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AN EXPERIMENTAL MONETARY WATER ACCOUNT FOR AUSTRALIA

AUSTRALIA

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CONTENTS

INQUIRIES

For further information about these and related statistics, contact the National Information and Referral Service on 1300 135 070 or Peter Comisari on Canberra (02) 6252 5381.

NOTES

ABSTRACT

Water accounts analysing the volume of water supplied and used in the Australian economy have been produced by the Australian Bureau of Statistics (ABS) in *Water Account, Australia* (ABS cat. no. 4610.0), for 1993–94 to 1996–97 and for 2000–01 and 2004–05. Data in the Water Account can theoretically be linked to economic data such as presented in the national accounts, and the inclusion of a range of monetary data in the Water Account itself would greatly facilitate such linking. This publication presents experimental water accounts analysing the revenue and expenditure associated with the supply and use of water in the Australian economy. It allows some of the physical flows of water to be matched with monetary transactions for the year 2004–05. Linking monetary and physical water accounts provides information useful for determining efficient water allocation, achieving cost recovery for water infrastructure assets and analysing trade-offs between alternative water and economic policies. A feature of this publication is a discussion of gaps and deficiencies requiring attention if a more complete monetary water account were to be produced for Australia.

ABBREVIATIONS

'000	thousand
$m	million dollars
ABS	Australian Bureau of Statistics
ANZSIC	Australian and New Zealand Standard Industrial Classification
cat. no.	Catalogue number
GL	gigalitre
I-O	input-output
kL	kilolitre
L	litre
ML	megalitre
nec	not elsewhere classified
no.	number
NWI	National Water Initiative
SEEA	System of Integrated Environmental and Economic Accounting
SEEAW	System of Environmental-Economic Accounting for Water
SNA	System of National Accounts
SNA93	System of National Accounts 1993
SNA93 Rev.1	System of National Accounts, revision to the 1993 edition
UN	United Nations

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INTRODUCTION

In Australia, water is a limited resource unevenly spread across the nation and over time. Water is not only essential for basic human needs and the health of ecosystems; it is also an essential input to economic production processes. The current drought has highlighted the importance of water to certain industries and the need for efficient use of water. The drought had been forecast to reduce growth in Gross Domestic Product (GDP) by 0.5% in 2006–07 due to a decline in agricultural production (ABS, 2006b).

Monetary water accounts provide a range of information of analytical interest. For example, they support the generation of output and value added measures for water-related industries. In addition, assigning monetary values to water stocks and flows for various water users permits a direct comparison of these values with the corresponding physical stocks and flows. Monetary water accounts also support commensurability with monetary measures of other natural resource stocks and flows (such as mineral and energy asset stocks and depletion of these stocks) thereby supporting potentially powerful analytical frameworks such as the *System of Environmental and Economic Accounts 2003* (SEEA).

Agreements developed by the Council of Australian Governments (CoAG) in 1994 and 2004 aim to increase the productivity and efficiency of Australia's water use. One of the key elements of the 2004 National Water Initiative (NWI) was to introduce best practice water pricing and institutional arrangements to promote economically efficient and sustainable use of water resources, water infrastructure assets and government resources devoted to the management of water. The information provided by linking monetary and physical water accounts could be useful for determining efficient water allocation, achieving cost recovery for water infrastructure assets and analysing trade-offs between alternative water and economic policies (United Nations Statistics Division, 2006).

This publication presents experimental monetary water accounts, and a discussion of methods, data sources and possible future developments in this field of work. The scope of this publication is limited to 'distributed water' which, in this context, is defined as water that has been supplied from one economic unit to another for a fee, creating a measurable economic transaction. Distributed water includes urban mains water as well as water delivered to irrigators by rural water suppliers. Many economic entities use self-extracted water for their own use, such as farms for irrigation or hydro power plants to generate electricity. Estimates for the value of self-extracted water have not been included in this publication due to a lack of reliable data, however a discussion of methods and issues related to the valuation of this category of water is included.

