Irrigation in the Murray-Darling Basin:

Regional estimates of gross value of irrigated production in 2006-07

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Foreword

Irrigated agriculture makes an important contribution to both the Australian and regional economies. The prolonged drought affecting much of the Murray-Darling Basin has resulted in significant reductions in water allocations to irrigation farms within the Basin. The gross value of agricultural production is an important consideration for decision-makers in monitoring changes in any sector. With greater focus on the regional effects of reduced water availability, it is important that such estimates are available at a regional level.

The Australian Bureau of Statistics has regularly published estimates of the gross value of agricultural production (GVP) and, more recently, the gross value of irrigated agricultural production (GVIAP) within the Murray-Darling Basin. However, estimates of GVIAP by region and industry are not currently available.

In response, ABARE was commissioned by the Australian Government Department of the Environment, Water, Heritage and the Arts to estimate GVIAP using data obtained from ABARE's survey of irrigation farms in the Murray-Darling Basin. Results from this analysis are provided in this report by region and commodity.

Phillip Glyde
Executive Director
December 2009

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1 Introduction

The Murray-Darling Basin is an important agricultural region in Australia, covering an area of around 1 million square kilometres and accounting for about 40 per cent of Australia's total gross value of agricultural production in 2006-07 (ABS 2008a). While most agricultural land is used for dryland enterprises, the Basin also supports a large irrigation sector with around 17 000 square kilometres being irrigated in 2005-06 (ABS 2008a).

Given the relative importance of the Murray-Darling Basin to the Australian economy, industry and government decision-makers need detailed information on economic activities within the Basin. To better understand the economic characteristics of irrigation industries at a farm level, ABARE was commissioned by the Australian Government Department of the Environment, Water, Heritage and the Arts to undertake a survey of irrigators throughout the Basin. Additional funding for the survey was provided by the Australian Government Department of Agriculture, Fisheries and Forestry. The objective of the survey was to collect a range of financial and physical data for the 2006-07 financial year from irrigation farms in selected regions and industries within the Murray-Darling Basin.

Using data collected in the ABARE survey of irrigation farms, it is possible to refine the estimates of gross value of irrigated agricultural production (GVIAP) published by the Australian Bureau of Statistics (ABS).

Gross value of production is a measure commonly used to demonstrate the contribution of an activity to the economy. The Australian Bureau of Statistics (ABS) has regularly published estimates of the gross value of agricultural production (GVP) and, more recently, the gross value of irrigated agricultural production (GVIAP) within the Murray-Darling Basin (ABS 2008a). GVIAP refers to the gross value of agricultural commodities which are produced with the assistance of irrigation. However, estimates of GVIAP by region and industry are not currently available.

This report presents a summary of estimates of crop yields and unit prices received for irrigated crops by region in 2006-07. These results were then used to estimate the contribution of various enterprises to GVIAP by region within the Basin.

2 Methods for estimating GVIAP

Estimates of the gross value of irrigated agricultural production are useful for informing government and industry decision-makers. Typically, such estimates are often used to demonstrate the contribution of a particular commodity, region or industry to economic output. Various methodologies have been developed to estimate the portion of the gross value of agricultural production that can be attributed to the use of irrigation water.

An issue of concern is the degree to which irrigation water is required to produce an agricultural output. Water is an essential input to agricultural production, either through rainfall or the application of irrigation water. The degree to which various agricultural enterprises rely on irrigation water varies widely across the Murray-Darling Basin. Some enterprises, such as rice, rely entirely on irrigation water, while others use relatively small volumes of irrigation water to supplement rainfall. Also, the reliance on irrigation water for individual farms varies widely across the Basin.

While estimates of GVIAP provide important information about irrigated activity in a region or industry, it is important to recognise some limitations. For example, GVIAP cannot be used to compare the net benefits from using irrigation water in alternative uses (e.g. in producing rice or vegetables). In this case the relevant information would be the net benefit (revenue less all costs) of using an additional megalitre of irrigation water in alternative uses.

ABS methodology

The Australian Bureau of Statistics (ABS) has developed a methodology for estimating the gross value of irrigated agricultural production (GVIAP) in the Murray-Darling Basin using data from the ABS Agricultural Census as well as other ABS collections. Estimates for 2006-07 (the most recent year for which data at Basin level have been estimated) are shown in table 1.

1 Gross value of agricultural production, by commodity, Murray-Darling Basin, 2006-07

	irrigated agriculture $m	total agriculture $m
Dairy farming	763	897
Other livestock	723	4 873
Rice	55	55
Cereals (excl. rice)	191	1 685
Cotton	457	478
Grapes	651	701
Fruit (excl. grapes)	1 207	1 300
Vegetables	570	713
Other agricultural commodities	305	2 038
Total	4 936	12 739

Source: ABS 2009.

The ABS uses a variety of methods to estimate GVIAP, with the method used dependent on the nature of the commodity and the availability of data. For rice, all of the gross value of agricultural production was attributed to irrigation. For cotton, the quantity of production from irrigated land was collected directly in the ABS Agricultural Censuses and Surveys. This quantity was then applied to an average unit value of cotton in the Murray-Darling Basin (ABS 2008b).

For the remaining commodities, the value of irrigated agricultural production was determined using two general methods. For the first method, the irrigated area of the commodity was divided by the total area of the commodity (that is irrigated plus non-irrigated area) and multiplied by the total value of the commodity produced. For the second method, the proportion of irrigating agricultural establishments within a particular industry (classified according to ANZSIC) was determined and this proportion applied to the total gross value of the particular commodities produced by that industry (ABS 2008b).

Both methods were used to estimate the gross value of irrigated agricultural production for vegetables, fruit, grapes, other livestock and other agriculture. The average of the two results was then used as the published estimate. The first method was used to estimate the value of cereals other than rice, while the second method was used to estimate the value of milk production from dairy pasture (ABS 2008b).

There is potential for the information collected in ABARE's survey to be used by the ABS in refining their estimates of GVIAP. In particular, the ABARE survey provides region level estimates of yields and prices received for irrigated crops, which could replace some of the assumptions currently being made by the ABS.

