NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Maximising returns from water in the Australian vegetable industry

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SECTION 3 – WATER USE IN THE NSW VEGETABLE INDUSTRY

3.1 – MANAGEMENT OF WATER RESOURCES IN NEW SOUTH WALES

In New South Wales, water policy and regulatory functions are undertaken by the Department of Natural Resources (DNR). State Water is a state-owned corporation responsible for delivery of bulk water to retailers. State Water incorporates, into a single business, all of New South Wales' bulk water delivery functions outside the areas of operation of the Sydney Catchment Authority, Sydney Water Corporation, Hunter Water Corporation and other water supply authorities. It owns 19 large dams and one small dam, and manages another 11 small dams on behalf of the Department of Lands. (The capacities of NSW's main water storages are listed in Table 8.)

Source: from the State Water website.

Table 8 – Main water storages in NSW, 2004

Catchment	Major storage	Storage capacity (ML)
Murrumbidgee catchment	Blowering	1 631 410
	Burrinjuck	1 026 000
Lachlan River Slopes catchment	Carcoar Dam	35 800
	Wyangala Dam	1 220 000
Upper Macquarie River catchment	Ben Chifley Dam	30 800
	Oberon Dam	45 400
	Burrendong Dam	1 188 000
Hawkesbury–Nepean catchment	Lake Burragorang	2 031 000
Murray catchment	Hume Reservoir	3 038 000
	Dartmouth (Victoria)	3 906 000
NSW total		19 015 000

*Source: State Water and Sydney Catchment Authority websites

Additionally, State Water owns and manages more than 280 weirs and regulators. State Water delivers water to irrigation corporations, country town water supply authorities, farms, mines and electricity generators, by releasing flows from its dams into rivers to be accessed by water users. It also provides water for stock and domestic users and is responsible for delivering environmental flows on regulated rivers.

State Water's core water delivery business provides services to about 6200 customers who purchase water sourced from 'regulated rivers'. These services include the operation of its assets (the dams and weirs) to deliver allocated water from storages, metering and commercial services. The operation of these assets enables the delivery of about 5000 GL/year of bulk water to water users and the environment in the 14 regulated river systems, along 7000 km of river.

Large commercial customers (wholesalers) of State Water include irrigation companies such as Murrumbidgee Irrigation (MI) and Murray Irrigation (MIL). The bulk water licence is managed by those commercial entities under the relevant Land and Water Management Plans (LWMP). Individual irrigators who buy the water are shareholders in the companies and have ultimate responsibility for meeting the conditions set under the relevant LWMPs.

