern Murray–Darling Basin, 2015–16

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation trade</td>
<td>Surface water trade volume</td>
<td>4,978.5 GL (89% of national trade)</td>
</tr>
<tr>
<td></td>
<td>Groundwater trade volume</td>
<td>123.4 GL (53% of national trade)</td>
</tr>
<tr>
<td></td>
<td>No. of surface water trades</td>
<td>23,087 (87% of national trade)</td>
</tr>
<tr>
<td></td>
<td>No. of groundwater trades</td>
<td>405 (38% of national trade)</td>
</tr>
<tr>
<td>Entitlement trade</td>
<td>Surface water trade volume</td>
<td>565 GL (42% of national trade)</td>
</tr>
<tr>
<td></td>
<td>Groundwater trade volume</td>
<td>84.4 GL (25% of national trade)</td>
</tr>
</tbody>
</table>

The sMDB is Australia’s most significant water market, and it is widely regarded as one of the most sophisticated water markets in the world. The sMDB is unique because its high degree of hydrological connectivity allows for relatively open water trading between water systems and across state boundaries. The vast majority of sMDB water supply is regulated surface water. Groundwater and unregulated surface water is also used (Figure 2). Most water in the sMDB is used for irrigated agriculture. Table 1 provides overview statistics for the sMDB.
### Australian water markets report 2015–16

#### Category

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of surface water trades</td>
<td>4,947 (69% of national trade)</td>
</tr>
<tr>
<td>No. of groundwater trades</td>
<td>347 (15% of national trade)</td>
</tr>
</tbody>
</table>

#### Water supply

- **Major dams**: Dartmouth, Hume, Blowering, Burinjuck and Lake Eildon (see Map 1)
- **Total storage capacity (excl. Snowy Mountains)**: 16,000 GL

#### Water use

- **Significant irrigation activities**: Broadacre cropping in southern New South Wales (including rice), dairy farming and horticulture in northern Victoria, horticulture in South Australia.
- **Gross value of irrigated agriculture production**: $5.3 billion in 2014–15

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**Figure 2 Entitlements on issue, by water system, southern Murray–Darling Basin, 2015–16**

![Graph showing entitlements by water system](image)

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### Major announcements

Table 2 lists the major relevant announcements and media reports of 2015–16 that may have affected sMDB allocation and entitlement markets.

