

JULY 2020

Water Update – Southern Connected Basin “summary report”

Prepared by RMCG consultants – Rob Rendell, George Warne,
Charles Thompson and Daryl Poole

Note – a detailed report providing the background data is also available from RMCG

Water Update – Southern Connected Basin: July 2020

This paper provides a report on the state of play regarding water availability in the Southern Connected Basin - as at July 2020. The paper is based on the recognition that a new equilibrium has become established between the diverse mix of irrigated sectors that have varying requirements regarding the security of their water supply- and the three water security products that are now available. The paper therefore covers:

- A brief analysis of the 2019/20 season
- A short history of irrigation development in the southern connected basin
- An analysis of the physical characteristics of the system
- The implications for water markets
- The relationship between the level of water allocations and prices
- An assessment of likely future trends and the major challenges facing the Basin.

The 19/20 season involved a severe drought across the southern connected Murray-Darling Basin (sMDB) in terms of stream flows and storage volumes. Allocated water volumes were low and prices were high for most of the irrigation season, at levels that were very similar to those experienced in the millennium drought. However, the allocations in the “Connected Murray” section of the lower MDB were not as low as those experienced in the millennium drought. Put simply, if the millennium drought was repeated now, because of the Basin Plan water recovery, there would be about 25 % less water allocated for irrigators than there was in 2007 or in 2019/20. By contrast, the Murrumbidgee allocations were similar to those of the millennium drought, but were offset by above-average autumn 2020 rainfall and access to significant volumes of groundwater, which had been carried over from prior years of under-use under the terms of the Murrumbidgee Groundwater sharing plan.

Therefore, 2019/20 while a year of significant shortage of irrigation water, was not as bad across the sMDB in terms of allocations as the millennium drought. However, the increase in horticulture and cotton development since the millennium drought changed who was able to access and use the available water in 2019/20 compared to the position during the millennium drought. Surprisingly carryover increased substantially by 451GL by the season end.

Three phases of development: There have been three broad phases of development in the sMDB:

- **50 years post WWII** – generally unbridled growth in irrigation occurred within the five main regions in the sMDB (Riverland SA, Sunraysia NSW & Vic, GMID Vic, Murray (MIL) NSW, and the MIA NSW), punctuated by sharp periods of drought (1967, 1972, 1982 & 1994)
- **A turbulent twenty years** from the year 2000 – adjusting to the cap and the introduction of water trading, and policy changes (carryover etc), which effectively joined the regions together as one interconnected southern catchment with the Basin Plan. The application of changed water sharing rules in NSW, the growth in the water portfolio held by Governments since 2004 and the apparent shift in climate, exacerbated by a drought of record between 2007 and 2009, have now increased the incidence of water shortages
- **Establishing a new equilibrium** – a new equilibrium has evolved of water availability, water ownership, water *products* and changed industry demand, and as this new equilibrium becomes clearer, irrigators can plan for a new world.

Equilibrium: The 19/20 drought confirmed that horticulture development in the “connected Murray” system has almost reached its limit, but that there is still some opportunity for continued growth in horticulture, particularly at the expense of irrigated cotton production within the Murrumbidgee Valley.

Otherwise an equilibrium has become established between the mix of water use by the different industries with quite significant differences in value per ML applied, (horticulture, dairy, cotton, rice, cereals/maize and livestock grazing) and across the five regions that dominate irrigation in the Southern Basin. Significant and sustained shifts in irrigated commodity prices will act to rebalance water use between farmers, sectors and regions from time to time.

Three levels of water security: The sMDB system generally now has three levels of surface water security – this means that for surface water supplies there is:

- i. **Super Secure water** (c1,500GL) which is generally used by Horticulture to irrigate permanent plantings without risk
- ii. **Secure Water** (1,500GL) which is used by the next most high value industries i.e. cotton, dairy and maize, available in almost all years, but being able to 'opt out' if conditions are very dry and allocations are lower
- iii. **Variable water** (2,200GL) which is used predominantly for rice, pasture for livestock grazing and finishing winter cereals. These industries depending on this water for irrigation have proved the most vulnerable to lower water availability and must cope with an interruptible allocation between years and later allocation announcements in many years. Fortunately many irrigators utilising this water have low overheads, lower per ha investment in irrigation-systems and have proven very adaptable.