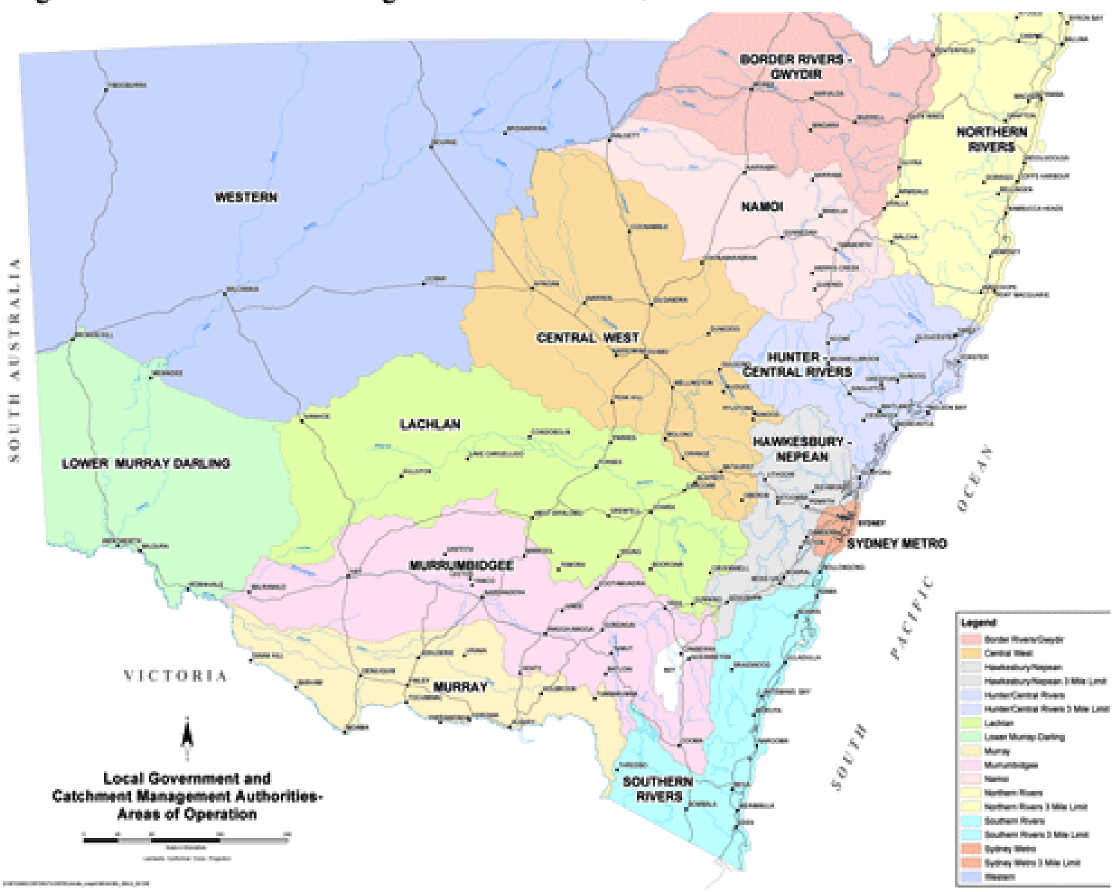
The role of the CMAs

Thirteen Catchment Management Authorities (CMAs) have been established across the state by the New South Wales Government to ensure that regional communities have a significant say in how natural resources are managed in their catchments (Figure 6).

The CMAs are locally driven organisations with a board that reports directly to the NSW Minister for Natural Resources. These statutory bodies, established under the *Catchment Management Authorities Act 2003* (CMA Act), coordinate natural resource management (NRM) in each catchment. They are responsible for involving regional communities in the management of the NRM issues facing their region, and are the primary means for the delivery of funding from the NSW and Commonwealth governments to help land managers improve and restore the natural resources of the state.

Each CMA board consists of a chairperson and up to six board members, who provide a range of experience, skills and knowledge in areas such as primary production, cultural heritage, biodiversity conservation, business administration and governance. Each CMA also has a general manager and a small team of professional staff. The CMAs work in partnership with the community, local government, state government agencies, industry and individuals. The CMAs are responsible for managing natural resources at the catchment scale. Key roles include preparing Catchment Action Plans (CAPs)

Figure 6 – Catchment Management Authorities, NSW



and managing incentive programs to implement the plans. The preparation of CAPs involves integrating previous work with the latest information and science and with local knowledge.

The CMAs' investment strategies will deliver $436 million from the National Action Plan (NAP) for Salinity and Water Quality and the Natural Heritage Trust (NHT) to on-ground works around the state. The strategies will aim to implement the standards and targets set by the NSW Natural Resources Commission and the funding requirements of both the NSW and the Commonwealth governments. The CMAs will also be responsible for administering and managing native vegetation consents under the *Native Vegetation Act 2003*, including Property Vegetation Plans (PVPs) for land clearing consents.

The specific functions of CMAs are described in Section 15 of the CMA Act. Their water-related roles can be summarised under the following headings.

Planning and investment

- Develop and implement CAPs, investment strategies and annual implementation plans.
- Make decisions on NAP/NHT expenditure.
- Manage NAP/NHT contracts.
- Provide financial assistance for catchment activities.
- Deliver incentives through PVPs and other mechanisms.
- Provide advice to local government and state government agencies on the impact of environmental planning instruments on natural resources.