#### Table 2 Major water announcements, southern Murray–Darling Basin, 2015–16

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 July 2015</td>
<td>Low opening allocation announcements across the Murray–Darling Basin. Murrumbidgee general security opens at 8 per cent, NSW Murray general security opens at 0 per cent and Victorian Murray high reliability opens at 35 per cent</td>
</tr>
<tr>
<td>17 July 2015</td>
<td>Senate Select Committee on the Murray–Darling Basin Plan announced</td>
</tr>
<tr>
<td>30 July 2015</td>
<td>Murray–Darling Basin Authority (MDBA) CEO Dr Rhondda Dickson announces she will leave role at the end of her term in late September</td>
</tr>
<tr>
<td>Date</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6 August 2015</td>
<td>Murrumbidgee IVT account closes for the first time this water year</td>
</tr>
<tr>
<td>7 August 2015</td>
<td>Almond Board of Australia announces almond exports reach new monthly record</td>
</tr>
<tr>
<td>15 September 2015</td>
<td>NSW Murray and Lower Darling water sharing plan changed to allow general security allocations to reach 30 per cent before the Barmah–Millewa environmental watering account is repaid</td>
</tr>
<tr>
<td>21 September 2015</td>
<td>The Hon. Barnaby Joyce MP sworn in as Minister for Agriculture and Water Resources and Senator the Hon. Anne Ruston as Assistant Minister for Agriculture and Water Resources</td>
</tr>
<tr>
<td>7 October 2015</td>
<td>Bureau of Meteorology (BOM) announces Indian Ocean Dipole is reinforcing El Niño to create hot and dry conditions across Australia</td>
</tr>
<tr>
<td>14 October 2015</td>
<td>Dairy Australia Dairy Situation and Outlook report notes ‘extreme lows’ in global dairy prices</td>
</tr>
<tr>
<td>23 October 2015</td>
<td>The Commonwealth Environmental Water Holder announces tender of up to 20 GL of water to be resold to the market in the Goulburn catchment</td>
</tr>
<tr>
<td>19 November 2015</td>
<td>Murrumbidgee IVT reopens for two days before closing again due to a surge of outward bound transfers</td>
</tr>
<tr>
<td>20 November 2015</td>
<td>Phillip Glyde announced as new MDBA CEO</td>
</tr>
<tr>
<td>18 December 2015</td>
<td>BOM announces severe to extreme heatwave peaks across Australia and the south-western Murray–Darling Basin</td>
</tr>
<tr>
<td>12 January 2016</td>
<td>BOM announces second severe to extreme heatwave hits northern New South Wales and southern Queensland</td>
</tr>
<tr>
<td>9 February 2016</td>
<td>WaterNSW announces new procedures for reporting on Murrumbidgee IVT</td>
</tr>
<tr>
<td>12 February 2016</td>
<td>Murrumbidgee IVT reopens for second time during 2015–16, allowing prices to reconverge across southern connected system</td>
</tr>
<tr>
<td>16 February 2016</td>
<td>Murray Irrigation Limited announces it is working with Snowy Hydro to again provide for an advance of water to its customers</td>
</tr>
<tr>
<td>22 February 2016</td>
<td>Australian Government announces creation of a registry of foreign ownership of water access entitlements</td>
</tr>
<tr>
<td>24 February 2016</td>
<td>Murrumbidgee IVT closes for third time</td>
</tr>
<tr>
<td>17 March 2016</td>
<td>Senate Select Committee on the Murray–Darling Basin Plan releases report Refreshing the plan</td>
</tr>
<tr>
<td>24 March 2016</td>
<td>Murrumbidgee IVT reopens for third time</td>
</tr>
<tr>
<td>12 April 2016</td>
<td>BOM announces that the El Niño is rapidly declining and La Niña is possible in coming months</td>
</tr>
<tr>
<td>28 April 2016</td>
<td>SA Government releases forward seasonal outlook suggesting very low allocations in the 2016–17 season</td>
</tr>
<tr>
<td>6 April 2016</td>
<td>Victorian Government 200 GL NSW to Victoria trade limit reached</td>
</tr>
<tr>
<td>8 April 2016</td>
<td>SA Government announces that carryover will be made available into the 2016–17 season</td>
</tr>
<tr>
<td>1 May 2016</td>
<td>NSW interstate allocation trading season closes</td>
</tr>
<tr>
<td>16 May 2016</td>
<td>Goulburn–Murray Water releases 2016–17 seasonal outlook suggesting very low allocations in its Victorian catchments</td>
</tr>
<tr>
<td>24 May 2016</td>
<td>BOM announces end of El Niño event</td>
</tr>
</tbody>
</table>
Seasonal conditions

Rainfall

In the first nine months of 2015–16, rainfall remained below average in many parts of the sMDB (Map 2). A combination of the El Niño-Southern Oscillation, Indian Ocean Dipole and Southern Annular Mode weather patterns contributed to these dry conditions. However, conditions dramatically improved late in the water year, with above average rainfall in most of New South Wales and parts of Victoria (Map 3). In 2015–16 rainfall on sMDB irrigation farms averaged 410 millimetres, an increase of 24 per cent from 2014–15 (Figure 3). This increase was largely a result of higher rainfall in the last few months of 2015–16.

Map 2 Rainfall decile map, Murray–Darling Basin, 1 July 2015 to 31 March 2016

Note: Modified from original. Higher quality images provided by BOM.
Source: BOM 2017b
Inflows and storage

Murray system inflows were well below the long-term average in the winter and spring of 2015–16 (Figure 4). However, inflows in late May and June 2016 were well above those for the same
period in 2015 as a result of above average rainfall in these months (MDBA 2016a). The below average inflows during winter and spring 2015–16 are representative of a long-term trend of lower winter rainfall in south-eastern Australia since the mid 1990s (Figure 5). Evidence suggests this long-term trend is at least partially due to climate change (BOM & CSIRO 2016).

Figure 4 Murray system inflows, daily and long-term average, 2015–16 and 2014–15

![Figure 4](image)

Source: Murray–Darling Basin Authority

Figure 5 Murray system inflows, annual average and long-term average, 1885 to 2016

![Figure 5](image)

Storage volumes in the sMDB declined from 48 per cent to 42 per cent during 2015–16 and were lower in each month on average compared with the previous year (Figure 6). Storage volumes in the Murrumbidgee (Blowering and Burrinjuck) ended the year relatively high at 61.7 per cent, compared with the Murray (Hume and Dartmouth) at 44.4 per cent and the Goulburn (Eildon and Waranga Basin) at 33.8 per cent.
Figure 6 Water storage percentages, selected southern Murray–Darling Basin dams, 1 July 2007 to 30 June 2016

Note: Murrumbidgee includes Blowering Dam and Burrinjuck Dam; Murray includes Dartmouth Dam, Hume Dam, Lake Victoria, Torrumbarry Weir and Yarrawonga Weir; Goulburn includes Lake Eildon and Waranga Basin. Southern MDB includes all major storages in the region (8 additional storages) for which data are available.