This publication builds on the work presented in *Research Paper: An Experimental Monetary Water Account for Australia, 2003–04* (ABS cat. no. 4610.0.55.004). It is the product of recent development work and therefore the estimates should be considered experimental at this stage.

The Australian Bureau of Statistics welcomes comments on this publication. Comments should be directed to:

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FRAMEWORKS

This section describes key frameworks associated with the 2004–05 monetary water account. In particular, it describes the '*System of Integrated Environmental and Economic Accounting 2003*' (SEEA) which governs much of the ABS work on environmental accounting, including monetary water accounts. The supply–use framework, which is used in this work to organise and confront various items of information, is also described.

SYSTEM OF INTEGRATED ENVIRONMENTAL AND ECONOMIC ACCOUNTING 2003

The SEEA is an analytical framework for environmental accounting that is under continuing development by the international statistical community. It provides extensive guidance on the development of accounts for each of the types of natural capital including water, land, minerals and ecosystems. The SEEA includes stock accounts, which measure the amount of a natural resource available for use in the economy at a point in time (e.g. water stored in dams, or minerals in the ground), and flow accounts that measure the change in the resource (e.g. how much is used over a period of time). These accounts can be compiled in physical or monetary units, and although work in this area has so far concentrated largely on physical accounts (e.g. ML of water, tonnes of minerals) the national balance sheet of the *Australian System of National Accounts* contains a time series of monetary values relating to land and to mineral and energy assets.

The development of monetary environmental accounts is limited at present since market values for natural resources are not always available, and where they are available, are not always appropriate to valuing the resource. In particular, market prices are derived through a mechanism that itself ignores most environmental externalities. However, monetary environmental accounts allow us to assess the impact of economic development on the different types of natural resources using a common basis of measurement. Potentially they can be used to assess, for example, the effects on the economy of environmental degradation and depletion of natural resources.

The SEEA shows how these individual environmental accounts can provide the basis of a natural capital balance sheet integrable with the national balance sheet for economic assets as described in the 1993 edition of the *System of National Accounts* (SNA93). The development of a monetary water account is therefore an important step in developing a comprehensive set of accounts to support a SEEA-style measurement of the contribution of natural resources to economic growth, and the effects that economic and human development have on our environment.

Within the broader context of the SEEA, the draft *System of Integrated Environmental and Economic Accounting for Water Resources* (SEEAW) released in May 2006 provides a consistent framework for compiling various water-related environmental-economic outputs, including monetary water accounts. Full monetary water accounts would provide information on:

- the supply of distributed water in the economy by the Water Supply, Sewerage and Drainage Services industry;
- expenditure on water and sewerage services by industries, households and governments;
- value added to the economy for the major industries related to water;
- the value of water extracted for own use (self-extracted water);

SYSTEM OF INTEGRATED ENVIRONMENTAL AND ECONOMIC ACCOUNTING 2003 *continued*

- water and waste water protection and management expenditure (expenditures made by the economy for the protection and management of water resources); and
- asset accounts, which can be compiled for the value of water and sewerage infrastructure assets, and the value of the stock of water itself.

It is not possible to implement all the above components of monetary water accounts for Australia at present because much of the required data are either unavailable or are of poor quality. Consequently, this publication concentrates on the supply of distributed water and waste water and sewerage services by the Water Supply, Sewerage and Drainage Services industry, and expenditure on water and waste water and sewerage services by industries, governments and households, and the value of water and sewerage infrastructure assets.

SUPPLY–USE FRAMEWORK

The approach used in this publication to compile the monetary water account is based on a supply–use system. This system is widely used by statistical agencies to compile national accounts and various satellite accounts, and serves both as a mechanism to assess the consistency of data drawn from different sources and as a framework to effect the necessary improvements. A feature of this system is that measures of supply and use for each product (i.e. each category of water and related services) in scope by sector are independently calculated, and discrepancies between supply and use can then be resolved using a systematic process of data confrontation.