Water

- Manage environmental water licences and water conservation trusts.
- Help communities make decisions on water management.

On-ground works

- Undertake or facilitate on-ground natural resource management works for the purpose of catchment activities, such as river rehabilitation, native vegetation management and salinity mitigation programs.
- Manage soil conservation and erosion mitigation projects.
- Help landholders undertake works to improve catchment health.

Security of water licences in NSW

In all regulated rivers in NSW, rules apply that ensure a very high reliability of supply to those with high security licences. Apart from local water utilities, and domestic supply, this generally applies to permanent horticulture and agricultural businesses highly dependent on water such as feedlots and piggeries. The rules can vary from system to system (see Table 9 for a comparison of the relative allocations within the vegetable-growing regions). For instance, in the Murray and Murrumbidgee, inflows from the Snowy Scheme are adequate to ensure there will always be sufficient water available to provide full allocations to high security in future years, unless a severe drought worse than any on record is experienced. In all other regulated systems in NSW, there is insufficient volume of assured inflow each year to guarantee full high security allocations. In these systems, water is set aside in the dam to provide for town water supplies, stock and domestic users, and high security licence holders in future years (generally two years) before any allocation is made to general security. The volume set aside also takes into account the losses likely to occur in delivering the water to farms.

Source: Advice to Water Management Committee Fact sheets 1–5.

Table 9 – High security licences compared with general security licences

Regulated system (vegetable growing regions)	High security irrigation licences (ML)	General security licences (ML)	Ratio of high security to general security licences
Macquarie/Cudgegong	17 500	633 000	2.8%
Lachlan	27 000	594 000	4.5%
Belubula	7 400	19 000	38.9%
Murrumbidgee	279 000	2 416 000	11.5%
Murray	151 000	1 954 000	7.7%
Darling	7 400	30 000	24.7%

Source: DIPNR, *Regulated rivers (high security) access licences,* Advice notes to Water Management Committees No. 4.

For this reason, the Murray and the Murrumbidgee are generally regarded as the more secure river valleys for water in NSW. During the worst of the 2002–05 drought in the Murrumbidgee, general security allocations did not fall below 38% and water was easily purchased through intra-valley transfer if an anticipated shortfall was expected. Most vegetable growers managed water sufficiently to plant and harvest the vast majority of their normal vegetable crop.

While a large proportion of high security water is dedicated to permanent tree and vine crops, high security water is also diverted to vegetable crops, particularly in the Murrumbidgee.

High security water allocation is always substantially higher than general security water, as demonstrated in Table 10.

Table 10 – Allocation to high versus general security water in NSW valleys, 2001–04

	2001/02		2002/03		2003/04	
	High security (%)	General security (%)	High security (%)	General security (%)	High security (%)	General security (%)
Murray	83	86	83	8	83	45
Murrumbidgee	95	72	95	38	95	41

3.2 – WATER DIVERSIONS IN NSW

According to the 2002/03 Water Audit Monitoring Report in the Murray–Darling Basin (Table 11), a total of 3972 GL of water was diverted for irrigated agriculture in NSW. Of this, the largest diversion was to the Murrumbidgee (1778 GL), followed by the Murray (824 GL) and the Macquarie/Castlereagh/Bogan system (390 GL). Total water diverted within the Basin to irrigated agriculture in 2002/03 was 8079 GL.

Table 11 – Murray–Darling Basin diversions, 2002/03

	Irrigation diversion (GL)	Other diversion (GL)	Total diversion (GL)
Border Rivers	137	1	137
Gwydir	238	0	238
Namoi/Peel	284	10	294
Macquarie/Castlereagh/Bogan	390	21	411
Barwon–Darling	19	0	19
Lower Darling	60	47	107
Lachlan	243	10	253
Murrumbidgee	1778	15	1793
Murray	824	55	879
Total	**3972**	**158**	**4131**

Source: MDBC 2003b

Estimated groundwater usage (Table 12) in the Basin was 1632 GL equivalent to 20% of the total surface water allocations (MDBC 2003b). In 2002/03 this represented only 57% of the groundwater allocation. Groundwater usage in NSW in 2002/03 was highest in the Murrumbidgee (416 GL), followed by the Lachlan (170 GL), the Murray (146 GL) and the Macquarie/Castlereagh/Bogan (79 GL).