**Allocations and carryover**

Figure 7 shows total water allocations to regulated surface water entitlements in the sMDB with and without carryover from previous years. Total water available decreased from the previous year by around 17 per cent after including carryover volumes. Final carryover available in 2015–16 was 1,714 GL, accounting for 28 per cent of total available water.
All high reliability regulated surface water entitlements other than the Victorian Murray and SA Murray received less than full allocations in 2015–16 (Figure 8). NSW Murray received 97 per cent and NSW Murrumbidgee 95 per cent. In Victoria, the Goulburn received 90 per cent and Loddon 84 per cent.

In 2015–16 final general security entitlement allocations were 23 per cent for NSW Murray and 37 per cent for Murrumbidgee, again lower than the previous year.
Figure 8 Allocations for major entitlement types, southern Murray–Darling Basin, 2007–08 to 2015–16

Figure 9 shows volumes of carryover into subsequent years for the connected sMDB since 2007–08. In 2014–15, 31 per cent of available water was carried over into 2015–16 while 38 per cent of 2015–16 allocations were carried over into 2016–17. This increase in carryover reflected expectations during the year of potential water shortages in 2016–17. Seasonal conditions improved significantly in the last two months of 2015–16. However, irrigation farms had already made carryover decisions and could not increase production and water use.

Figure 9 Allocations carried over into the next year, southern Murray–Darling Basin, 2007–08 to 2015–16

CEWH Commonwealth Environmental Water Holder.
Carryover has become increasingly important for the sMDB water market since the introduction of carryover rules in Victoria and South Australia in 2007–08 (Hughes, Gupta & Rathakumar 2016). Water allocation prices are now more sensitive to water availability expectations for subsequent seasons. More water users are seeking to establish carryover reserves to protect against future shortages. Greater use of carryover is likely to smooth annual variation in water prices in the longer term. This may help to reduce price spikes (such as those observed in 2006–07) in future drought years (see Hughes, Gupta & Rathakumar 2016).

**Environmental water**

The Commonwealth secured 35 GL of additional entitlements for environmental use in the sMDB in 2015–16. This was an increase from the 29 GL secured in 2014–15 but was still lower than the annual average. As in 2014–15, almost all water recovered by the Commonwealth in 2015–16 was recovered through investment in water-saving infrastructure (Figure 10). In 2015–16 it purchased around 3.2 GL in entitlements. These were sourced exclusively from the SA Murray (Figure 11).

Figure 10 Annual Commonwealth environmental water recovery, southern Murray–Darling Basin, 2007–08 to 2015–16

Note: Represents annual volume of additional entitlements secured by the Commonwealth.
Water recovered through purchases effectively reduces the supply of water available for irrigation users while infrastructure projects achieve water savings that are shared between irrigators and the Commonwealth. Hughes, Gupta and Rathakumar (2016) provide a more detailed discussion of the effect of environmental water recovery on the sMDB allocation market.

Figure 12 compares total water availability (allocations plus carryover) since 2007–08 accounting and not accounting for Commonwealth water purchases. Excluding the effects of infrastructure savings, Commonwealth water purchases in the sMDB led to a reduction in water supply of 14.3 per cent during 2015–16. Hughes, Gupta and Rathakumar (2016) estimate that—holding all else constant—environmental purchases led to an increase in allocation prices in the sMDB of around $25 per ML between 2012–13 and 2014–15. However, they note that environmental purchases can explain only a small part of the increase in allocation prices between 2010–11 and 2015–16. Other key factors included declining allocation volumes, greater use of carryover and growth in irrigation water demand.
Irrigation water demand

Short-run variation in output and input prices can alter the relative profitability of irrigation activities and in turn affect the demand for water. In the longer term, changes in relative profitability can alter investment patterns and lead to more substantial shifts in irrigation land use.

Prices for major irrigated commodities in the sMDB varied widely from 2000–01 to 2015–16 (Figure 13). Key trends in the sMDB were:

- from 2000–01 the price of wine grapes declined significantly, leading to a gradual contraction in wine grape plantings
- from 2006–07 the financial performance of Murray–Darling Basin cotton farms exceeded that of rice farms, contributing to a slight shift towards cotton and away from rice
- between 2000–01 and 2004–05 almond prices more than doubled, leading to a large increase in almond plantings. Between 2004 and 2015 area planted more than doubled, from around 15 000 hectares to 31 000 hectares (ABA 2016).