ABARE estimates

ABARE's survey of irrigation farms in the Murray-Darling Basin provides coverage of broadacre (including rice and cotton growers), dairy and horticulture irrigation farms within 10 regions throughout the Murray-Darling Basin. In producing survey based estimates, individual farm data are weighted so that surveyed farms are representative of an industry in a particular region. Further information on the survey methodology can be found in appendix A.

While the survey has been designed to provide regional and industry coverage, the extent to which individual crops have been covered will vary according to how common particular crops are in each of the regions. As a consequence, the results presented in this report do not provide full coverage of the gross value of agricultural production for all irrigated cropping activities within the Murray-Darling Basin. Nevertheless, the estimates provided do cover the main irrigated cropping activities in 2006-07.

The contribution of each region and various crops to total GVIAP for the Murray-Darling Basin was estimated using data collected in the ABARE survey. For each irrigated crop, regional averages were obtained for water use (megalitres per hectare), crop yields (tonnes per hectare), unit prices received (dollars per tonne), and gross receipts per megalitre (dollars per megalitre). Estimates of GVIAP for each crop were obtained by multiplying per farm averages of area

harvested, crop yields and unit prices received (i.e. average gross cash receipts for each crop) by the population of farms producing that crop.

ABARE's estimates of GVIAP for various industries differ from those published by the ABS (table 2). These differences highlight the need for caution in interpreting the results. Table 2 provides a comparison between ABARE's estimates and those published by the ABS.

2 ABARE survey coverage of GVIAP, by industry, Murray-Darling Basin, 2006-07

	ABARE estimate $m	ABS estimate $m	proportion a %
Dairy farming	1 012	763	142
Other livestock	608	723	84
Rice	43	55	78
Cereals (excl. rice)	188	191	99
Cotton	214	457	47
Grapes	666	651	102
Fruit (excl. grapes)	952	1 207	79
Vegetables	697	570	122
Other agricultural commodities	176	305	58
Total	4 556	4 936	84

a ABARE estimate relative to ABS estimate.
Sources: ABS 2009, ABARE survey of irrigation farms in the Murray-Darling Basin.

The ABS include some commodities that are not covered by ABARE's survey, such as nurseries, cut flowers and cultivated turf (included in the ABS estimate for other agricultural commodities). Also, although ABARE's irrigation survey was designed to provide coverage of the major irrigated crops and livestock activities, there are likely to be some commodities that are not well represented by the survey, hence the differences in estimates for rice, cotton, grapes and fruit.

Second, differences in the estimates may be the result of the different methodologies and sources of data used. For example, the ABS methodology makes assumptions about irrigated crop yields and prices, whereas the ABARE estimates are based on actual yields and prices received by irrigators.

Livestock enterprises and GVIAP

Irrigated pasture (for either grazing, seed production, hay or silage) is typically a major user of irrigation water. In 2004-05, the ABS estimated that 43 per cent of the water consumed in agriculture was used by dairy farms (16 per cent), other livestock industry farms (19 per cent) and other irrigated pasture (8 per cent).

While it is clear that irrigated livestock enterprises make an important contribution to GVIAP, determining the actual contribution is problematic because irrigation water is not a direct

input to livestock production. The link between livestock production and irrigation is through the use of water to produce pasture, fodder crops (including hay and silage) and feed grains. The extent to which livestock enterprises rely on irrigation water as an input to production varies considerably among farms and through time.

Given the resources available, it was beyond the scope of this project to develop a method to overcome the conceptual difficulties discussed. An approach used by the ABS is to attribute the gross value of livestock production (sales of beef cattle, sheep, lambs, wool, dairy and milk) occurring on irrigated farms to GVIAP. However, this approach is likely to result in an over estimate of livestock GVIAP. Nevertheless, estimates of the gross value of livestock production on irrigated farms are presented in this report to provided consistency with the results published by the ABS. For irrigated dairy farms, the gross value of production was estimated as the sum of receipts from the sales of milk, dairy cattle and beef cattle. For all other farms, the gross value of livestock production was estimated as the sum of receipts from the sale of beef cattle, sheep, lambs and wool. To prevent double counting, receipts from the sale of irrigated silage, lucerne and hay were subtracted from the estimates of the gross value of livestock production because these receipts were accounted for elsewhere.

3 Survey results

Throughout the Murray-Darling Basin, irrigation water is used on a wide variety of crops and pasture. There is marked variation in water application rates, crop yields and crop receipts both within and between regions. A summary of key estimates is shown in table 3. Estimates by region are shown in tables 4 to 8 where there were sufficient survey sample points to provide statistically meaningful results.

Rice had the highest irrigation water application rate per hectare in 2006-07, while broadacre crops such as wheat, barley, oats, oilseeds and pulses had among the lowest water application rates per hectare. Tomatoes generated the highest gross receipts from crop sales on both a per hectare and per megalitre basis.

The volume of water applied per hectare for individual crops varied considerably across the regions. For example, the volume of water applied to wine grapes ranged from 1.4 megalitres a hectare in the Macquarie-Castlereagh region to 7.1 megalitres a hectare in the Eastern Mount Lofty Ranges region. In part, these results reflect the availability of irrigation water during the year, as well as the extent to which some crops required irrigation water in various regions.

3 Selected estimates, by crop and pasture, Murray-Darling Basin, 2006-07

average per farm

	water use ML/ha	crop yield t/ha	gross receipts per hectare $/ha	gross receipts per megalitre $/ML	unit price received $/t
Wine grapes	5.0	13.0	5 467	1 694	584
Other vine crops	6.4	13.2	10 057	1 523	796
Citrus	8.1	24.3	7 613	2 481	320
Pome fruit	6.3	24.7	16 815	15 269	900
Stone fruit	6.8	10.4	9 729	2 410	2 071
Potatoes	5.7	29.9	10 246	2 384	391
Tomatoes	3.6	37.8	57 991	18 978	1 911
All vegetables	4.7	41.4	52 832	23 420	441
Wheat	2.3	3.0	708	672	232
Barley	2.0	2.5	505	529	175
Rice	12.3	9.5	2 859	232	316
Oilseeds	1.8	1.4	621	513	342
Cotton	5.8	2.0	3 773	755	1 916
Pasture	4.5	na	na	na	na
Silage	4.7	6.5	396	115	78
Lucerne	4.2	3.6	521	561	256
Hay	4.0	5.9	962	415	237

Source: ABARE survey of irrigation farms in the Murray-Darling Basin.