The supply table records the total supply of certain categories of water and related services in the economy, and the use table shows the use of these categories of water and related services throughout the economy. Total use is broken into intermediate consumption and final consumption. The use of categories of water and related services by industry or by general government is considered intermediate consumption as water is used in production processes for goods and services that are then consumed by other producers or by households. The use of categories of water and related services by households is termed final consumption as households are, in this instance, the final users of the outputs of production. Use tables generally also show capital expenditure, changes in inventories and exports. These three items are not relevant for this exercise as expenditure on water and related services is rarely capitalised and water is not exported from Australia, though this concept would apply where water flows across country boundaries, as in Europe. (Input-output modelling could potentially show not only where water is *directly* used but also the *indirect* use of water. For example, water is used by the Agriculture industry to produce food for households, and water is *embodied* in this food. An advantage of input-output modelling is that it enables indirect water use to be attributed to final users so that cumulative water use can be estimated for each final demand category. It is therefore possible to estimate the extent to which water is embodied in the various products exported from Australia, however, such an analysis is outside the scope of this publication.) In Australia, changes in water inventories occur but these are difficult to measure and have been excluded from this exercise.

Monetary supply–use tables can be presented in conjunction with the corresponding physical tables as hybrid accounts. Hybrid accounts link the monetary and physical information related to water supply and use, and can also be used to link the emission of pollutants in return flows to the environment.

METHODOLOGY

This section broadly describes how the 2004–05 monetary water account was produced, including an outline of the principal data sources used.

CATEGORIES OF WATER AND RELATED SERVICES IN SCOPE OF THE MONETARY WATER ACCOUNT

The first step in constructing monetary water accounts is to identify the categories of water and related services considered to be in scope of the accounts. Four such categories were used for this exercise:

- Urban distributed water;
- Rural distributed water;
- Bulk water (both urban and rural); and
- Waste water and sewerage services.

Urban distributed water is treated water supplied to urban areas via a mains water system. Rural distributed water is water supplied via mains, open channels or natural waterways, for irrigation and other rural uses. Bulk water (or wholesale water) is water supplied from one water authority to another before it is supplied to end use customers. The bulk water component must be separately identified in order to balance the estimates of supply and use. Waste water and sewerage services represent the activity of collecting and treating waste water and sewerage produced by households and businesses, including trade waste water.

The reference period for the monetary accounts presented here is 2004–05. This period was chosen as it is the most recent year for which the required data are available and because it allows direct comparison with the most recent estimates of the physical supply and use of water. Where possible and appropriate, monetary data in respect of 2003–04 are also included, though no comprehensive physical water data for Australia are available in respect of 2003–04.

SUPPLY SIDE ESTIMATES

Monetary estimates for the supply of urban distributed water, rural distributed water, and waste water and sewerage services were compiled for each State. There is no single data source providing all the information required, so a variety of data sources have been used, including the ABS Economic Activity Survey (EAS) and reports produced by State governments, industry associations and companies.

State government reports used include:

- the 2004–05 New South Wales *Water Supply and Sewerage Performance Monitoring Report*;
- the *Victorian Water Review 2004–05*;
- the 2004–05 Queensland *Annual Water Statistics*; and
- the 2004–05 Tasmanian *Local Government Water and Waste Water Business Cost Recovery Compliance Review*.

Industry association reports used include:

- *WSAA Facts 2005*, produced by the Water Services Association of Australia; and
- *Australian Irrigation Water Provider Benchmarking Data Report for 2004–05*, prepared by the Australian National Committee on Irrigation and Drainage (ANCID).

For water supply organisations not covered by the above reports, annual reports and financial statements were used wherever possible. Annual reports and financial statements were also used for all large water providers to validate the information collected in ABS surveys and State government and industry association reports.