Figure 13 Selected commodity price indexes, 2000–01 to 2015–16

Note: Price data for wine grapes (warm climate) not available before 2002–03.
Source: ABARES 2015, 2016a

At a regional level, the decline in grape plantings between 2010–11 and 2014–15 was largest in the SA Murray and Mallee (Sunraysia) natural resource management regions. During the same period, fruit, nut and grape plantings increased in the Goulburn, Murrumbidgee and NSW Murray regions and decreased in the SA Murray region.

Since 2005–06 the Victorian Mallee region had the largest increases in horticultural plantings by far (Figure 14). The water application rate for horticulture in the Victorian Mallee has risen significantly, potentially driven by the expansion of almond plantings. Overall these changes appear to have increased horticultural water demand in the sMDB.
Surface water allocation markets

General price trends

Monthly prices and trade volumes for water allocations in the sMDB since 2007–08 are shown in Figure 15. Allocation prices increased during the first half of the 2015–16 water year, from around $142 in June 2015 to around $260 in December 2015, before falling to around $185 by the end of the year. Good rainfall in May and June 2016 led to higher storage levels and a decrease in the price of allocations at the end of the year.

The primary driver of water market prices in the sMDB is the supply of water allocations, which is largely a function of the volume of water in storage (Hughes, Gupta and Rathakumar (2016)). Allocation volumes were lower in 2015–16 compared with 2014–15, driving the increase in allocation prices (Figure 15). Despite the dry conditions, around 38 per cent of water allocations in 2015–16 were carried over into 2016–17, likely because of the expectation of continuing dry conditions. This was relatively high and further contributed to the increase in 2015–16 allocation prices.
Monthly prices for major sMDB water systems are shown in Figure 16. Historically, average prices across different trading zones have moved more or less in unison—as expected in an open market. However, trade restrictions in recent years have led to some price differences. Interregional trade in the sMDB is discussed further in the Interregional trade section.
Figure 16 Surface water allocation prices, monthly average, selected systems, southern Murray–Darling Basin, 1 July 2007 to 30 June 2016

Figure 17 shows prices of individual allocation trades in the sMDB from 2013–14 to 2015–16. Prices increased significantly in the first half of 2015–16. This followed the May 2015 Bureau of Meteorology announcement of El Niño conditions and relatively dry seasonal conditions. Increased rainfall late in the water year helped ease prices. Figure 18 shows a negative correlation between sMDB water price trends and the Southern Oscillation Index, a major indicator of El Niño.
Figure 17 Surface water allocation trade prices, southern Murray–Darling Basin, 2013–14 to 2015–16

Note: Each dot represents a recorded trade.
Source: ABARES 2017

Figure 18 Water allocation prices, monthly, southern Murray–Darling Basin, and the Southern Oscillation Index, 2013–14 to 2015–16

Note: Southern Oscillation Index is presented as a four-month moving average.
Source: BOM 2017a

**Interregional trade**

**Environmental transfers**

Map 4 shows net sMDB interregional water allocation movements in 2015–16. Also shown are major environmental and market transfers. Total environmental transfers accounted for around
50 per cent of total surface water allocation trade volume in 2015–16. These mostly involved downstream movement of water from the Victorian Murray and Goulburn into South Australia.

Map 4 Surface water allocation net interregional trade flows, including environmental transfers, southern Murray–Darling Basin, 2015–16

Note: Regions in blue were net importers of water and regions in red were net exporters of water in 2015–16. Arrows represent major net trade flows; not all trade flows are presented.

Source: MDBA pers. comm.

Additional information is provided in Table 3 and Table 4. These show net sMDB interregional water allocation movements in 2015–16 for surface water market trades and environmental transfers by source and destination water system.
### Table 3 Market trades, volume (GL) of net surface water allocation trades, by source and destination system, 2015–16

