

APPENDIX 5

Sources and statistics on water use

Sources

A first comprehensive national survey of water in Australia (quality, availability and use) was conducted as part of the National Land and Water Resources Audit, which took place between 1997 and 2002. The Audit derived its raw data from a range of sources, primarily State and Commonwealth Departments and agencies.

At about the same time the Australian Bureau of Statistics (ABS) conducted its first '*Water Account Australia 1993-94 to 1996-97*' survey, which was published in May 2000. The next survey in the series, covering the years 1997-8 to 2000-1, was published in May 2004.

While the general order of magnitude of the figures was similar, there were differences between the Audit and ABS figures. For example, the Audit's estimate of total water use in 1996/7 was 24,058 GL and the ABS figure was 22,186 GL.

It is likely that the ABS figures will, over time, create the most reliable series as their regular two-yearly and five-yearly surveys take place in the future.

National Land and Water Resources Audit (NLWRA)

The National Land and Water Resources Audit (the Audit) was set up in 1997 as a partnership between the States, Territories and Commonwealth and funded under the Natural Heritage Trust. The aim of the Audit was to provide better information to resource managers which in turn would improve land, water and vegetation management.¹

The NLWRA, also known as 'Audit 1', took place from 1997 to 2002 at a cost of about \$34 million.

Audit 1 represented the most comprehensive review ever undertaken of Australia's natural resources. A number of detailed reports were published setting out the state of Australia's farming systems and natural environment. An online atlas and data library of the nation's resources were created.

¹ NLWRA home page <http://www.nlwra.gov.au/>

The Australian Natural Resources Atlas provides an extensive range of information across seven key areas: agriculture; coasts; land; people; rangelands; vegetation and biodiversity; and water.²

Audit 1, in its report '*Australian Water Resources Assessment 2000*', made the following comment in relation to the availability of data on Australia's water resources:

Overall, data completeness and quality remain issues for comprehensive reporting of Australia's water resources. On average only 77% of the groundwater management units have information on aquifer characteristics, allocation, use and extraction. Similarly 78% of all surface water management areas have information on water availability, allocation, use and water trading. However the reliability of this data is extremely variable...water quality and trend information is even further limited.³

In discussing data content, quality, and comparability, the Audit noted:

Data are extremely variable....There is a mismatch between data availability and quality, and the requirements of decision makers.⁴

The Audit found a great diversity of procedures, methodologies, and definitions between the States and Territories in relation to water issues, which had evolved over the last 150 years or so. This made it very difficult to compare methods and processes in different States and the results achieved.

The Audit recommended that:

Australia requires a systematic, and Australia-wide approach for water resource data collection to provide a foundation for improved water resources management. Data analysis and access need to be compatible and comparable.⁵

Following a review of the results of Audit 1, the Commonwealth decided to continue the project. Audit 2 is a five year program, 2003 – 2007, with a budget of up to \$3 million per annum.

Audit 2 collects data and information to enable an evaluation of natural resource management initiatives such as the National Action Plan for Salinity and Water Quality, and the Natural Heritage Trust.

² The web site for the Atlas is at http://audit.ea.gov.au/ANRA/atlas_home.cfm

³ National Land and Water Resources Audit '*Australian Water Resources Assessment 2000*', p. 83.

⁴ National Land and Water Resources Audit '*Australian Water Resources Assessment 2000*', p. 84.

⁵ National Land and Water Resources Audit '*Australian Water Resources Assessment 2000*', p. 84.

Australian Water Data Infrastructure Project

In response to the Audit recommendation, the Australian Water Data Infrastructure Project (AWDIP) was established to develop a comprehensive national water information framework.

This project is managed by the Executive Steering Committee for Australian Water Resources Information. The Steering Committee comprises representatives of: the Commonwealth Departments of Agriculture, Fisheries and Forestry (Chair) and Environment and Heritage; representatives from each State and Territory government; and representatives from the Australian Bureau of Statistics, the National Land and Water Resources Audit, the CSIRO, the Bureau of Meteorology, the Bureau of Rural Sciences, and the Murray-Darling Basin Commission. This project is funded under the National Heritage Trust.