Carryover: In order to change the relative security of “variable” water into more “secure” water, farmers use “carryover” which increases the availability of water in dry years but reduces the total average yield (and use for irrigation) of water available in wet years, by increasing the frequency and volume of spills from storages. Carryover levels by irrigators have been maintained at around an annual balance of c1,200GL (750 to 2,000GL) which is about 1/3rd of average water use in the sMDB.

Groundwater use: The increasing value of surface water for irrigation has led to a steady increase in groundwater pumping, which previously was always regarded as a very expensive source of irrigation water, for use only in very dry seasons. In recent years, approx. 500GL of deep lead aquifer groundwater has been used annually in the sMDB, with 350GL in the Murrumbidgee, 80GL within Murray Irrigation Ltd's area of operations and 70GL in the Victorian GMID. There is another 50GL scattered throughout the upper reaches of the Murray Goulburn catchments. However, the combined sustainable yield for groundwater is closer to 400GL than 500GL but there is often the ability to carryover large volumes of unused groundwater from one season to the next, and to use up to 200 % of the annual groundwater allocation in any year. This makes groundwater extremely reliable. The rising value of surface water, and declining real energy prices also make lifting groundwater more affordable.

Five recent periods: The last 25 years can be viewed as five lots of five years, where the average annual available water *and average available allocation prices (\$ 2020)* in each period is shown i.e.:

- i. 1995 – 2000: “Historical wet 90's” – extreme wetting period – 6,662GL, \$35/ML
- ii. 2000 – 2005: “Normal period after a long wet period” but still had a mix of wet and dry years – 5,463GL, \$125/ML
- iii. 2005 – 2010: “Millennium drought” – the most extreme drought series – 3,099GL, \$398/ML
- iv. 2010 – 2015: “Wet period” with almost maximum allocations every year but some Basin recovery – 5,563GL, \$61/ML
- v. 2015 – 2020: “Dry period” but with a mix of wet and dry years after Basin recovery – 3,342GL, \$277/ML.

The average available water, over the last five years, has therefore declined by a total of 3,320GL or halved since the historical wet period, pre 2000, **whilst at the same time, the price of water in real terms has increased by a factor of eight.**

Of this reduction in **available water**, 1,146GL is due to the Basin Plan recovery, up to 500GL from Policy changes and irrigator behaviour resulting in “underuse”¹ and therefore 1,674GL or more is due to drier conditions. In summary, of the reduction in water and increase in water prices over the last 20 years, 1/3rd is due to the Basin Plan, 1/6th to underuse, 1/2 to drier conditions.

Data for the last five years are instructive: This is illustrated in the following table.

Table S1-1: Water availability and prices in the Southern Basin

		ALLOCATIONS %			AVAILABLE WATER IN SOUTHERN BASIN (GL) ²	PRICE OF WATER (\$/ML) ³
		NSW GS (MURRAY)	VIC HS MURRAY	BIDGEE GS		
2015/16	Dry	23	100	34	3,232	\$208
2016/17	Wet	100	100	100	5,204	\$63
2017/18	Average	51	100	41	3,738	\$129
2018/19	Very Dry	0	100	7	2,644	\$438
2019/20	Drought	0 (+ late season 3 %)	66 (80 Goulb)	6 (+ 5 % late season)	2,187(+ late 108GL)	\$515
Repeat of millennium drought – worst on record		0	50 %(50 Goulb)	10	1,724	\$800 - 900

For an irrigator planning water use, the last five years (2015/16- 2019/20) provide examples of the possible different scenarios that could apply in the future. There are roughly five roughly-equal likely future scenarios in which the data and behaviours around water use/trade/prices and production provide a reasonable if not perfect basis for irrigators engaged in planning. At the more extreme ends of seasonal variation, RMCG has also considered the likely impacts of a repeat of the millennium drought, based on current demand and current water-ownership. At the other end of the spectrum, a possible variation on the wet-year scenario is a wet summer, with widespread flooding, where irrigation demand is very low, as occurred in the 2010/11 season.