<table>
<thead>
<tr>
<th>Destination region</th>
<th>Goulburn</th>
<th>Broken</th>
<th>Campaspe</th>
<th>Loddon</th>
<th>Victorian Murray</th>
<th>NSW Murray</th>
<th>Murray</th>
<th>SA Murray</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source region</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goulburn</td>
<td>293.4</td>
<td>0.1</td>
<td>13.1</td>
<td>1.3</td>
<td>160.1</td>
<td>5.0</td>
<td>0.2</td>
<td>12.2</td>
<td>485.3</td>
</tr>
<tr>
<td>Broken</td>
<td>0.9</td>
<td>0.7</td>
<td>0.0</td>
<td>0.0</td>
<td>0.5</td>
<td>0.0</td>
<td>0.0</td>
<td>0.3</td>
<td>2.3</td>
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<tr>
<td>Campaspe</td>
<td>2.6</td>
<td>0.0</td>
<td>1.6</td>
<td>0.0</td>
<td>2.3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>6.5</td>
</tr>
<tr>
<td>Loddon</td>
<td>2.3</td>
<td>0.0</td>
<td>0.0</td>
<td>1.8</td>
<td>2.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.2</td>
<td>6.4</td>
</tr>
<tr>
<td>Victorian Murray</td>
<td>126.5</td>
<td>0.1</td>
<td>1.1</td>
<td>0.1</td>
<td>340.1</td>
<td>10.4</td>
<td>6.2</td>
<td>36.8</td>
<td>521.2</td>
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<td>NSW Murray</td>
<td>48.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.0</td>
<td>108.0</td>
<td>173.2</td>
<td>7.0</td>
<td>64.8</td>
<td>401.1</td>
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<td>Murray</td>
<td>13.7</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>23.4</td>
<td>183.3</td>
<td>302.9</td>
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<td>524.2</td>
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<td>SA Murray</td>
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<td>0.0</td>
<td>0.0</td>
<td>72.0</td>
<td>0.9</td>
<td>0.6</td>
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<tr>
<td>Total</td>
<td>515.9</td>
<td>0.8</td>
<td>15.8</td>
<td>3.2</td>
<td>708.5</td>
<td>372.6</td>
<td>316.9</td>
<td>115.3</td>
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</tr>
</tbody>
</table>

### Table 4 Environmental transfers, volume (GL) of net surface water allocation environmental transfers, by source and destination system, 2015–16

<table>
<thead>
<tr>
<th>Destination region</th>
<th>Goulburn</th>
<th>Broken</th>
<th>Campaspe</th>
<th>Loddon</th>
<th>Victorian Murray</th>
<th>NSW Murray</th>
<th>Murray</th>
<th>SA Murray</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>Source region</td>
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<td>Goulburn</td>
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<td>12.0</td>
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<td>0.0</td>
<td>0.0</td>
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<td>24.0</td>
</tr>
<tr>
<td>Campaspe</td>
<td>0.0</td>
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<td>3.3</td>
<td>0.0</td>
<td>13.2</td>
<td>0.0</td>
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<td>16.5</td>
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<td>Loddon</td>
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<td>0.0</td>
<td>1.5</td>
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<td>0.0</td>
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<td>Victorian Murray</td>
<td>11.8</td>
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<td>0.0</td>
<td>0.0</td>
<td>341.0</td>
<td>9.2</td>
<td>0.0</td>
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<td>0.0</td>
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<td>280.1</td>
<td>0.0</td>
<td>3.2</td>
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</tr>
<tr>
<td>Murray</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>54.0</td>
<td>562.1</td>
<td>0.0</td>
<td>616.1</td>
</tr>
<tr>
<td>SA Murray</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
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<td>0.5</td>
<td>11.3</td>
<td>2.7</td>
<td>618.6</td>
<td>343.3</td>
<td>562.1</td>
<td>691.7</td>
<td>0.0</td>
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</tbody>
</table>
The Commonwealth Environmental Water Holder (CEWH) is one of several environmental water holders that regularly transfer allocations between sMDB regions. Other major environmental water holders include the Victorian Environmental Water Holder, the Living Murray and NSW Office of Environment and Heritage. The CEWH accounted for around 65 per cent of all environmental transfers in 2015–16.

Figure 19 compares net interregional sMDB environmental transfers made by the CEWH with those made by other environmental water holders. The CEWH accounted for a relatively small proportion of net interregional environmental transfers, indicating that most 2015–16 CEWH trades were made within the same region.

**Figure 19 Net environmental transfers, southern Murray–Darling Basin, 2015–16**

CEWH Commonwealth Environmental Water Holder. EWH environmental water holder.