The Steering Committee met for the first time in May 2003, and meets two or three times a year. It reports to the Audit Advisory Council of the National Land and Water Resources Audit on data coordination issues.

Australian Bureau of Statistics

The ABS's first '*Water Account Australia 1993-94 to 1996-97*', published in May 2000, contains detailed water supply and water use tables. This survey was based primarily on data collected by State-based departments and agencies, such as bulk water suppliers. The ABS published the next in the series, *Water Account Australia 1997-98 to 2000-01*, in May 2004.

In October 2003 the ABS distributed to a large sample of irrigators (7,000 out of an estimated total population of about 38,000 irrigators) a *Water Survey - Agriculture* (WSA) questionnaire to gather information on water availability and use in irrigated agriculture in 2002-03. The information being collected on the WSA covers:

- Water entitlements and allocations
- Trading of water (buying and selling)
- Area of pastures and crops irrigated
- Volumes of water applied to pastures and crops
- Irrigation methods
- Irrigation scheduling tools
- Sources of irrigation water
- On-farm water storage
- On-farm water recycling
- Areas of laser levelling for irrigation
- Changes to irrigation practices
- Irrigation expenses
- Basic farm financials - value of agricultural and irrigated production, and net profit/loss from agricultural production

The *Water Survey – Agriculture 2002-03* represents the first time that the ABS has collected detailed information on water direct from farmers themselves. This report is expected to be published in late 2004.

The ABS is planning to undertake a *Water Survey – Agriculture* report every two years, and the more extensive *Water Account for Australia* every four years. To complete the water picture, in 2005 the ABS is planning to also commence two yearly *Water Surveys* to cover urban and industrial water use, and stock and domestic rural water use.

Statistical overview

Information is drawn from the National Land and Water Resources Audit and the State of the Environment Report 2001.⁶

Water Availability

Surface water

On average, only 12 % of Australia's rainfall runs off to collect in rivers and streams. The remaining 88% of rainfall is accounted for by evaporation, water used by vegetation, and water held in storages including natural lakes, wetlands and groundwater aquifers.

Table 1 shows that most run-off occurs in the northern parts of the continent, with three drainage divisions, North East Coast, Timor Sea and Gulf of Carpentaria, representing about two-thirds of total mean annual run-off.

Mean annual run-off totals 387 184 GL, of which 18 147 GL (4%) is presently diverted for consumptive use.

Drainage division	Mean annual run-off (GL)	Percent mean annual run-off (%)	Mean annual outflow (GL)	Volume diverted (GL)
North-East Coast	73 411	19.0	69 580	3 182
South-East Coast	42 390	10.9	40 366	1 825
Tasmania	45 582	11.8	45 336	451
Murray–Darling	23 850	6.2	5 750	12 051
South Aust. Gulf	952	0.2	787	144
South-West Coast	6 785	1.8	5 925	373
Indian Ocean	4 609	1.2	3 481	12
Timor Sea	83 320	21.5	81 461	48
Gulf of Carpentaria	95 615	24.7	96 066	52
Lake Eyre	8 638	2.2	n/a	7
Bulloo–Bancannia	546	0.1	–	<1
Western Plateau	1 486	0.4	n/a	1
Total	387 184	100%		18 147

Source: National Land and Water Resources Audit, Australian Water Resources Assessment 2000, p. 25.

6 In May 2004 the ABS published *Water Accounts Australia 1997-98 to 2000-01*, which contains the latest figures on water use.

Australia has 447 large dams with a combined capacity of 79,000 GL, developed mainly for urban, irrigation and hydroelectric power uses. Australia's several million farm dams account for an estimated 9% of the total water stored.

Groundwater

Australia has 25,789 GL of groundwater that can be extracted sustainably each year and is suitable for potable, stock and domestic use, and irrigated agriculture. Ten percent (2489 GL) is used. Australia has one of the world's largest aquifer systems: the Great Artesian Basin is an estimated 1.7 million km² and stores 8.7 million GL. Each year the Great Artesian Basin supplies 570 GL of water for a variety of uses—mainly grazing and mining.