SUPPLY SIDE ESTIMATES *continued*

Subsidies are usually shown in a separate column in the supply table. Because so many data sources were used to compile the supply estimates it was not always possible to separately identify subsidies with confidence. Consequently, in this publication subsidies are included in the estimates for revenue from the sales of each of the categories of water and related services identified above.

OUTPUT AND VALUE ADDED

Total output is the value of goods and services produced within an industry. Value added is output less the value of goods and services consumed as inputs to the process of production. At the broad level, these statistics are already compiled by the ABS for the Water Supply, Sewerage and Drainage Services industry and are published in *Electricity, Gas, Water and Sewerage Operations* (ABS cat. no. 8226.0), and the *Australian System of National Accounts* (ABS cat. no. 5204.0) and reproduced in table 7 of this publication. The industry value added for the Water Supply, Sewerage and Drainage Services industry was $5,101 million in 2004–05.

In order to calculate value added for water supply and sewerage services separately it would be necessary to identify not only the incomes from each activity (as in this publication), but also the value of goods and services consumed as inputs through the process of production for each activity. Existing data sources generally don't have the necessary detail to make this possible. In addition, the organisations that supply both water and waste water services would need to separate the income and expenses associated with each activity. Not all of these organisations are currently able to do so.

USE SIDE ESTIMATES

Monetary use of distributed water relates to expenditure on each category of water and related services by households, governments and industries. Household expenditure on water was calculated using estimates from State/territory government reports of the percentage of total water revenue relating to households. This was supplemented with financial information for all major urban water suppliers from *WSAA Facts*, including the number of residential properties receiving water supply services and the average revenue per property. In those cases where no alternative was available, household expenditure on water was estimated from the percentage of water supplied for domestic use as reported in *Water Account, Australia 2004–05*.

Expenditure on water by the agriculture industry was based on data from *Water Use on Australian Farms 2003–04* (ABS cat. no. 4618.0), which contained estimates of volumetric and usage charges associated with irrigated agriculture. However, this information was not collected for 2004–05. In the absence of actual data, monetary estimates for 2004–05 were generated by extrapolating the 2003–04 estimates by the proportional change in physical agricultural water use between 2003–04 and 2004–05. Data for expenditure on water by industries other than agriculture were available from the ABS EAS. This survey collects information on water expenses for the non-government sector, excluding the agriculture, mining, and manufacturing industries.

There are no recent data for expenditure on waste water and sewerage services by industries, governments and households. Therefore estimates in this publication were generated by distributing the supply side total across industries based on their relative levels of expenditure on distributed water.

WATER SUPPLY AND SEWERAGE INFRASTRUCTURE ASSETS

Values for water supply and sewerage infrastructure assets were calculated using the same approach used in the supply table, which is using information from State government, industry associations and company annual reports. Infrastructure asset valuation methods can differ between organisations and therefore the values shown here should be used with caution.

Physical water 2004–05

Data on the physical supply and use of water have come from a range of ABS surveys as well as State, territory and local government agencies, water authorities and industry organisations.

The main ABS surveys used were:

- 2004–05 Water Supply Survey
- 2004–05 Agricultural Survey
- 2004–05 Economic Activity Survey (of mining and manufacturing industries; sporting associations; thoroughbred, harness and greyhound racing associations and trainers)
- 2004–05 Electricity Generators Survey of Water Use
- March 2005 Monthly Population Survey

A range of other data sources were used, including surveys conducted by industry associations, annual reports of water providers, and reports of State and territory government agencies and relevant businesses.

For a more comprehensive description of data sources and methodologies used for physical measures of water see the Explanatory Notes of *Water Account, Australia 2004–05* (ABS cat. no. 4610.0).