**Market trade**

Market trade flows (excluding environmental transfers) in 2015–16 were moderately different from those observed in 2014–15 (Map 5):

- The Victorian Murray region was a large net importer of water, partly due to low rainfall in 2015–16 and a longer term trend towards increased demand for irrigation water in the region (Hughes, Gupta and Rathakumar (2016)).
- The relatively high allocations in the Murrumbidgee compared with the rest of the sMDB led to it being a large net exporter. However, the region's IVT limit constrained net exports from the Murrumbidgee.
- The NSW Murray region switched from being a net importer in 2014–15 (ABARES 2016b) to a net exporter in 2015–16 (Figure 20) as a result of significant transfers to the Victorian Murray region. Trade from New South Wales to Victoria was officially constrained in March and April of 2016 by the 200 GL annual limit on net trade. However, there is evidence that water holders moved water around this constraint by trading with South Australia.
- The SA Murray region was a net importer of water, with significant net imports during the April to June 'late-season'. This was likely influenced by the April 2016 announcement that
carryover would be made available in SA Murray for the first time since the Millennium drought.

- The Goulburn region was a net importer of water, partly reflecting an increase in demand for irrigation water in this region in 2015–16.

Figure 20 Net trade positions for water systems, excluding environmental transfers, southern Murray–Darling Basin, 2014–15 and 2015–16

Map 5 Surface water allocation net interregional trade flows, excluding environmental transfers, southern Murray–Darling Basin 2015–16

Source: MDBA pers. comm.
Note: Regions in blue were net importers of water and regions in red were net exporters of water in 2015–16. Arrows represent major net trade flows; not all trade flows are presented.
Source: MDBA pers. comm.

The Barmah Choke trade constraint, the Goulburn IVT export limit, the Murrumbidgee IVT export limit and the New South Wales to Victoria trade constraint were all binding for some periods during 2014–15 and 2015–16.

The frequency of sMDB trade constraints in recent years raises concerns. For example, each constraint limits trade into the downstream Murray trading zones in SA, NSW and Victoria. Irrigation water demand in the downstream Victorian Murray region in particular has grown strongly as a result of an expansion in horticultural crops, including almonds, and the region has become a consistent net importer of water in recent years (Figure 21). If current trade limits continue, it is likely that future water prices in the downstream Murray trading zones will often trade at higher prices than other zones.

Figure 21 Net trade flows into Victorian Murray, excluding environmental transfers, 2000–01 to 2015–16

Source: Hughes, Gupta & Rathakumar 2016; MDBA

Murrumbidgee trade limit

In 2015–16 seasonal conditions in the Murrumbidgee were favourable compared with those in other sMDB water systems (Map 2 and Map 3). In the second half of the water year, Murrumbidgee storage levels were higher than in the Murray or Goulburn (Figure 6). This led to interregional trade from the Murrumbidgee to the Murray, where demand for water allocations was greater.

However, the Murrumbidgee trade limit restricts net trade out of the region once the IVT balance reaches a maximum of 100 GL. Once this limit is reached, trade out of the region is not permitted until the net balance falls below 100 GL or additional trade allowances are announced. In 2015–16 the Murrumbidgee trade limit was reached just two months into the year (in August), preventing further trade out of the region and resulting in a divergence in allocation prices between the Murrumbidgee and Murray (Figure 22) (Hughes, Gupta & Rathakumar 2016). The trading constraint was briefly relaxed in November 2015 and February
2016, resulting in a flurry of trade that reduced the price difference briefly in those months. In November, trade was closed after just two days because of a surge of trade out of the Murrumbidgee.

**Figure 22 Monthly allocation prices, Murrumbidgee and Murray, October 2014 to June 2016**

Source: Hughes, Gupta & Rathakumar 2016

**New South Wales to Victoria**

A number of state water trading rules have the potential to limit inter-state water trade between New South Wales and Victoria. Victoria maintains a rule that limits trade from New South Wales to Victoria if: net annual trade from New South Wales to Victoria reaches 200 GL; or, the risk of spill from Victoria’s share of Hume Dam for the rest of the season is 50 per cent or more. This rule was introduced in 2013 after high volumes of trade and carryover in 2010–11 and 2011–12 caused internal spills from Victoria’s share of Hume Dam (for more detail see Hughes, Gupta & Rathakumar 2016 and Hughes et al. 2013).

Figure 23 tracks the 2015–16 daily remaining balance available for trade under the Victorian 200GL limit and spill risk limit. The effective trade opportunity is the minimum of these two limits. By September the 200 GL limit became the effective limit and trade opportunities gradually decreased as the year progressed. The trade limit was reached in March 2016, officially preventing any further net trade from New South Wales into Victoria.