4 Water application rates for selected crops, by region, Murray-Darling Basin, 2006-07

average per farm

		Border Rivers	Condamine-Balonne	Goulburn-Broken	Lachlan	Loddon-Avoca	Macquarie-Castlereagh	Eastern Mt Lofty Ranges	Murrumbidgee	Namoi	Murray
Wine grapes	ML/ha			2.0	4.9		1.4	2.7	5.5		6.0
Other vine crops	ML/ha										6.5
Citrus	ML/ha								5.8		8.1
Pome fruit	ML/ha			5.5		2.3			1.4		9.5
Stone fruit	ML/ha	2.1		4.5					5.2		8.1
Potatoes	ML/ha		4.4			5.9		7.0			6.2
Tomatoes	ML/ha	2.5		5.5							
Total vegetables	ML/ha	2.6	3.0	4.5	3.1	8.9		4.1	5.4	6.1	4.7
Wheat	ML/ha		1.3				2.5		2.5	2.6	2.1
Barley	ML/ha								1.5		2.0
Rice	ML/ha								12.6		
Oilseeds	ML/ha								2.0		1.7
Cotton	ML/ha	6.0	4.6				8.6				5.9
Silage	ML/ha			2.9		2.3			4.0		6.9
Pasture	ML/ha			3.7		4.2		4.7	4.3		5.2
Lucerne	ML/ha		3.4	6.0			4.9			3.7	4.6
Hay	ML/ha	3.5	2.8	2.9	4.2	3.3	5.7	4.5	3.8	2.0	5.2

Source: ABARE Survey of irrigation farms in the Murray-Darling Basin.

5 Gross receipts per hectare for selected crops, by region, Murray Darling-Basin, 2006-07

average per farm

		Border Rivers	Condamine-Balonne	Goulburn-Broken	Lachlan	Loddon-Avoca	Macquarie-Castlereagh	Eastern Mt Lofty Ranges	Murrumbidgee	Namoi	Murray
Wine grapes	$/ha			5 932	4 205		7 921	5 167	4 052		5 777
Other vine crops	$/ha										9 955
Citrus	$/ha								4 416		8 845
Pome fruit	$/ha			20 309		11 513			16 713		13 363
Stone fruit	$/ha	10 349		7 648					8 812		9 396
Potatoes	$/ha		6 675			11 926		9 726			15 488
Tomatoes	$/ha	32 311		41 201							
Total vegetables	$/ha	27 103	14 095	251 548	8 126	127 854		47 106	9 962		12 033
Wheat	$/ha		637				776		898	665	540
Barley	$/ha								588		537
Rice	$/ha								3 269		
Oilseeds	$/ha								895		449
Cotton	$/ha	2 687	3 627				4 691			3 653	
Silage	$/ha			124		79			0		587
Lucerne	$/ha		1 429	6 025			0			281	275
Hay	$/ha	615	1 941	1 100	1 534	769	1 055	891	269	848	710

Note: Figures are based on gross receipts for crops sold. *Source:* ABARE Survey of irrigation farms in the Murray-Darling Basin.

6 Crop yields for selected crops, by region, Murray-Darling Basin irrigation farms, 2006-07

average per farm

		Border Rivers	Condamine-Balonne	Goulburn-Broken	Lachlan	Loddon-Avoca	Macquarie-Castlereagh	Eastern Mt Lofty Ranges	Murrumbidgee	Namoi	Murray
Wine grapes	t/ha			5.1	10.5		5.0	4.6	11.7		16.6
Other vine crops	t/ha										13.4
Citrus	t/ha									20.6	26.6
Pome fruit	t/ha			47.6		13.1				22.8	18.8
Stone fruit	t/ha	4.6		21.1						9.6	8.8
Potatoes	t/ha		19.6			47.8		24.1			36.5
Tomatoes	t/ha	19.9		48.3							
Total vegetables	t/ha	18.9	22.3	207.4	13.2	29.4		26.0	15.3		28.3
Wheat	t/ha		2.0				3.0		3.7	3.0	2.6
Barley	t/ha								3.1		2.0
Rice	t/ha								9.5		
Oilseeds	t/ha								1.7		1.2
Cotton	t/ha	1.8	1.7				2.6			2.0	
Silage	t/ha			6.0		4.2			11.3		5.6
Lucerne	t/ha		1.8	9.0			3.8			2.3	3.3
Hay	t/ha	6.2	8.3	4.4	4.8	3.3	11.3	7.2	3.2	3.0	6.5

Source: ABARE Survey of irrigation farms in the Murray-Darling Basin.

7 Gross receipts per megalitre for selected crops, by region, Murray-Darling Basin, 2006-07

average per farm

		Border Rivers	Condamine-Balonne	Goulburn-Broken	Lachlan	Loddon-Avoca	Macquarie-Castlereagh	Eastern Mt Lofty Ranges	Murrumbidgee	Namoi	Murray
Wine grapes	$/ML			3 551	1 663		6 895	2 316	815		1 071
Other vine crops	$/ML										1 459
Citrus	$/ML								1 225		3 155
Pome fruit	$/ML			4 631		6 791			162 713		2 619
Stone fruit	$/ML	12 886		2 096					9 394		1 340
Potatoes	$/ML		2 295			2 128		1 909			3 387
Tomatoes	$/ML	12 027		6 190							
Total vegetables	$/ML	12 887	7 614	177 442	2 699	7 211		17 531	2 325		1 641
Wheat	$/ML		930				377		562	331	899
Barley	$/ML								557		670
Rice	$/ML								232		
Oilseeds	$/ML								450		601
Cotton	$/ML	448	966				547			636	
Silage	$/ML			77		68				138	
Lucerne	$/ML		1 930	66						92	30
Hay	$/ML	168	1 379	298	1 592	406	248	577	93	228	171

Note: Figures are based on gross receipts for crops sold. *Source:* ABARE Survey of irrigation farms in the Murray-Darling Basin.