Tables 1 to 10 present estimates and, where appropriate, these are considered in conjunction with the physical (or volume) water use estimates from *Water Account, Australia 2004–05*. The Water Account showed that 11,160 Gigalitres (GL) of water was supplied to the economy (i.e. to industry, government and households) by the Water Supply, Sewerage and Drainage Services industry in 2004–05. This amount included 2,022 GL of water losses and 842 GL of water provided to the environment. Excluding these amounts, there were 8,296 GL of water distributed to users, and it is this amount that should be used when making comparisons to the monetary estimates presented here. The mining, manufacturing and electricity and gas supply industries supplied 14 GL of water to users, however the corresponding monetary values are not available.

SUPPLY SIDE

The supply side of the monetary account, i.e. revenue from sales of urban water, rural water and waste water and sewerage services is presented in tables 1 and 2. Table 1 shows that $3,514 million of revenue was generated from the supply of urban and rural distributed water by the Water Supply, Sewerage and Drainage services industry in 2004–05. This industry supplied 8,296 GL of water.

1 MONETARY AND PHYSICAL DISTRIBUTED WATER SUPPLY, by industry—2004-05

	MONETARY UNITS	PHYSICAL UNITS
	Distributed water (urban and rural)	*Supply to other economic units*
Industry	$m	GL
Agriculture, forestry and fishing	—	—
Manufacturing	na	8
Mining	na	5
Electricity and gas supply	na	1
All other industries	—	—
Water supply, sewerage and drainage	3 514	8 296

— nil or rounded to zero (including null cells)

Note: Monetary data in this table are considered experimental.

Table 2 presents revenue (including subsidies) from sales of urban water, rural water, bulk water and waste water and sewerage services. Data are presented for each State and territory and at the national level. The total revenue from sales of water and related services was $7,488 million in 2004–05, an increase of 3% from 2003–04 when it was $7,271 million. In 2004–05, there was $3,215 million generated from the sale of urban distributed water (an increase of 1.9% on the 2003–04 level), $3,530 million from the sale of waste water and sewerage services (an increase of 5.4% on 2003–04), $444 million from the sale of bulk water and $299 million from sales of rural distributed water.

SUPPLY SIDE *continued*

2 SUPPLY TABLE - REVENUE FROM SALES OF WATER AND RELATED SERVICES BY THE WATER SUPPLY, SEWERAGE AND DRAINAGE SERVICES INDUSTRY—2003–04 and 2004–05

	DISTRIBUTED WATER		BULK WATER			
	Urban	*Rural*	*Urban*	*Rural*	*Wastewater & sewerage*	*Total*
	$m	$m	$m	$m	$m	$m
2004–05						
New South Wales	1 102	80	128	15	1 137	2 462
Victoria	628	123	164	6	761	1 682
Queensland	618	52	90	6	675	1 441
South Australia	317	18	—	—	363	698
Western Australia	351	25	—	—	421	797
Tasmania	77	1	31	—	75	184
Northern Territory	59	—	—	—	29	88
Aust. Capital Territory	63	—	4	—	69	136
Total	**3 215**	**299**	**417**	**27**	**3 530**	**7 488**
2003–04						
New South Wales	1 188	64	122	40	1 180	2 594
Victoria	527	116	159	5	783	1 590
Queensland	600	86	85	5	563	1 339
South Australia	306	19	—	—	261	586
Western Australia	336	25	—	—	402	763
Tasmania	75	1	35	—	70	181
Northern Territory	61	—	—	—	27	88
Aust. Capital Territory	62	—	4	—	64	130
Total	**3 155**	**311**	**405**	**50**	**3 350**	**7 271**

— nil or rounded to zero (including null cells)

Note: Data in this table are considered experimental.

USE SIDE

Table 3 shows physical use of water in 2004–05 and related expenditures. It shows that households had the highest expenditure on distributed water of any sector or industry in 2004–05 at $2,147 million (61% of total expenditure), though they used only 1,874 GL of distributed water (23% of total use). The agriculture industry spent $291 million (8% of total expenditure) in 2004–05 but used 5,353 GL of distributed water (64% of total use). Expenditure by the remaining industries totalled $1,076 million (31% of total expenditure) while they used 1,082 GL (13%) of distributed water. The difference in the patterns of expenditure on water observed between households and agriculture largely reflect the different costs of storage, treatment and delivery between categories of water used by urban and rural users.