The New South Wales Government also maintains a trade closure date which limits all inter-state trade in the later part of the year. On 1 May 2016 the NSW trade closure came into effect, preventing all inter-state water trade to or from NSW until the 2016–17 season.
Although trade from New South Wales to Victoria was officially constrained in March and April of 2016, there is evidence that water traded around this restriction with allocation moving from NSW to South Australia and then South Australia to Victoria. Figure 24 shows net trade patterns from NSW to South Australia and from Victoria to South Australia in 2015–16. There was a noticeable increase in trade during March, April and May of 2016. In addition, it is possible to identify a number of ‘like for like’ transactions (with identical volumes) first from NSW to South Australia and then from South Australia to Victoria in March and April during the ban. Similar behaviour was observed during the previous NSW to Victoria ban on trade back in April 2011 (see Hughes et al. 2013).

Note: Trades from NSW to SA in May were lodged prior to the 1 May inter-state trade closure.
Source: MDBA
Figure 25 shows 2015–16 monthly average allocation prices for NSW, SA and Victorian Murray, and the monthly net trade from New South Wales to Victoria. Victorian Murray and NSW Murray prices remained similar during the March and April NSW to Victoria trade ban, possibly as a result of trade through South Australia. However, prices did diverge during May, after the closure of NSW inter-state trade.

**Barmah Choke**

The Murray–Darling Basin Authority reinstated the Barmah Choke trade constraint at the end of October 2014. This constraint limits trade from above to below the Choke unless the same or greater volume of water has already been transferred from below to above the Choke. Trade is restricted to protect delivery of water downstream (MDBA 2016b). Since reinstatement, the trade balance for water holders has opened at 26 GL, after water savings transferred upstream to the Snowy scheme have been taken into account. This effectively allows water holders to transfer an annual net volume of 26 GL downstream.

Figure 26 shows monthly net trade flows from above the Barmah Choke to below it and allocation prices for 2015–16. Figure 27 shows monthly net trade flows from above to below and cumulative annual volumes from 2008–09.

In contrast to previous years, trade primarily occurred from below the Choke to above the Choke in 2015–16 and the limit was not reached. This direction of trade was driven by significantly lower allocation volumes above the choke in 2015–16 compared with previous years, mainly due to low NSW Murray general security allocations. As a result, prices above and below the Choke remained similar throughout the year.
Figure 26 Monthly average prices, above and below the Barmah Choke, 2015–16

Note: Above the Barmah Choke is trading zone 6, Vic. Murray–Dart to Barmah. Below the Barmah Choke is trading zone 7, Vic. Murray–Barmah to South Australia.

Figure 27 Monthly net trade flows, above to below the Barmah Choke, 2008–09 to 2015–16

Note: Data for 2008–09 to 2012–13 include Victorian trades only. NSW trades for this period could not be separated between zones above and below Barmah Choke.

**Lower Darling**

The suspension of interregional water trade in the Lower Darling region continued from 2014–15 into 2015–16 due to low storage volumes in the Menindee Lakes. As a result, the number of trades was limited and Lower Darling prices remained below those for the rest of the sMDB in 2015–16. This is demonstrated in Figure 28, with the NSW Murray price representative of the rest of the sMDB.
Surface water entitlement markets

In 2015–16 water entitlement prices increased dramatically (Figure 29). SMDB prices averaged around 47 per cent higher than in 2014–15. This was by far the largest annual increase since 2007–08.

The jump in entitlement prices indicates a change in market expectations for future water demand and supply in the sMDB. Potential drivers of this change include the higher than expected allocation prices observed during 2015–16, evidence of increasing demand for irrigation water in the horticulture sector and growing recognition of long-term climate trends—particularly a reduction in average winter rainfall and streamflow in the region since the mid 1990s (Hughes, Gupta & Rathakumar 2016).

Note: Entitlement price is a volume-weighted average of major regulated surface water entitlement types in these water systems: Goulburn; Murrumbidgee; NSW, Victorian and SA Murray; Broken; Campaspe; and Ovens. Allocation price is a volume-weighted average of surface water allocation trades in these water systems: Goulburn; Murrumbidgee; NSW, Victorian and SA Murray; and Campaspe.
Water entitlement market prices are highly specific to particular water systems, resource types and reliability classes. Figure 30 shows average water entitlement prices in 2015–16 for major water systems and reliability classes. The price variation can largely be explained by differences in expected entitlement allocation percentages:

- NSW high security entitlements are among the most reliable in the sMDB and command a price premium over other high security entitlements. NSW Murrumbidgee was the most expensive in 2015–16 at around $3,382 per ML, followed by NSW Murray at around $2,852 per ML.

- Victorian high reliability entitlements generally have expected allocations somewhere between those of NSW high security entitlements and NSW general security entitlements. In 2015–16 prices ranged from around $1,475 per ML (Loddon) to around $2,385 per megalitre (Victorian Murray and Goulburn).