Irrigation-dependent industries production over five seasons: The production of the key commodities produced in the southern basin are shown below. *Other* horticulture production is not included as it did not vary significantly between years.

¹ MDBA “Trends in water use relative to the Sustainable Diversion Limit in the Southern Murray Darling Basin” draft 11 June 2020.

² Water available to irrigators in main surface systems and excludes environmental water and groundwater. Also some additional water from conveyance dividends (NSW& Vic totals 150GL), plus NSW Suppl. Water (237GL in 2016/17, 140GL in 15/16), plus upstream Vic rivers 65GL.

³ Weighted average price – MIL.

Table S1-2: Production of key commodities over last five seasons

SEASON & CLIMATE SCENARIO		ALMONDS TONNES ⁴	DAIRY GMID M LITRES	COTTON BALES ⁵	RICE TONNES
2015/16	Dry	82,333	1,728	100,000	244,184
2016/17	Wet	79,462	1,449	409,000	600,000
2017/18	Average	76,000	1,667	63,500	625,000
2018/19	Very Dry	92,000	1,319	409,000	54,000
2019/20	Drought	97,000	1,279	100,000	40,000
Repeat Millennium drought		Est 100,000	Est 1,300	Est 50,000	20,000

Connected system – the five regions within the southern basin usually act as one general supply-system and water market, but there are some trade limitations that effectively break the sMDB into two parts i.e.:

- The “**Connected Murray**”, which consists of SA, Sunraysia, MIL, and GMID, including the Goulburn and some minor Victorian tributaries, and acts almost as one system, despite periodic declarations of ‘choke’ constraints, and a tightening of transfers from the Goulburn system
- The **Murrumbidgee** system, which is poorly connected to the Murray, with recognised in-season capacity constraints, and growing internal demand for water for increased areas of higher value crops.

Therefore any evaluation of water within the sMDB should not only consider how the southern basin water marketplace operates as a whole; and how the Murrumbidgee system and connected Murray operate for significant periods of time as two separate systems; but also how each of the five regions function as a local systems, given local nuances in system management, water allocation policy, carry over rules and water trading constraints that are sometimes applied locally.

Five regions: Within the southern connected basin there are five general irrigation regions or communities that interact:

- Riverland in SA** – comprises predominantly irrigated horticulture supplied by direct pumping from the Murray, with a large proportion supplied from pressurised pipelines operated by Central Irrigation Trust, Renmark Irrigation Trust or by individual farmers. The region typically uses up to 400GL annually which has remained unchanged over the last 20 years. (This does not include the flood irrigated areas in the SA Lower Swamps, where there have been large changes – with a subsequent loss of dairying etc.)
- Sunraysia in Victoria and NSW** – comprises predominantly horticulture supplied by direct pumping from the Murray mostly from pressurised pipelines operated by Lower Murray Water (Vic), Western Murray Irrigation (NSW) or by individual farmers on both sides of the river. The region typically uses up to 700GL which is about double what it used 20 years ago. The growth has been driven by large scale horticultural users, usually on green fields sites developed on Mallee cereal farms, with new privately owned pumps and supply pipelines
- GMID (Goulburn Murray Irrigation District)** – comprises predominantly dairy pastures but with significant horticulture and some annual cropping. The water is supplied via an automated gravity channel system operated by GMW (Goulburn Murray Water). The region typically uses 900-1,300GL within the 640,000Ha district and another 100GL outside along the river network, which is about half of the water used within the GMID and associated users 20 years ago

⁴ Total Australian production, noting that more than 90 % of Australia's almonds are grown within the Southern Murray Darling Basin.

⁵ Based on Cotton Australia annual region reports, assuming 66 % of crop in “Southern Valleys” is Murrumbidgee and Murray (i.e. excludes Lachlan Valley).