USE SIDE *continued*

3 MONETARY AND PHYSICAL DISTRIBUTED WATER USE, by industry and households—2004-05

	EXPENDITURE ON WATER		PHYSICAL USE OF WATER	
	Distributed water	*Percent of total*	*Distributed water*	*Percent of total*
	$m	%	GL	%
Intermediate consumption				
Agriculture, forestry and fishing	291	8	5 353	64
Manufacturing	232	6	341	4
Mining	53	2	72	1
Electricity and gas supply	91	3	115	2
Water supply, sewerage and drainage	2	—	23	—
Other industries	698	20	531	6
Total intermediate consumption	1 367	39	6 436	77
Final consumption by households	2 147	61	1 874	23
Total use	**3 514**	**100**	**8 310**	**100**

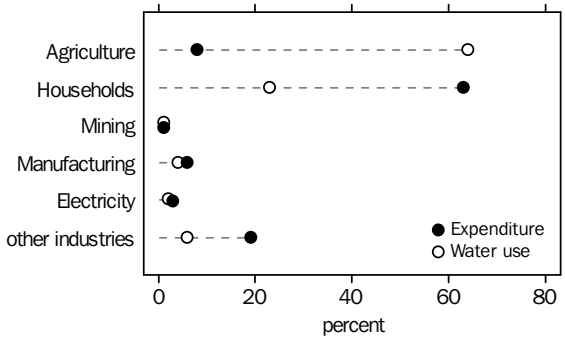
— nil or rounded to zero (including null cells)

Note: Differences in patterns of physical water use and of payments for water use observed between households and agriculture largely reflect different pricing policies and different costs of storage, treatment and delivery relating to categories of water used by urban and rural users.

Monetary data in this table are considered experimental.

Graph 4 utilises data presented in table 3 and provides a percentage comparison between use of distributed water (by households and by industry) and corresponding expenditures.

4 DISTRIBUTED WATER EXPENDITURE AND USE, by households and by industry, 2004–05



USE SIDE *continued*

5 USE TABLE - EXPENDITURE ON WATER AND RELATED SERVICES SUPPLIED BY THE WATER SUPPLY, SEWERAGE AND DRAINAGE SERVICES INDUSTRY—2004–05 and 2003–04

	Urban water	*Rural water*	*Bulk water*	*Waste water & sewerage*	*Total*
	$m	$m	$m	$m	$m
	2004–05				
Intermediate consumption					
Agriculture, forestry and fishing	—	291	—	—	291
Manufacturing	229	3	—	252	484
Mining	51	2	—	55	108
Electricity and gas supply	88	3	444	97	632
Water supply, sewerage and drainage	2	—	—	2	4
Construction	9	—	—	10	19
Wholesale & retail trade	77	—	—	84	161
Accommodation, cafés and restaurants	45	—	—	49	94
Transport and storage	56	—	—	61	117
Finance, property and business services	91	—	—	100	191
Government administration	80	—	—	88	168
Education	56	—	—	62	118
Health & community services	44	—	—	49	93
Cultural and recreational services	240	—	—	264	504
Total intermediate consumption	1 068	299	444	1 173	2 984
Final consumption by households	2 147	—	—	2 357	4 504
Exports	—	—	—	—	—
Total	**3 215**	**299**	**444**	**3 530**	**7 488**
	2003–04				
Intermediate consumption					
Agriculture, forestry and fishing	—	294	—	—	294
Manufacturing	225	10	—	239	474
Mining	50	2	—	52	104
Electricity and gas supply	86	5	—	92	183
Water supply, sewerage and drainage	2	—	455	2	459
Construction	9	—	—	9	18
Wholesale & retail trade	75	—	—	80	155
Accommodation, cafés and restaurants	44	—	—	47	91
Transport and storage	55	—	—	58	113
Finance, property and business services	89	—	—	95	184
Government administration	79	—	—	84	163
Education	55	—	—	59	114
Health & community services	43	—	—	46	89
Cultural and recreational services	236	—	—	250	486
Total intermediate consumption	1 048	311	455	1 113	2 927
Final consumption by households	2 107	—	—	2 237	4 344
Exports	—	—	—	—	—
Total	**3 155**	**311**	**455**	**3 350**	**7 271**

— nil or rounded to zero (including null cells)

Note: Data in this table are considered experimental.