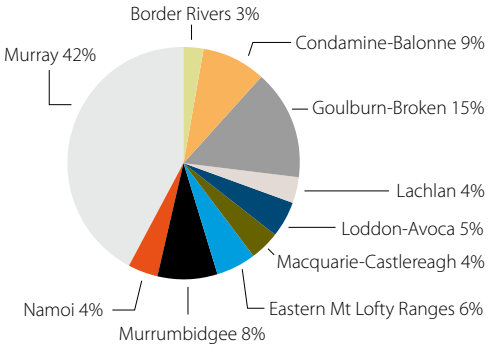
8 Unit price received for selected crops, by region, Murray-Darling Basin, 2006-07

average per farm

		Border Rivers	Condamine-Balonne	Goulburn-Broken	Lachlan	Loddon-Avoca	Macquarie-Castlereagh	Eastern Mt Lofty Ranges	Murrumbidgee	Namoi	Murray
Wine grapes	$/t			1 301	628		1 591	991	445		413
Other vine crops	$/t										769
Citrus	$/t								229		342
Pome fruit	$/t			477		1 155			1 156		695
Stone fruit	$/t	4 067		1 020					2 716		2 226
Potatoes	$/t		355			266		491			464
Tomatoes	$/t	1 608		1 488							
Total vegetables	$/t	864	603	460	516	253		578	758		328
Wheat	$/t		259				247		266	227	197
Barley	$/t								198		137
Rice	$/t								316		
Oilseeds	$/t								490		256
Cotton	$/t	1 573	2 089				1 787			1 812	
Silage	$/t			19		24					150
Lucerne	$/t		291	41						32	558
Hay	$/t	276	379	156	308	247	256	435	298	295	190

Note: Figures are based on gross receipts for crops sold. *Source:* ABARE Survey of irrigation farms in the Murray-Darling Basin.

a Contribution to GVIAP by region, Murray-Darling Basin, 2006-07

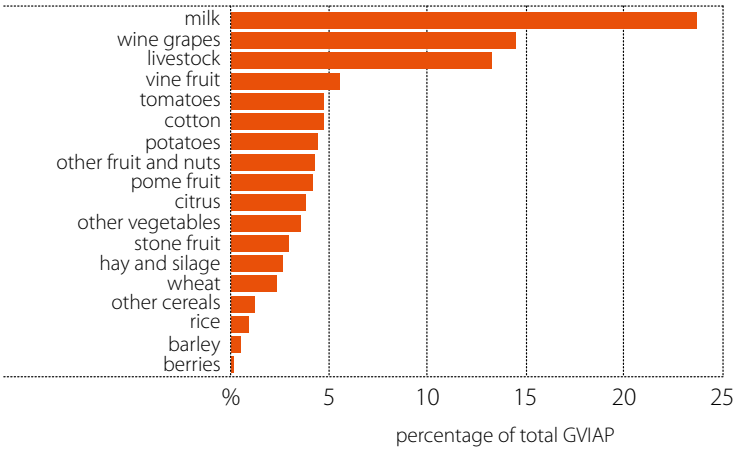


Sources: ABS and ABARE.

Crop yields also vary widely among individual crops and across the regions. Horticulture crops typically have the highest yields when expressed in tonnes per hectare, although the total area of such crops is usually considerably less than for broadacre crops. Horticulture crops also tend to have higher unit prices per tonne than broadacre crops. As a consequence, the highest crop receipts on both a per hectare and per megalitre basis were recorded for tomatoes and pome fruit in 2006-07.

The Murray region is the largest region in the Murray-Darling Basin in terms of total area of land, number of irrigation farms, and total area irrigated. Consequently, the Murray region contributed an estimated 42 per cent of GVIAP in the Basin in 2006-07 (figure a). Wine grapes and vegetables made the largest contribution to GVIAP in the Murray-Darling Basin in 2006-07 (figure b).

b Contribution to GVIAP, by crop, Murray-Darling Basin, 2006-07



Contribution to GVIAP by region

Border Rivers

In 2005-06 there were an estimated 585 irrigation farms in the Border Rivers region. ABARE's survey results indicate that irrigated agriculture accounted for an estimated 62 per cent of the gross value of agricultural production within the region, while the Border Rivers region accounted for around 3 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. Fruit, vegetables (particularly tomatoes) and wine grapes were the most significant irrigated crops grown in the Border Rivers region in 2006-07.

Condamine-Balonne

In 2005-06 there were an estimated 1135 irrigation farms in the Condamine-Balonne region. ABARE's survey results indicate that irrigated agriculture accounted for around 39 per cent of the gross value of agricultural production within the region, while the Condamine-Balonne region accounted for around 9 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. Vegetables (particularly tomatoes, beans, peas, onions and cauliflowers) and cotton were the most significant crops grown in the region.

Namoi

In 2005-06 there were an estimated 777 irrigation farms in the Namoi region. ABARE's survey results indicate that irrigated agriculture accounted for an estimated 28 per cent of the gross value of agricultural production within the region, while the Namoi region accounted for around 4 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. Cotton was the most significant irrigated crop grown in the Namoi region in 2006-07.

Macquarie-Castlereagh

In 2005-06 there were an estimated 658 irrigation farms in the Macquarie-Castlereagh region. ABARE's survey results indicate that irrigated agriculture accounted for an estimated 44 per cent of the gross value of agricultural production within the region, while the Macquarie-Castlereagh region accounted for around 4 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. Cotton, wine grapes and hay were the most significant irrigated crops grown in the Macquarie-Castlereagh region in 2006-07.

Lachlan

In 2005-06 there were an estimated 834 irrigation farms in the Lachlan region. ABARE's survey results indicate that irrigated agriculture accounted for an estimated 25 per cent of the gross value of agricultural production within the region, while the Lachlan region accounted for around 4 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. Wine grapes, vegetables and hay were the most significant irrigated crops grown in the Lachlan region in 2006-07.

Murrumbidgee

In 2005-06 there were an estimated 1926 irrigation farms in the Murrumbidgee region. ABARE's survey results indicate that irrigated agriculture accounted for an estimated 46 per cent of the gross value of agricultural production within the region, while the Murrumbidgee region accounted for around 8 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. Wine grapes, pome fruit and wheat were the most significant irrigated crops grown in the Murrumbidgee region in 2006-07.