- iv. **Murray Irrigation Area** – comprises primarily rice and annual cropping where the water is supplied via gravity channel systems operated by Murray Irrigation Ltd. The 700,000Ha region typically uses 300 – 800GL. There is another c100GL used on broadacre crops outside the irrigation area along the Murray, Edwards and Wakool Rivers, which is about half what was used 20 years ago and is much more prone to a sharp reduction in water available between seasons than the GMID
- v. **Murrumbidgee Irrigation Area** – comprises a mix of rice, annual cropping, cotton, and horticulture. Water is supplied via a mix of gravity canal systems operated by Murrumbidgee Irrigation and Coleambally Irrigation, some pipeline supplies for horticulture and private river pumping. The region typically uses a total 700-1,500GL which is about 20 % less than it used 20 years ago. The large scale LowBidgee flood plain no longer has water diverted for annual cropping and pasture production, as the LowBidgee area is currently being transformed into an environmental reserve, and is no longer flood irrigated.



Figure S1-1: Map showing the irrigation regions in the Southern Basin

Trade restrictions and regional price variations: There are a number of limits on water trading around the southern catchment (interstate, intervalley, Barmah choke and Goulburn river). Despite these trade restrictions the water price for allocation trade remains similar around the sMDB at almost any time in any given season, and the Murray Irrigation Exchange has to-date provided the most reliable and timely records of indicative price data for the southern catchment. However, during the 2019/20 drought the trade restrictions had significant impact in creating a ‘price spread’ between irrigation areas. There were significant differences in allocation water prices, of up to \$150/ML, between upper and lower Murray trading zones (refer fig below) for extended periods within the 2019/20 irrigation season.

Allocation Water prices these vary continuously throughout the season in response to seasonal conditions (rainfall, & temperature) and the anticipated future allocations. This is shown in the graph below:

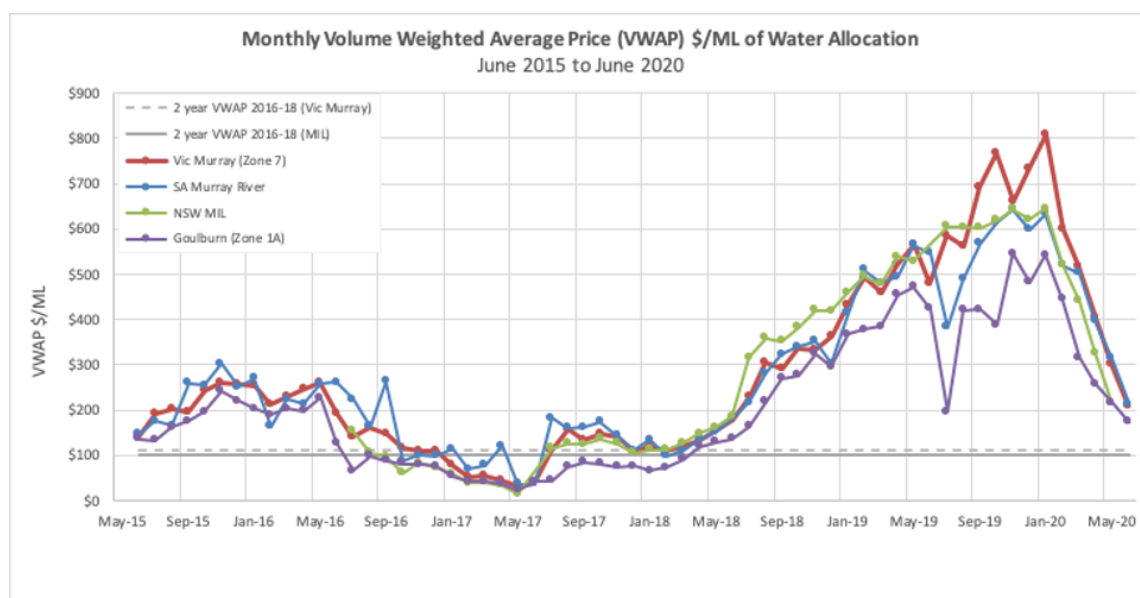


Figure S1-2: Reported allocation traded/transferred May 2015 to May 2020⁶ (excludes \$0 trades)

Entitlement water prices have increased significantly over the last five years in response to drier conditions and increased allocation prices. This is shown in the graphs below:

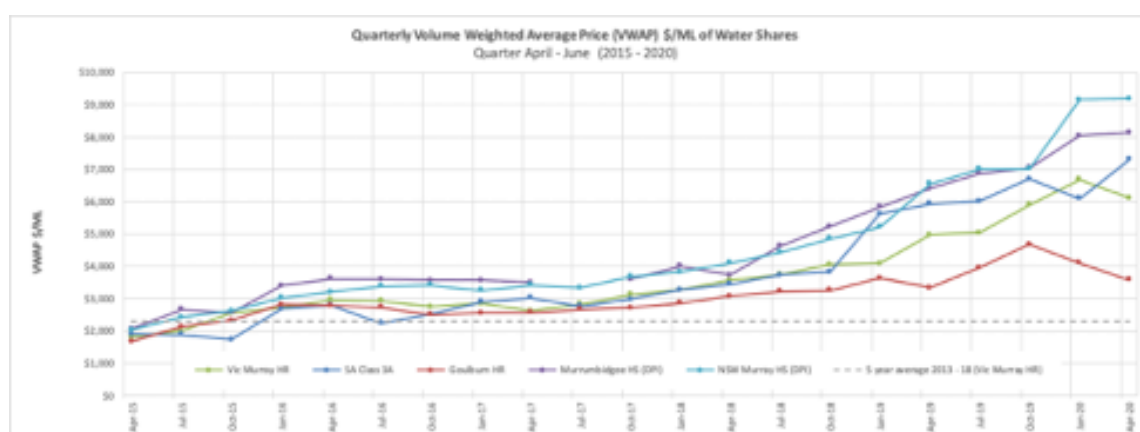


Figure S1-3: Values for high security water

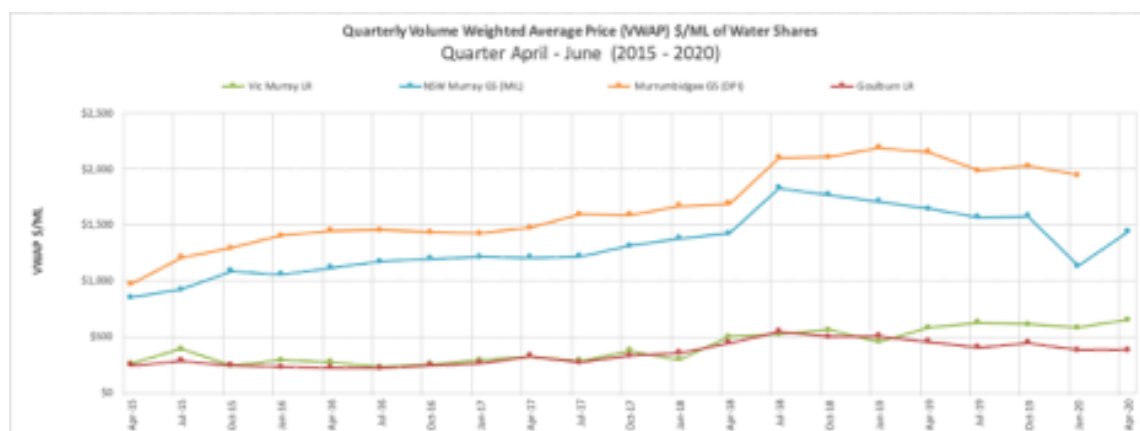


Figure S1-4: Values for low security products

⁶ Victorian Water Register: <http://waterregister.vic.gov.au>, NSW Murray Irrigation Limited: <http://www.murrayirrigation.com.au/water/water-trade/>, and South Australia WaterConnect: <https://www.waterconnect.sa.gov.au/Systems/WTR/Pages/Default.aspx>.

Entitlement prices compared to allocation prices: RMCG has also compared the value of different security entitlements to annual yield (or allocation) and the average annual temporary market price paid, by using weighted probabilities of annual income dividends (i.e. allocation prices times allocation level) and found that the temporary value reflects about an annual 3-4 % of the entitlement price before entitlement holding-costs are considered (regardless of which of the multiple mainstream sMDB entitlement or water-share products are purchased). For example, for NSW Murray entitlements:

Table S1-3: Income per ML of entitlement owned from NSW Murray entitlements

	GENERAL SECURITY	HIGH SECURITY
The average "income dividend" over the last five years.	\$53/ML	\$278/ML
Today's entitlement value. Return on entitlement.	\$1,500/ML 3.5 %	\$9,000/ML 3.0 %
Entitlement value five years ago. Return on entitlement at this price.	\$800/ML 6.6 %	\$2,500/ML 10.9 %
Capital gain last five years.	10 %/year	70 %/year
Fixed charges applied per ML (within MIL).	\$18/ML	\$5-20/ML

Seasonal forecasts – For the 20/21 water year at July 15, 2020; are provided in the table below.