Water Use

There is a great variation in water use. Some areas of the country such as the northern coastline make little use of divertible water resources. Other areas make significant use, notably the Murray–Darling Basin. Table 1 shows that 51% of runoff in the Basin is diverted for use.

Approximately 73% of the water used in Australia (~24,000 GL in total) is supplied by rivers, 21% by groundwater aquifers, and the remaining 9% by harvest of overland flows. Surface water predominates in all States and Territories except Western Australia and the Northern Territory.

Surface water use

Table 2 shows that surface water use in Australia increased by 59% between 1983/4 and 1996/7. An estimated 26% of Australia's 325 surface water management areas are either close to or overused compared with their sustainable flow regimes.

Table 2. Change in mean annual surface water use (GL), 1983/84–1996/97			
	Total use 1983/84	Total use 1996/97	Percent increase
	(GL)	(GL)	
NSW	5 932	9 000	52
Victoria	3 714	5 166	39
Queensland	1 209	2 969	145
WA	461	658	43
SA	498	746	50
Tasmania	165	451	173
NT	29	51	76
ACT	n/a	68	–
Total	12 008	19 109	59

Source: National Land and Water Resources Audit

Groundwater use

Table 3 shows that groundwater use across Australia increased 88% between 1983/4 and 1996/7. Overall, 32% of groundwater extracted is for urban-industrial use, 51% for irrigation and 17% for stock watering and rural use. It is estimated that 30% of Australia's groundwater management units are close to or overused compared with their sustainable yield.

	1983/84 (GL)	1996/97 (GL)	Percent increase
NSW	318	1 008	217
Victoria	206	622	202
Queensland	1 121	1 622	45
WA	373	1 138	205
SA	542	419	-22
Tasmania	9	20	122
NT	65	128	97
ACT	n/a	5	–
Total	2 634	4 962	88

Source: National Land and Water Resources Audit, Australian Water Resources Assessment 2000, p. 65

Uses of water

Approximately 75% of the water used in Australia is for irrigated agriculture. NSW (48%), Victoria (25%) and Queensland (16%) account for 90% of Australian irrigation. Half of the profit in 1996/97 from Australian agriculture, when measured as profit at full equity, was generated from irrigated production systems. These occupy less than 0.5% of Australia's land area. About 20% of total water use is for urban and industrial purposes, the rest for other rural uses such as stock and domestic needs.

	Irrigation	Urban/industrial	Rural	Total use
NSW	8 643	1 060	305	10 008
Victoria	4 451	987	339	5 777
Queensland	2 978	1 052	561	4 591
WA	710	1 027	59	1 796
SA	819	292	53	1 164
Tasmania	276	186	9	471
NT	53	87	39	179
ACT	5	63	4	72
Total	17 935	4 754	1 369	24 058

Source: National Land and Water Resources Audit, Australian Water Resources Assessment 2000, p. 56

Australian water use increased by 65% between 1983/84 and 1996/97. This was mostly due to increases in irrigated agriculture. Urban centres have shown either low increases or net decreases in water consumption per person over the same period.

Table 5. Change in mean annual water use (GL) in Australia between 1983/84 and 1996/97 by water use category

	1983/84	1996/97	Percent change%
Irrigation	10 200	17 935	76
Urban/industrial	3 060	4 754	55
Rural	1 340	1 369	2
Total	14 600	24 058	65

Source: National Land and Water Resources Audit, Australian Water Resources Assessment 2000, p. 57

There are great variations in the efficiency of delivery systems used to supply irrigation water. On average, only 77% of water reaches users' properties, although supply efficiency can be as low as 45% in some irrigation areas.

Financial return

Different irrigation enterprises and the intensity of water use in those enterprises leads to a wide range in the economic benefits achieved from irrigation. There is scope for further rationalisation of water use and increases in returns as water use moves to higher value products. The gross value from irrigated agriculture for 1996/97 was \$7,254 million. The highest financial return in agriculture per hectare of irrigation comes from vegetables, closely followed by fruit. Financial return on net water use is similarly highest for vegetables followed by fruit.