- NSW general security entitlements averaged allocations of around 49 per cent between 2000–01 and 2015–16 and traded at between $1,099 per ML (NSW Murray) and $1,280 per ML (Murrumbidgee) in 2015–16.

- Victorian low reliability entitlements are among the least reliable in the sMDB, with many not receiving any allocations since their creation in 2007–08. These traded at around $223 per ML (Campaspe, Goulburn, Victorian Murray) in 2015–16.

- SA high reliability (class 3a and 3b) entitlement prices generally fall between NSW high security and Victorian high reliability prices. In 2015–16 prices peaked at over $3,000 per ML, just below NSW high security entitlements.
Figure 30 Average water entitlement prices, southern Murray–Darling Basin, 2015–16

Figure 31 shows a weighted price index for NSW high security, Victorian high reliability, SA high reliability, NSW general security, and Victorian low reliability entitlement classes between 2007–08 and 2015–16. During 2015–16 the price of NSW high security and SA and Victorian high reliability entitlements increased significantly; the average annual price for these types of entitlements increased by more than 50 per cent compared with 2014–15.
Figure 31 Weighted price index, selected entitlement classes, southern Murray–Darling Basin, 1 July 2007 to 30 June 2016

Note: Weights were determined using proportions of entitlements on issue. NSW High is high security entitlements in NSW Murray and Murrumbidgee. NSW General is general security entitlements in NSW Murray and Murrumbidgee. SA High is class 3a and 3b entitlements in SA Murray. Victorian High is high reliability entitlements in Goulburn, Broken, Loddon, Campaspe and Victorian Murray. Victorian Low is low reliability entitlements in Goulburn, Broken, Loddon, Campaspe and Victorian Murray. The price series for NSW Murrumbidgee high security required additional manual data cleaning to remove potential outliers.

Figures 31, 32, 33, 34 and 35 show the annual price and trade volume trends for major entitlement types in the sMDB. Prices for all major entitlement types increased in 2015–16. This was more pronounced for high reliability entitlements types.
Figure 32 Water entitlement markets, Victorian high reliability water shares

Figure 33 Water entitlement markets, Victorian low reliability water shares
Figure 34 Water entitlement markets, NSW high security water shares

Figure 35 Water entitlement markets, NSW general security water shares

Figure 36 Water entitlement markets, SA high reliability water shares

Note: SA high reliability comprises class 3a and 3b entitlements.
Groundwater markets

Allocations

In 2015–16 groundwater allocations were traded exclusively in southern New South Wales. Murrumbidgee accounted for 70 per cent (87 GL) of groundwater allocation trade and NSW Murray for the remaining 30 per cent (Figure 37). Victoria has temporary trade of groundwater entitlements which amounted to 16 GL in 2015–16.

Figure 37 Groundwater allocation trade, 2015–16

![Bar chart showing groundwater allocation trade in Murrumbidgee and NSW Murray in 2015–16.]

Annual market prices for groundwater allocations follow a similar trend to prices for surface water allocations. However, groundwater allocation prices tend to be less sensitive to changes in seasonal conditions (Figure 38).

Figure 38 Groundwater allocation trade price, by water system, 2007–08 to 2015–16

![Line chart showing annual market prices for groundwater allocations in various water systems from 2007–08 to 2015–16.]

Entitlements

Groundwater entitlements are traded in all sMDB states, with most trade in NSW Murrumbidgee (31 GL) and Victorian Goulburn (21 GL) (Figure 39). In 2015–16 groundwater entitlement trade volume for all states was lower than in 2014–15.
Historically, average annual prices for groundwater entitlements have followed a similar trend to those for surface water entitlements. However, in 2015–16 prices for surface water entitlements increased significantly while groundwater entitlement prices decreased marginally (Figure 40).

Figure 39 Groundwater entitlement trade, 2015–16

<table>
<thead>
<tr>
<th>Location</th>
<th>2015–16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murrumbidgee</td>
<td>30</td>
</tr>
<tr>
<td>Goulburn</td>
<td>20</td>
</tr>
<tr>
<td>NSW Murray</td>
<td>15</td>
</tr>
<tr>
<td>SA Murray</td>
<td>10</td>
</tr>
<tr>
<td>Loddon</td>
<td>5</td>
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</tbody>
</table>

Figure 40 Groundwater entitlement trade price, 2007–08 to 2015–16

Historically, average annual prices for groundwater entitlements have followed a similar trend to those for surface water entitlements. However, in 2015–16 prices for surface water entitlements increased significantly while groundwater entitlement prices decreased marginally (Figure 40).
References

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