Table 12 – Groundwater management areas, water usage, 2001 to 2004

Valley description	2001/02 (ML)	2002/03 (ML)	2003/04 (ML)
Lachlan total	**96 837**	**169 838**	**172 720**
Upper Lachlan (upstream of Lake Cargelligo)	17 141	43 553	43 012
Lower Lachlan (downstream of Lake Cargelligo)	78 036	122 800	128 682
Belubula Valley	1 267	1 075	756
Young Granite	393	2 410	269
Macquarie total	**41 654**	**79 525**	**56 235**
Lower Macquarie (downstream of Narromine)	30 966	54 520	43 118
Upper Macquarie (upstream of Narromine)	6 843	14 755	11 521
Cudgegong Valley	1 227	5 324	1 595
Oxley Basin	2 617	4 925	0
Murray total	**79 181**	**146 535**	**32 592**
Billabong Creek (upstream of Mahonga)	565	915	965
Upper Murray (upstream of Corowa)	5 126	10 266	7 870
Lower Murray (downstream of Corowa)	73 490	135 354	23 757
Murrumbidgee total	**345 696**	**415 925**	**298 243**
Lower Murrumbidgee (downstream of Narrandera)	326 270	382 250	290 593
Mid Murrumbidgee (upstream of Narrandera)	19 426	33 675	7 650
Total all areas NSW (including Border rivers, Namoi and Gwydir valleys)	**800 639**	**1 237 514**	**805 964**

Source: DIPNR 2005, *Submission to IPART to set Bulk Water Resource Management Charges from 1 July 2005*.

In terms of water trading, the bulk of inter-valley trading occurs between the Murrumbidgee and the Murray. During the low allocation years of 2002/03 and 2003/04, water moved from the Murrumbidgee to the Murray. In 2002/03, 14 789 ML of water was transferred from the Murrumbidgee to the Murray, while a further 21 297 ML was transferred into the Murray from Victoria. In the same year a total of 198 023 ML of temporary allocation was sold within the Murrumbidgee Valley.

Water allocation policy

There are two broad categories of licences for water in the regulated river system of the Murrumbidgee: high security licences and general security licences. High security licences are generally used for permanent plantings such as fruit trees and vines, and are guaranteed to receive their full entitlement at all times, except during the most severe droughts. Less than 10% of vegetables grown in the MIA are grown using high security water. With the introduction of water reforms, high security licence holders will receive 95% of their base allocations, and the remaining 5% is diverted to environmental flows (DIPNR 2005).

Farms with a general security licence have entitlements to a maximum 1400 ML per year based on a farm size of 220 ha. The entitlements were worked out (see Table 14) on a total irrigable area of a large area farm. Water is allocated at:

- for 120 hectares, 6 ML per hectare
- for the next 120–180 ha, 720 ML plus 10 ML for each irrigable hectare in excess of 120 ha
- for areas in excess of 180 ha, 1320 ML plus 2 ML for each irrigable hectares in excess of 180 ha (Water Resources Commission WRC 1983).

In the MIA, in 2002/03, 14 970 ML was diverted to 3737 ha of vegetable crop, which represented 2% of total diversions in the MIA. Although there is some variation from year to year in the proportion of water diverted for vegetables, the figure is less than 3% of the total (Murrumbidgee Irrigation 2003). In terms of contribution to the agricultural economic value of the Murrumbidgee, vegetable production was worth $103 million in 2001, or almost 6% of the total value for the region.