Table 6. Water use and gross value for irrigated agriculture (1996/97)

	Gross value (\$m)	Net water use (GL)	Irrigated area (ha)	Value/ha \$/ha	Value/GL \$m/GL
Livestock, pasture, grains, etc.	2 540	8 795	1 174 687	2 162	0.3
Vegetables	1 119	635	88 782	12 604	1.8
Sugar	517	1 236	173 224	2 985	0.4
Fruit	1 027	704	82 316	12 476	1.5
Grapes	613	649	70 248	8 726	0.9
Cotton	1 128	1 841	314 957	3 581	0.6
Rice	310	1 643	152 367	2 035	0.2
Total	7 254	15 503	2 056 581		

Source: National Land and Water Resources Audit

International comparisons

Australia has a variable climate with high levels of evapotranspiration, resulting in a low proportion of rainfall converted to runoff. Table 7 shows that Australia is relatively dry in terms of overall rainfall and runoff. Australia has about 5% of the world's land and about 1% of its water resources.

Region	Land Area Millions of sq. kms	Estimated % of world's total water resources (a) %	Average annual rainfall (b) mm	Estimated runoff as % of average annual rainfall (b) %
Africa	30.3	9	690	38
America, North	24.7	16	660	52
America, South	17.8	27	1,630	57
Asia	44.9	33	600	48
Australia	7.7	1	465	12
Europe	9.9	14	640	39

Source(a) Food & Agricultural Organisation, Water Report No. 23 – Review of Water Resources by Country 2003, p. 127
Source (b) Year Book Australia 2003, p. 30.
Percentages have been rounded to nearest whole number.

Australian rivers have comparatively low and variable flows. Table 8 compares some of the major rivers around the world with three of Australia's major rivers.

Country	River	Ratio of maximum to minimum annual flows
Brazil	Amazon	1.3
Switzerland	Rhine	1.9
China	Yangtze	2.0
Sudan	White Nile	2.4
USA	Potomac	3.9
Australia	Murray	15.5
Australia	Hunter	54.3
Australia	Darling	4705.2

Source: Murray Darling Basin Commission presentation

A recent study estimated water availability and use in fourteen selected countries (see Table 9). Australia ranked fourth in Estimated Per Capita Water Withdrawal in 2000. The study noted that the data should be viewed with caution, as it comes from different sources and over different periods. As well, international comparisons of water availability and water use must be highly qualified because circumstances vary so greatly.

Table 9. Water resources and withdrawals, selected countries

Country	Annual Renewable Water Resource km³/yr (year of estimate)	Total Freshwater Withdrawal kms³/yr (year of estimate)	Estimated per capita withdrawal in 2000 m³/p/yr	Agriculture as % of total water usage %
Argentina	814 (2000)	28.6 (1995)	772	75
Australia	398 (1995)	17.8 (1995)	945	75
Canada	2901 (1980)	43.9 (1990)	1,431	8
Chile	922 (2000)	20.3 (1987)	1,334	84
Germany	182 (2001)	58.9 (1990)	712	18
Indonesia	2,838 (1999)	74.4 (1990)	350	93
Mexico	457 (2000)	77.8 (1998)	787	78
New Zealand	397 (1995)	2.0 (1991)	532	44
South Africa	50 (1990)	13.3 (1990)	288	72
Spain	111 (1985)	33.3 (1994)	837	62
Thailand	410 (1999)	33.1 (1990)	548	91
Turkey	201 (1997)	31.6 (1992)	481	72
United Kingdom	120 (1980)	11.8 (1994)	201	3
USA	2,478 (1985)	469 (1995)	1,688	42

Source: The World's Water 2002-03 - The Biennial Report on Freshwater Resources, p. 237 & 243. Pacific Institute for Studies in Development, Environment, and Security, Oakland California.

Australia has about 1% percent of the world's water resources, and about 0.3% of its people. On this basis Australia could be regarded as 'water rich' per person. However, other considerations need to be taken into account. For example, almost half of Australia's water resources are in the far north, remote from the major population and agricultural centres. Australia's relatively high rate of per capita water usage reflects its large agricultural production, much of which is exported, and the amount of water used in irrigation.