Murray

In 2005-06 there were an estimated 5218 irrigation farms in the Murray region. ABARE's survey results indicate that irrigated agriculture accounted for an estimated 50 per cent of the gross value of agricultural production within the region, while the Murray region accounted for around 42 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. Vegetables, wine grapes, and hay and silage were the most significant irrigated crops grown in the Murray region in 2006-07.

Goulburn-Broken

In 2005-06 there were an estimated 1720 irrigation farms in the Goulburn-Broken region. ABARE's survey results indicate that irrigated agriculture accounted for an estimated 47 per cent of the gross value of agricultural production within the region, while the Goulburn-Broken region accounted for around 15 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. Tomatoes, pome fruit and wine grapes were the most significant irrigated crops grown in the Goulburn-Broken region in 2006-07.

Loddon-Avoca

In 2005-06 there were an estimated 912 irrigation farms in the Loddon-Avoca region. ABARE's survey results indicate that irrigated agriculture accounted for an estimated 25 per cent of the gross value of agricultural production within the region, while the Loddon-Avoca region accounted for around 5 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. Vegetables, hay and pome fruit were the most significant irrigated crops grown in the Loddon-Avoca region in 2006-07.

Eastern Mount Lofty Ranges

In 2005-06 there were an estimated 445 irrigation farms in the Eastern Mount Lofty Ranges region. ABARE's survey results indicate that the Eastern Mount Lofty Ranges region accounted for around 6 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. Potatoes, wine grapes, and hay and silage were the most significant irrigated crops grown in the Eastern Mount Lofty Ranges region in 2006-07.

Contribution to GVIAP by enterprise

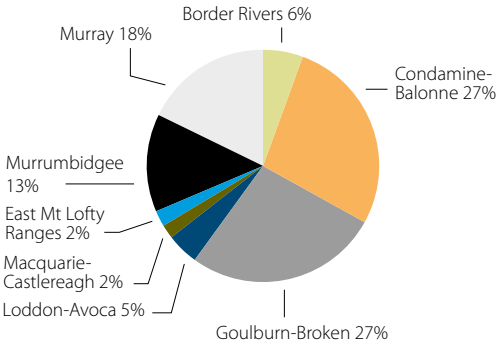
Pome fruit

Pome fruit accounted for an estimated 4 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. In terms of GVIAP, the main pome fruit producing regions were the Goulburn-Broken (27 per cent), Condamine-Balonne (27 per cent), Murray (18 per cent) and Murrumbidgee (13 per cent) regions (figure c).

Citrus

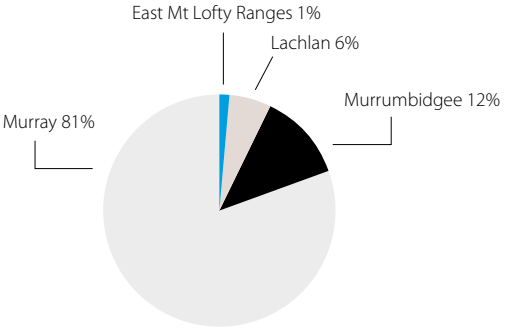
Citrus accounted for an estimated 4 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. The main citrus producing regions were the Murray (18 per cent) and Murrumbidgee (12 per cent) regions (figure d).

c Contribution to pome fruit GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

d Contribution to citrus GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

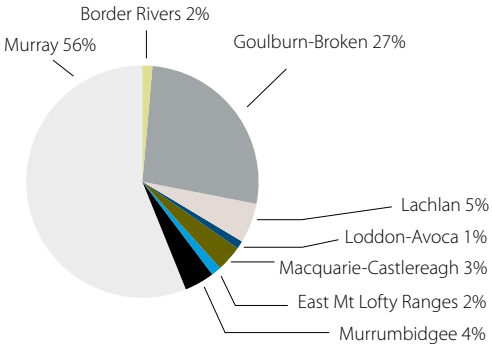
Stone fruit

Stone fruit accounted for an estimated 3 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. The main stone fruit producing regions were the Murray (56 per cent) and Goulburn-Broken (27 per cent) regions (figure e).

Wine grapes

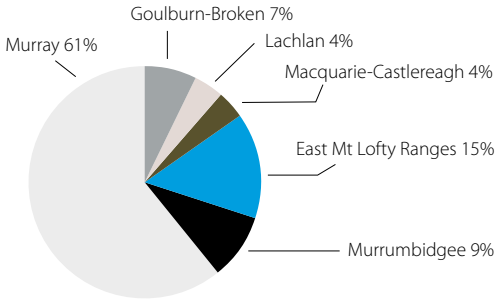
Wine grapes accounted for around 15 per cent of total GVIAP for the Murray-Darling Basin in 2006-07 (ABS 2009). The main wine grape producing regions were the Murray (61 per cent), Eastern Mount Lofty Ranges (15 per cent), Murrumbidgee (9 per cent) and Goulburn-Broken (7 per cent) regions (figure f).

e Contribution to stone fruit GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

f Contribution to wine grapes GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

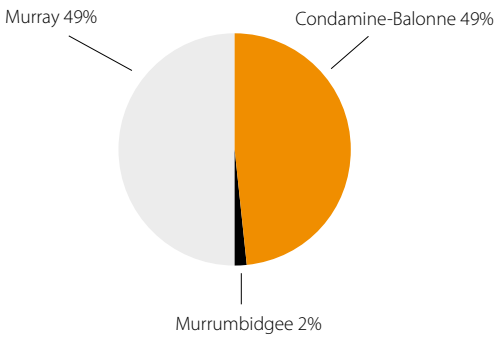
Other vine fruit

Vine fruit (excluding wine grapes) accounted for an estimated 6 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. The main vine fruit producing regions were the Murray (49 per cent) and Condamine-Balonne (49 per cent) regions (figure g).