Table 13 – Regulated river water usage, 2002/03 and 2003/04

Valley	2003/04 irrigated vegetables (ha)	2002/03 total actual usage (GL)	2003/04 total actual usage (GL)	Estimated long-term extraction limit (GL)
Lachlan* (including Hillston)	4003	238	35	305
Macquarie*	647	376	167	392
Murray	2662	927	1240	48
Murrumbidgee	3012	1765	1600	25
North Coast*	2162	29	14	1.6
Hunter*	709	169	133	217
South Coast** and Cooma	1074	9	8	7

Source: DIPNR 2005, *Submission to IPART to set bulk water resource management charges from 1 July 2005*.
* Based on 2001 ABS figures. **Cooma is located on the unregulated section of the Murrumbidgee.

Irrigation diversions to vegetable crops

Water diversions to vegetable crops for the southern inland irrigation districts of Murrumbidgee, Coleambally and Murray are derived from water orders placed by farmers during the season. As water is sometimes diverted to other uses on-farm after it enters a property, the figures published in annual reports are to be regarded as indicative only. In addition, as over 70% of water applied to vegetable crops is by surface irrigation and only metered at the farm level, it is difficult to obtain precise measures of actual crop water use. Table 14 and 15 present some of those 'indicative' figures and can be regarded as a guide to total water use on vegetables as a percentage of total district water allocations on a crop-by-crop basis.

Table 14 – Water allocation, typical Murrumbidgee vegetable farm, 220 ha

Allocation categories	Area	Total water entitlement	
		ML/ha	ML/farm
First 120 ha	120	6	720
Between 120 and 180 ha	60	10	600
Between 180 and 220 ha	40	2	80
Total			1400

Source: WRC 1983

Table 15 – Diversions to vegetable and other crops, Murrumbidgee, 2002/03 and 2003/04

	2002/03		2003/04	
	Area (ha)	Volume delivered (ML)	Area (ha)	Volume delivered (ML)
Vegetables	3 737	14 970	3 012	16 504
Total all crops	152 176	720 420	107 682	628 931
Vegetables as % of total crop volume	2.5	2.01	2.8	2.8

Source: Murrumbidgee Irrigation Annual Environment Report 2003–04

Reporting for larger volume uses such as rice and pastures has a higher level of reliability. It should be noted for Coleambally (Table 16) in particular that groundwater applications to vegetable crops are not reported. A processing tomato crop, for example, may be irrigated with water from channels and from a bore, but is reported as using surface irrigation only.

Table 16 – Diversions to vegetable and other crops, Coleambally Irrigation Area, 2004/05

Crop	Area (ha)	Volume delivered (ML)	Water use (ML/ha)	% total water delivery
Corn (includes sweet corn and maize)	3 670	17 188	4.68	7.1
Processing tomatoes	113.2	425	3.76	0.2
Onions	11	34	3.1	0.01
Pumpkins	10.5	89	8.5	0.04

Source: Coleambally Irrigation Annual Environmental Report 2004/05

3.3 – WATER PRICING POLICY IN NSW

Under the new Rural Water Pricing Policy (1999), the NSW government announced that cross-subsidies for irrigation services would be removed, with full recovery of costs of all service operations as well as the establishment of an asset replacement fund. Under the new arrangements, horticultural and large area farms now pay fixed and variable water charges using separate systems of water pricing. Tables 17 and 18 present a range of water charges from several valleys in NSW.

To illustrate the variations in charging from year to year, note that in 2004/05, on the Murrumbidgee system, when general security allocations were just 43%, a large area farmer with a general security allocation of 1500 ML in the MIA paid a fixed price of $6.73/ML. This price was unrelated to the amount of water used, and included charges such as administration, bulk water, asset levy, entitlement fee and Land and Water Management Plan costs. The variable cost related to water volume used was $12.92/ML, giving a total of $28.57/ML for the 645 ML of water used.