USE SIDE *continued*

Table 5 shows expenditure on urban, rural and bulk water, and waste water and sewerage services, for 2003–04 and 2004–05, and provides greater industry detail than contained in table 3. Industry data are presented only at the national level, as State level estimates are not available. Household expenditure is available by State for 2004–05, and these data are presented in table 6.

In 2004–05 New South Wales had the highest expenditure on urban distributed water of $727 million (34% of total expenditure), and also used the largest quantity of water (29% of total water consumed by the household sector). Victoria recorded the second highest level of household spending on urban distributed water (21% of total), and the third highest level of water usage (also 21%). Average per capita expenditure on urban distributed water for Australia was $106, with the Northern Territory the highest at $138 per person and Victoria the lowest at $91 per person. Average expenditure per household for Australia was $271 in 2004–05. The derived price per KL for urban distributed water averaged $1.15 per KL for Australia, with New South Wales and the Australian Capital Territory recording the highest average price ($1.33 per KL) and Queensland the lowest at $0.97 per KL.

6 HOUSEHOLD EXPENDITURE ON URBAN DISTRIBUTED WATER, by State—2004-05

	EXPENDITURE ON URBAN DISTRUBITED WATER						
	Total	*per capita*	*per household*	*Population 30 June 05*	*Households 30 June 05*	*Water use 2004-05*	*Urban water*
	$m	$	$	'000	'000	GL	$/KL
NSW	727	107	279	6 769	2 605	545	1.33
Vic	459	91	236	5 023	1 946	389	1.18
Qld	446	112	289	3 977	1 544	458	0.97
SA	153	99	238	1 542	642	143	1.07
WA	237	118	300	2 011	789	226	1.05
Tas	56	115	279	486	201	57	0.98
NT	28	138	424	203	66	25	1.12
ACT	41	126	320	326	128	31	1.33
Total	**2 147**	**106**	**271**	**20 337**	**7 921**	**1 874**	**1.15**

Note: Data in this table are considered experimental.

Table 7 presents some key statistics for the Water Supply, Sewerage and Drainage Services industry for 2004–05.

USE SIDE *continued*

7 KEY STATISTICS, WATER SUPPLY, SEWERAGE AND DRAINAGE SERVICES INDUSTRY—2004-05

	Employment at end June	*Wages and salaries*(a)	*Sales and service income*(b)	*Operating profit before tax*	*Industry gross value added*	*Wages and salaries per person employed*	*Industry gross value added per person employed*
	'000	$m	$m	$m	$m	$000	$000
2004–05	22.2	1 285	7 703	2 405	5 101	57.9	230

(a) Excludes the drawings of working proprietors
(b) Includes rent, leasing and hiring income

Employment in this industry was 22,200 at 30 June 2005, and wages and salaries were $1,285 million for 2004–05, giving an average of $57,900 in wages and salaries per employed person. The industry earned $7.7 billion in sales and service income in 2004–05, industry value added was $5.1 billion and operating profit before tax was $2.4 billion.