Potatoes

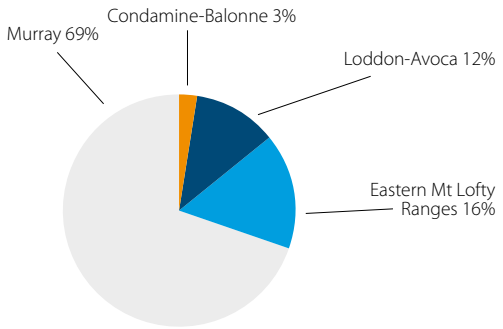
Potatoes accounted for an estimated 4 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. The main potato producing regions were the Murray (69 per cent), Eastern Mount Lofty Ranges (16 per cent) and Loddon-Avoca (12 per cent) regions (figure h).

g Contribution to other vine fruit GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

h Contribution to potatoes GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

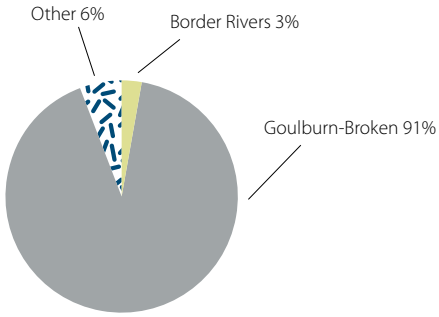
Tomatoes

Tomatoes accounted for an estimated 5 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. The main potato producing region was the Goulburn-Broken (91 per cent) (figure i).

Other vegetables

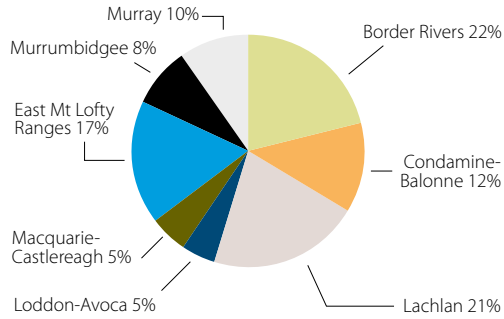
The contribution of vegetables (excluding tomatoes and potatoes) is estimated to have accounted for around 4 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. The main regions producing vegetables other than tomatoes and potatoes were the Border Rivers (22 per cent), Lachlan (21 per cent), Eastern Mount Lofty Ranges (17 per cent) and Murray (10 per cent) regions (figure j).

i Contribution to tomatoes GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

j Contribution to other vegetables GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

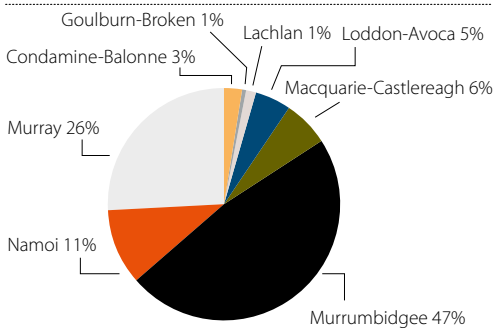
Wheat

Irrigated wheat accounted for an estimated 2 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. The main irrigated wheat producing regions were the Murrumbidgee (47 per cent) and Murray (26 per cent) regions (figure k).

Barley

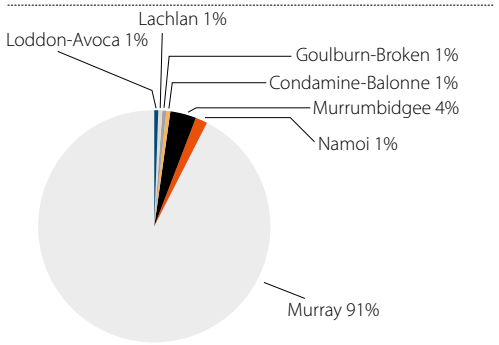
Irrigated barley accounted for an estimated 1 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. The main irrigated barley producing region was the Murray region (91 per cent) (figure l).

k Contribution to wheat GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

l Contribution to barley GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

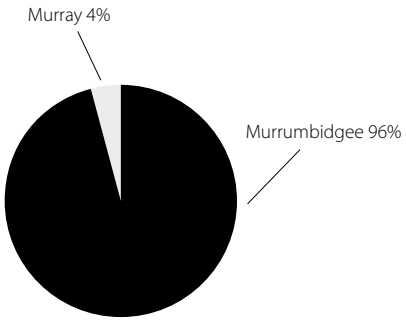
Rice

Rice culture in Australia depends entirely on irrigation. In 2000-01, rice accounted for around 7 per cent of total GVIAP for the Murray-Darling Basin (ABS 2009). With severe reductions in water availability, the contribution of rice to total GVIAP has estimated to have declined to around 1 per cent in 2006-07. Rice was mainly produced in the Murrumbidgee region (96 per cent) in 2006-07 (figure m).

Cotton

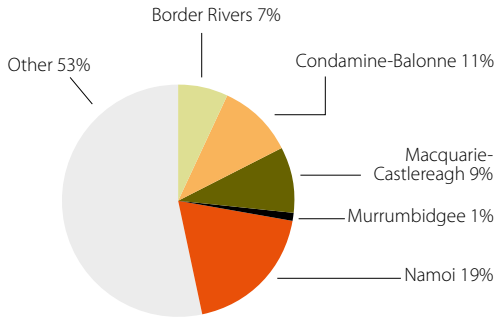
In 2000-01, cotton accounted for around 22 per cent of total GVIAP for the Murray-Darling Basin (ABS 2009). With severe reductions in water availability, irrigated cotton accounted for an estimated 5 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. The main irrigated cotton producing regions were the Namoi (19 per cent), Condamine-Balonne (11 per cent), Macquarie-Castlereagh (9 per cent) and Border Rivers (7 per cent) regions (figure n).

m Contribution to rice GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

n Contribution to cotton GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

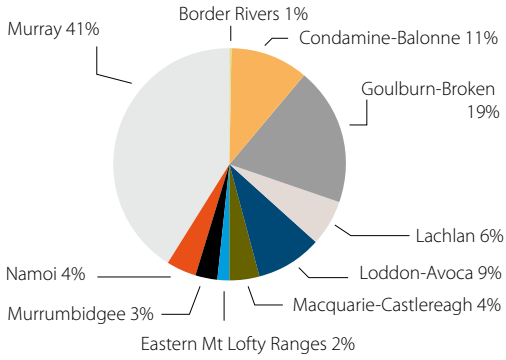
Hay, silage and lucerne

Sales of irrigated hay, silage and lucerne accounted for an estimated 3 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. The main regions producing irrigated hay, silage and lucerne were the Murray (41 per cent), Goulburn-Broken (19 per cent), Condamine-Balonne (11 per cent) and Loddon-Avoca (9 per cent) regions (figure o).