High security water users in the MIA also pay fixed and variable costs. Based on 2004/05 allocations of 95%, high security water users on a 10 ha horticultural farm would pay a fixed price of $13.36/ML and variable costs of $19.05/ML, giving a total of $33.11/ML for actual water used.

Table 17 – Irrigation water costs, Coleambally, Murray and Murrumbidgee rivers, 2004/05

System	Fixed water costs ($/ML)		Variable water costs ($/ML)		Total volumetric charge (variable costs/ML)			
	High security	General security	High security	General security	High security		General security	
Annual allocation					*100%*	*95%*	*100%*	*43%*
Coleambally average farm 250 ha		$19.98		$6.61			$26.61	53.08
Murrumbidgee river pumper		$3.88		$5.04			$8.92	14.06
Lachlan river pumper	$7.09	$4.72	$5.41	$5.41	$12.50	12.87	$10.13	16.39
Murray average farm 500 ha		$11.10		$11.64			$22.74	37.45
Murray, river pumper	$5.23	$4.75	$1.27	$1.27	$6.50	$6.78	$6.02	12.32
Murrumbidgee, average farm 350 ha	$13.36	$6.73	$19.05	$12.92	$32.41	$33.11	$19.65	$28.57

Table 18 – Water charges, large area and vegetable farms (general and high security), MIA, for wet year (100%)* and dry year (43%)

	Large area farm general security		Vegetable farm general security		Small vegetable farm high security	
Annual allocation (ML)	*1500*		*1500*		*150*	
Fixed water costs						
Administration	$285/farm	$285/farm	$285/farm	$285/farm	$285/farm	$285/farm
Rice monitoring	$145/farm	$145/farm				
LWMP	$145.19/ farm	$145.19/ farm	$145.19/ farm	$145.19/ farm	$145.19/ farm	$145.19/ farm
Asset levy	$65.00	$65.00	$65.00	$65.00	$50.00	$50.00
Total allocation charges per megalitre	$5.89	$5.89	$5.89	$5.89	$9.65	$9.65
Envirowise levy	$0.51/ML	$0.51/ML	$0.51/ML	$0.51/ML	$0.51/ML	$0.51/ML
Total fixed costs for total allocation	$10 240.19	$10 240.19	$10 095.19	$10 095.19	$2 004.19	$2 004.19
Total fixed costs per megalitre	$6.83	$15.88	$6.73	$15.65	$13.36	$14.06
Variable water costs						
Season	*wet year*	*dry year*	*wet year*	*dry year*	*wet year*	*dry year*
Actual allocation	1500 ML	645 ML	1500 ML	645 ML	150 ML	142.5 ML
Actual as % of total allocation	100%	43%	100%	43%	100%	95%
Total variable costs	$12.92/ML	$12.92/ML	$12.92/ML	$12.92/ML	$19.05/ML	$19.05/ML
Total water costs	**$19.75**	**$28.80**	**$19.65**	**$28.57**	**$32.41**	**$33.11**

Source: Costs based on 2004/05 water year (Singh, Mullen & Jayasuriya 2005).

In the Sydney Basin, many vegetable growers would use town water only, or a mix of on-farm dam water and town water when supplies run low. Of the irrigators in the Sydney Basin, cut flowers (55%) and nurseries (70%) use town water, while the balance of these growers, and all turf and fruit growers, either use farm dams or are river pumpers.

Charges for town water used by vegetable growers in the Sydney Basin are based on commercial Tier 1 rates. As of October 2005, Tier 1 charges were $1.20/kL, which is equivalent to $1200/ML: it should be remembered, however, that this water is often used in high value operations such as hydroponic systems, and requires little if any treatment prior to use.

While town water is used by many vegetable growers, water from on-farm dams is used when possible to reduce water costs. Water bills for Sydney Basin vegetable growers can be up to $20 000 per annum, so an on-farm water source is the preferred option when adequate supply and water quality permits.