Table S1-4: Seasonal Outlooks for season 2020/21 (as of 15 July 2020)

ENTITLEMENT	WET (10 %)	AVERAGE	DRY (90 %)
NSW Murray High	97 %	97 %	97 %
NSW Murray General	Not published	30 %	7 %
NSW Murrumbidgee High	95 %	95 %	95 %
NSW Murrumbidgee General	Not published	45 %	22 %
Victorian Murray High	100 %	100 %	48 %
Victorian Goulburn High	100 %	100 %	68 %
SA High Security	100 %	100 %	100 %

Indicative water pricing: RMCG has found a very good relationship between the water allocation volumes and the average allocation price paid on the MIL exchange as shown in the graph below. Using this relationship the various seasonal outlooks have been plotted which indicate possible water price for each seasonal outlook scenario.

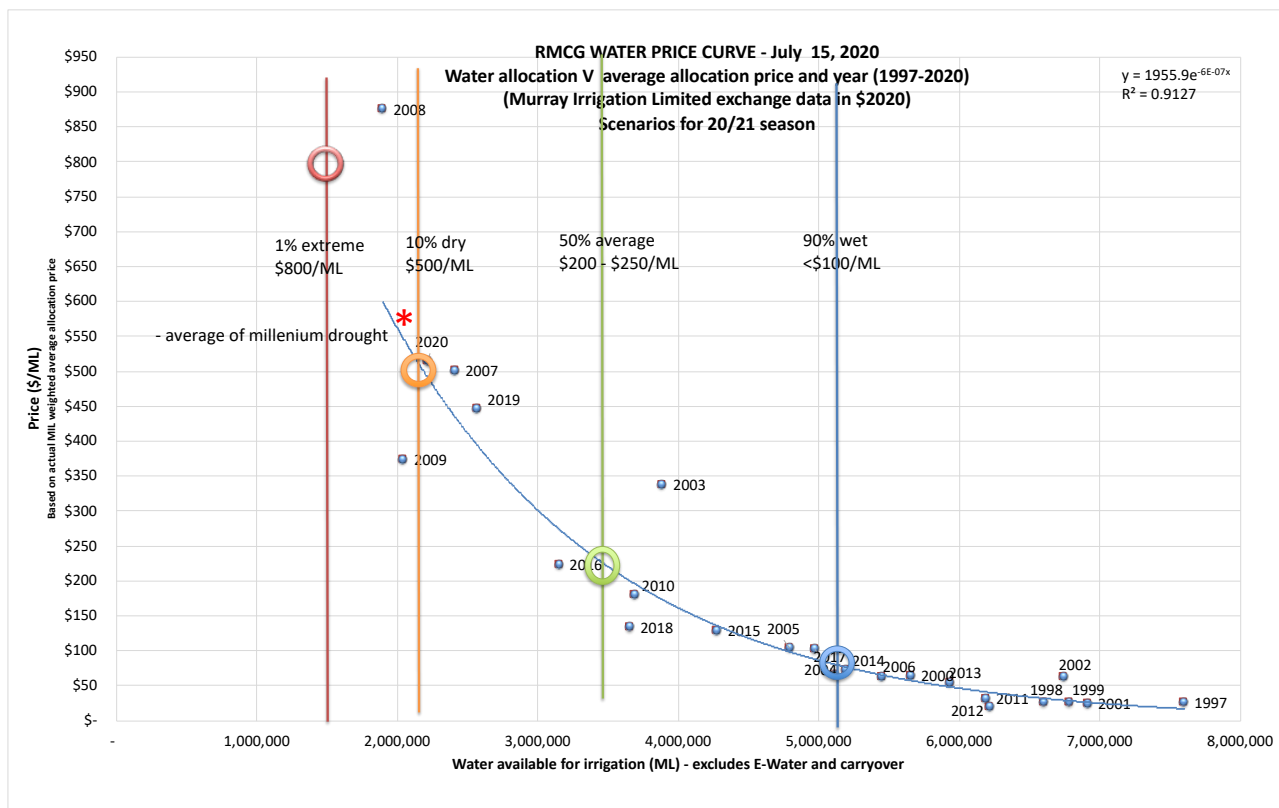


Figure S1-5: Seasonal Outlooks Prices for season 2020/21

Future trends: A number of future scenarios and trends can be considered i.e.:

- **Impact of a repeat of the millennium drought** – whilst the available water would be about 25 % less than 19/20 season, the impact would not be greatly different as current carryover levels would provide sufficient buffer so that 19/20 production levels could be maintained. The costs (increased water prices and for dairy, additional fodder costs) of maintaining that production would be significant, but this is not considered a disastrous outcome when the 19/20 season is considered as a benchmark
- **Horticulture growth in the 'Bidgee** – there is likely to be continued growth of horticulture in the 'Bidgee region at the expense of the recent growth in cotton areas planted, this growth is underpinned by a significant volume of high security water, and groundwater, currently used on broadacre crops throughout the Murrumbidgee Valley
- **Allocation prices** – the supply price curve correlation has remained unchanged for last 25 years and appears unlikely to change in the near future in that the allocation price is directly related to volumes allocated as per the historical price curve, i.e. the relationship between price and total water allocated appears very strong
- **Entitlement prices** – historically these have risen primarily due to reducing volumes of water being allocated. It is considered unlikely that the same rate of increase will continue over the coming years, unless there is further water recovery e.g. under the proposed MDBP 450GL recovery of *Upwater*. However entitlement prices also appear to go up and down in response to a dry or a wet sequence, particularly a sustained period of wet or dry years
- **On-farm water efficiencies** are continually improving – increased water prices and reduced volumes will continue to put pressure on irrigators to increase water efficiencies particularly in the dairy and rice industries, where cost of owning entitlements or buying allocation water represent a higher proportion of production costs than for some other industries.

Key industry challenges – a number of challenges face each of the agricultural commodities under the new water equilibrium. Horticulture expansion is now more limited by the amount of water available in a drought, the dairy industry is aiming for more milk per ML of water and thus conversion to dairy barns is being considered by more and more dairy farmers, the Cohuna dairy farmers in the Torrumbarry district within the Victorian GMID are facing continued water trade pressure from downstream horticultural demand, the rice industry is trying to adapt to reduced and seasonally highly variable production, cotton, as a relatively recent entrant, is still to work out its sustainable level of production in the sMDB after establishing a stronghold in the Murrumbidgee Valley over the last ten years.

Basin challenges – while much of the Basin Plan has now been delivered, there are still a number of issues being addressed. These include:

- Resolving the issue of the legislated further recovery of 'up to 450GL' of Upwater which could further reduce the available water for irrigators. (Implementation may result in increased entitlement prices)
- The deliverability of water from the Murray during periods of peak demand to Lower Murray irrigation areas, particularly when there are limited supplies available from the Menindee Lakes/Darling
- The Keelty report and the associated identification of systemic "underuse" by irrigators which suggests that the irrigators may not be getting access to an appropriate amount of available water and almost certainly are not using their share when it is made available
- Completing successfully the sustainable diversion limit adjustment projects (or SDL offset projects) and what happens to further water recovery initiatives if the offset projects are not completed as planned
- The unreleased socio-economic impacts report outlining the extent of adjustment that the delivery of the Basin Plan has caused
- The lower lakes studies, indicating the health of the lakes is dependent on an even greater share of available water.

All of these issues have the potential to further impact on water availability, the water market and the new southern basin water equilibrium.

This summary report has been prepared by:

RM Consulting Group Pty Ltd trading as RMCG

Level 1 East, 1100-1102 Toorak Road, Camberwell Victoria 3124

(03) 9882 2670 — rmcg.com.au — ABN 73 613 135 247

Offices in Victoria, Tasmania, ACT and NSW



Key RMCG contact

Rob Rendell

0428 510 642 — robr@rmcg.com.au

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