Dairy

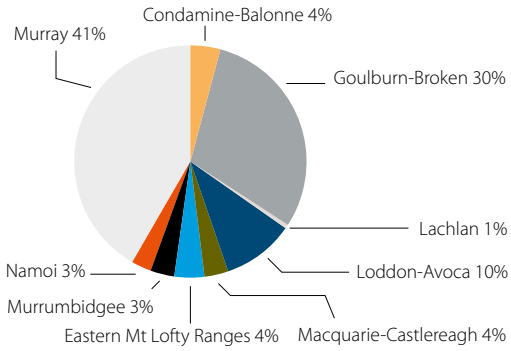
In 2000-01, milk production accounted for around 16 per cent of total GVIAP for the Murray-Darling Basin (ABS 2009). Milk accounted for an estimated 24 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. The main regions producing milk were the Murray (41 per cent), Goulburn-Broken (30 per cent) and Loddon-Avoca (10 per cent) regions (figure p).

o Contribution to hay, silage and lucerne GVIAP, by region, Murray-Darling Basin, 2006-07



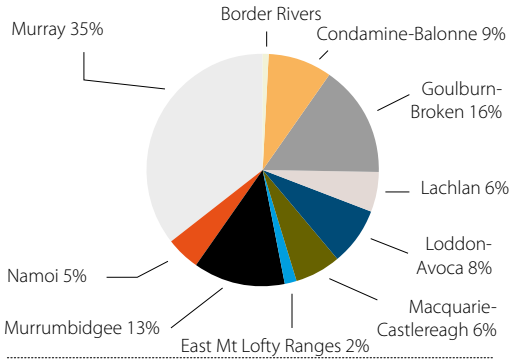
Sources: ABS and ABARE.

p Contribution to dairy GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

q Contribution to other livestock GVIAP, by region, Murray-Darling Basin, 2006-07



Sources: ABS and ABARE.

Other livestock

Sales of wool, sheep, lambs, beef cattle and other livestock from irrigated farms accounted for an estimated 13 per cent of total GVIAP for the Murray-Darling Basin in 2006-07. The main regions contributing to livestock GVIAP were the Murray (35 per cent), Goulburn-Broken (16 per cent) and Murrumbidgee (13 per cent) regions (figure q).

4 Conclusions

Given the relative importance of the Murray-Darling Basin to the Australian economy, industry and government decision-makers have a need for detailed information on economic activities within the Basin by region and industry. The aim of this study was to address this need by providing more detailed estimates of gross value of irrigated agricultural production (GVIAP) than are currently available.

Using data collected in ABARE's survey of irrigation farms, it has been possible to refine the estimates of GVIAP published by the Australian Bureau of Statistics by using farm-level estimates of irrigated crop yields and unit prices received. The results presented in this report show the contribution of each region to GVIAP in the Murray-Darling Basin, and the relative contribution of various crops in each region.

Crop yields and prices received vary widely among individual crops and across the regions. Horticulture crops typically have the highest yields, prices and gross returns per hectare, although the total area of such crops is usually considerably less than for broadacre crops.

The Murray region is the largest region in the Basin in terms of total area of land, number of irrigation farms and total area irrigated. Consequently, the Murray region contributed an estimated 42 per cent of GVIAP in the Basin in 2006-07. Wine grapes and vegetables made the largest contribution to GVIAP in the Murray-Darling Basin in 2006-07.

While it is clear that irrigated livestock enterprises make an important contribution to GVIAP, determining the actual contribution of such enterprises to GVIAP is problematic because irrigation water is not a direct input to livestock production. The extent to which livestock enterprises rely on irrigation water as an input to production varies considerably among farms and through time. Given the resources available, it was beyond the scope of this project to develop a method to overcome these difficulties. Nevertheless, estimates of the gross value of livestock production on irrigated farms are presented in this report to provide consistency with the results published by the ABS.

Caution should be used in interpreting GVIAP estimates. For example, such estimates are not appropriate if the aim is to represent the value added through using irrigation water as an input to agricultural production.

appendix A Survey methodology

The Murray-Darling Basin is the largest catchment for irrigation activities in Australia. A wide range of irrigated agricultural enterprises are undertaken within the Basin, including vegetable crops, perennial tree and vine crops, pastures for grazing, rice, cotton and a variety of cereal, pulse and oilseed crops. Some of these enterprises, such as rice, rely entirely on the availability of irrigation water. Other activities, such as cereal crops, pasture and cotton, use irrigation water when available but can also be grown under dryland conditions. The major users of irrigation water within the Basin are dairy farms (mainly for pasture, hay and silage production), rice, cotton and horticulture (including both perennial and annual crops) (ABS 2008).

The ABARE survey of irrigation farms was designed to provide coverage of broadacre (including rice and cotton growers), dairy and horticulture irrigation farms in 10 regions across the Murray-Darling Basin (table 8). The survey regions were chosen to cover the major irrigation regions in the Basin and were based on those defined by the CSIRO in its Sustainable Yields Project (CSIRO 2007), namely: Condamine–Balonne; Border Rivers; Namoi; Macquarie–Castlereagh; Lachlan; Murrumbidgee; Murray; Goulburn–Broken; Loddon–Avoca; and Eastern Mount Lofty Ranges (map 1). Some of the CSIRO regions were not covered by the survey because of relatively small numbers of irrigation farms in those regions.

The survey was conducted by ABARE in two stages between October 2007 and March 2008. Irrigation farms in the southern part of the Basin were surveyed from October to December 2007, while farms in the remaining regions were surveyed between February and March 2008.