Note that the crop area quoted in Table 19 varies significantly from the ABS crop area reported in Table 2. This is most likely due to small market garden businesses less than 5 ha which are taken into account by the NSW DPI estimate, but may not have been included in the ABS survey figure in 2001.

Table 19 – Reticulated water use for irrigation in the Sydney Basin, Hawkesbury-Nepean system, estimates by industry

	Traditional field grown vegetables	Asian veg market gardens	Traditional market growers	Hydroponic lettuce	Greenhouse cucumbers	Greenhouse tomatoes	Total all vegetables	Total all crops
Estimated no. of growers	150	450	400	35	100	200	1 335	2 917
Estimated average irrigated area (ha) per grower	10	2	2	1	1	1		
Estimated total irrigated area (ha)	1 500	900	800	35	100	200	3 535	11 380
Estimated average annual irrigation volume (ML per farm)	90	14	16	1.5	3	3		
Total estimated average irrigation volume (ML per year)	13 500	6 300	6 400	53	300	600	27 153	83 050
Non-potable water source %	100%	60%	90%	5%	10%	10%		
Potable water source %	0%	40%	10%	95%	90%	90%		
Non-potable water use (ML)	13 500	3 780	5 760	3	30	60	23 133	72 900
Potable water use (ML)	0	2 520	640	50	270	540	4 020	10 150

'Total crops' – including turf, cut flowers, nurseries, fruit trees, nuts etc.

Source: B Yiasoumi, Irrigation Officer NSW DPI, Jan 2006.

Non-potable water sources in Table 19 would include river pumpers, farm dams and groundwater.

For licensed river pumpers, flow meters are now mandatory for large irrigation farms. The system of monitoring used by DNR to estimate water use is shown in Table 20. Although it is anticipated that there will be volumetric charging for water, water charges based per megalitre extracted from the river were not in place as of August 2006.

Table 20 – DNR monitoring systems

Volume extracted from river/ annum	System of metering	Licence required
More than 200 ML	Flowmeter	Yes
21–200 ML	Power consumption record	Yes
Less than 20 ML	Diary entries	Yes

3.4 – THE MURRAY–DARLING BASIN CAP

In the six years prior to 1995, an *Audit of Water Use in the Murray Darling Basin* found that diversions across the Murray–Darling Basin increased by 8%. What was more disturbing was that, during the same period, only 63% of the water that was permitted under existing allocations was used. This raised concerns that if unchecked, further increases would have negative impact on river health. In addition, it would adversely affect water quality across the Basin, and reduce reliability for existing water users. For these reasons, the Murray–Darling Basin Ministerial Council agreed to place a cap on further growth in diversions across the Basin.

It was agreed that the Cap would be set 'at the volume of water that would have been diverted under the 1993/94 level of development and management'. The Cap currently applies to NSW, Victoria and South Australia, with minor adjustments to occur in each state to allow for developments that occurred after 1994. In Queensland, the Cap will be decided at the end of that state's process to develop Water Resource Plans.

from: MDBC 2003a

The benefits of the Cap include:

- stabilising access rights to existing users
- a greater emphasis on achieving water use efficiencies as a means to obtain water for further development
- a subsequent reduction in percolation of groundwater with fewer consequent problems from waterlogging and soil salinisation
- a better framework for trading in water entitlement between the states and between individuals in different states
- less deterioration in water quality
- less deterioration in health of natural ecosystems

Each state must determine its own method for managing diversions. However, a typical approach is to limit the maximum volume that can be diverted in any year. This may be done by first reducing access to 'surplus' flows and then reducing annual allocations. In some valleys, there is still a substantial difference between the Cap and the maximum allocation, so a reduction in annual allocations over time is expected.

Although it did not redress past degradation, the Ministerial Council decision to cap diversions in the Basin was an important step in preventing further decline in the Basin flow regimes. The Cap also established a benchmark for defining future changes in flow. The process for monitoring and managing the Cap is being applied for monitoring and managing any future decisions to increase flows to the environment (*The Living Murray*).