9 Population of irrigation farms [a] and survey coverage, by region, 2006-07

	population	sample
Condamine–Balonne	1 135	67
Border Rivers	585	32
Namoi	777	39
Macquarie–Castlereagh	658	42
Lachlan	834	44
Murrumbidgee	1 926	129
Murray	5 218	324
Goulburn–Broken	1 720	107
Loddon–Avoca	912	59
Eastern Mt Lofty Ranges	445	57
Total	14 210	900

a Defined as those farms in the dairy, horticulture or broadacre industries that irrigated in 2005-06.

map 1 Murray-Darling Basin regions

Sample farms were selected on the basis of data provided by the Australian Bureau of Statistics. Using these data, target farms were identified by an irrigation flag (defined as farms that irrigated in 2005-06), location (in terms of statistical local area), and industry classification. An advantage of this method is that benchmark data can be used to weight individual farm data in producing averages, so that surveyed farms are representative of an industry in a particular region.

The survey was designed to enable results to be reported by region and industry (dairy, horticulture or broadacre). For this report, survey estimates were drawn from subsets of farms that produced individual irrigated or dryland crops.

The survey was conducted by ABARE field officers using face-to-face interviews to obtain physical and financial details of the farm business for the 2006-07 financial year. The questionnaire was designed to collect comprehensive data on land area and value; broadacre crop production and sales; tree and vine crop production and sales; irrigation water use by crop type and pasture; livestock production and sales; farm receipts and costs; labour use; debts and assets; and market values of farm capital. The survey also included questions on types of water licences held; irrigation water use in 2006-07; water trading; types of irrigation infrastructure; basis for irrigation scheduling decisions; and future intentions.

Target populations

ABARE surveys are designed, and samples selected, on the basis of a framework drawn from the Business Register which is maintained by the Australian Bureau of Statistics (ABS). This framework includes agricultural establishments (that is, farms) classified by size and industry in each statistical local area.

To be eligible for this survey, farms had to have engaged in irrigated agricultural activities during 2005-06, had an estimated value of agricultural operations of $40 000 or more, and be defined as broadacre, dairy or horticulture industry farms.

The industry definitions used in this study are based on the Australian and New Zealand Standard Industrial Classification (ANZSIC). This classification is consistent with international standards and permits comparisons between industries, both within Australia and internationally. Farms assigned to a particular ANZSIC class means that they have a high proportion of their total output characterised by that class (refer to ABS 2006 for further information).

The ANZSIC industry classes and associated codes associated with the broadacre, dairy and horticulture categories used for this study were as follows:

Broadacre	Grain growing	ANZSIC code 0121
	Grain-sheep and grain-beef cattle farming	ANZSIC code 0145
	Rice growing	ANZSIC code 0146
	Other grain growing	ANZSIC code 0149
	Cotton growing	ANZSIC code 0152
	Beef cattle farming	ANZSIC code 0142
	Sheep–beef cattle farming	ANZSIC code 0144
	Sheep farming	ANZSIC code 0141
Dairy	Dairy cattle farming	ANZSIC code 0160
Horticulture	Grape growing	ANZSIC code 0131
	Apple and pear growing	ANZSIC code 0134
	Stone fruit growing	ANZSIC code 0135
	Citrus fruit growing	ANZSIC code 0136
	Other fruit and tree nut growing	ANZSIC code 0139
	Vegetable growing (under cover)	ANZSIC code 0122
	Vegetable growing (outdoors)	ANZSIC code 0123

Survey design and sample weighting

The farm population to be surveyed was stratified by operation size using the estimated value of agricultural operations (EVAO). The size of each stratum was determined using the Dalenius-Hodges method. The sample allocation to each stratum was done using a mixture of the Neyman allocation, which takes into account variability within strata of the auxiliary variable, in this case EVAO, and proportional allocation, which only considers the population number in each stratum. The Neyman allocation allocates large proportions of sample to strata with large variability, in the case of this survey, strata of larger farms.

The estimates presented in this report are calculated by appropriately weighting the data collected from each sample farm and then using the weighted data to calculate population estimates. Generally, larger farms have smaller weights and smaller farms have larger weights, reflecting the strategy of sampling a higher fraction of the larger farms than of small farms (the former having a wider range of variability of key characteristics).

Reliability of estimates

The reliability of the estimates of population characteristics presented in this report depends on the design of the sample and the accuracy of the measurement of characteristics for the individual sample farms.

Sampling errors

Only a small number of farms out of the total number of farms in a particular industry or region are surveyed. The data collected from each sample farm are weighted to calculate population estimates. Estimates derived from these farms are likely to be different from those which would have been obtained if information had been collected from a census of all farms. Any such differences are called 'sampling errors'.

The size of the sampling error is most influenced by the survey design and the estimation procedures, as well as the sample size and the variability of farms in the population. The larger the sample size, the lower the sampling error is likely to be. Hence, national estimates are likely to have smaller sampling errors than industry and state estimates.

References

Australian Bureau of Statistics (ABS) 2006, *Australian and New Zealand Standard Industrial Classification (ANZSIC)*, cat no. 1292.0, Canberra.

—— 2008a, *Water and the Murray-Darling Basin – A Statistical Profile*, cat no. 4610.0.55.007, Canberra.

—— 2008b, *Methods of estimating the Gross Value of Irrigated Agricultural Production*, cat no. 4610.0.55.006, Canberra.

—— 2009, *Experimental estimates of the gross value of irrigated agricultural production, 2000-01 to 2006-07*, cat no. 4610.0.55.008, Canberra.

CSIRO 2007, *The CSIRO Murray-Darling Basin sustainable yields project*. Available from URL: http//www.csiro.au/partnerships/MDBSY.html.

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02.09

AusAid

Australian Fisheries Management Authority

Australian Government Department of Climate Change

Australian Government Department of the Environment, Water , Heritage and the Arts

Australian Government Department of Infrastructure, Transport, Regional Development and Local Government.

Australian Government Department of Resources, Energy and Tourism

CRC Plant Biosecurity

CSIRO (Commonwealth Scientific and Industrial Research Organisation)

Dairy Australia

Department of Primary Industries, Victoria

DN Harris and Associates

European commission

Fisheries Research and Development Corporation

Fisheries Resources Research Fund

Forest and Wood Products Australia

Grains Research and Development Corporation

Grape and Wine Research and Development Corporation

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The Treasury