Table 8 shows industry details for 2004–05 relating to gross value added, physical water consumption and the ratio of industry gross value to industry water consumption. Physical water consumption in this table relates to consumption of all categories of water and not just distributed water. The relationship between level of water consumption and value added of the industry varies markedly from industry to industry. For example, Agriculture generated on average around $2 million in gross value added for every GL of water consumed in 2004–05—the lowest of any industry. Mining contributed on average $97 million for each GL of water consumed and Manufacturing $166 million on average. The average gross value added per GL of water consumed across all industries was $54 million in 2004–05. All industries require water to a greater or lesser degree but for some industries, such as for much of Agriculture, the availability of water is a key determinant of the output and value added of the industry. The relationship between water consumption and industry gross value added is dependent upon the nature of production processes taking place within each industry and this cannot readily be represented in a simple table format. Nevertheless, it is worth repeating the point about input-output modelling and its potential to present cumulative consumption of water. For example, businesses engaged in the manufacture of food, beverage and tobacco products will generate on average $86 million in industry gross value added per GL of water consumed. However, this ignores the embodied water content of the various inputs to these manufacturing processes and therefore does not show, for example, the cumulative water consumption associated with the manufacture of food, beverage and tobacco products. Despite these limitations, table 8 clearly indicates the relative contribution made to GDP by industries that are major *direct* users of water.

USE SIDE *continued*

8 INDUSTRY GROSS VALUE ADDED FOR WATER USING INDUSTRIES—2004-05

	Industry gross value added	*Water consumption*	*Industry gross value added per GL water consumed*
	$m	GL	$m/GL
Agriculture	27 153	12 191	2
Mining			
Coal Mining	10 146	118	86
Oil and gas extraction	14 349	12	1 196
Metal ore mining	11 468	230	50
Other Mining(a)	3 982	53	75
Total mining	*39 945*	*413*	*97*
Manufacturing			
Food beverage and tobacco	18 551	215	86
Textile, clothing and footwear	2 827	15	188
Wood and paper products	6 479	99	65
Printing, publishing and recorded media	10 127	6	1 688
Petroleum, coal, chemical & associated products	12 956	70	185
Non-metallic, mineral products	4 951	20	248
Metal products	18 730	146	128
Machinery and equipment	19 078	16	1 192
Other manufacturing	4 070	2	2 035
Total manufacturing	*97 769*	*589*	*166*
Electricity and gas	14 933	271	55
Water supply, sewerage and drainage services	5 101	2 083	2
Other industries	711 667	1 059	672
Total	**896 568**	**16 606**	**54**

(a) Includes services to mining

Table 9 shows the gross value of irrigated agricultural production for various crop types in 2004–05. The gross value of irrigated agricultural production in 2004–05 was $9,076 million, which comprised 23% of the gross value of agricultural commodities produced in 2004–05. Fruit was the largest contributor ($1,777 million or 20% of gross value of irrigated agricultural production), followed by vegetables ($1,761 million or 19%) and dairy farming ($1,632 million or 18%).

USE SIDE *continued*

9 GROSS VALUE OF IRRIGATED AGRICULTURAL PRODUCTION, by crop type—2004-05

	NSW	*Vic.*	*Qld*	*SA*	*WA*	*Tas.*	*NT*	*ACT*	*Australia*
	$m	$m	$m	$m	$m	$m	$m	$m	$m
Dairy farming	204	1 090	108	88	72	70	—	—	1 632
Vegetables	206	411	563	267	163	147	4	—	1 761
Sugar	1	—	471	—	5	—	—	—	477
Fruit	297	524	494	263	118	49	32	—	1 777
Grapes	252	336	16	600	89	12	8	1	1 314
Cotton	513	—	395	—	—	—	—	—	908
Rice	101	1	—	—	—	—	—	—	102
Nurseries, cut flowers & turf	160	244	173	44	95	14	5	2	737
Livestock, pasture, grains & other	130	71	129	22	3	12	—	—	367
Total	**1 864**	**2 677**	**2 349**	**1 284**	**545**	**304**	**49**	**3**	**9 075**

— nil or rounded to zero (including null cells)

Source: Water Account, Australia, 2004-05 (cat. no. 4610.0)

Gross value of irrigated agricultural production is derived from agricultural commodity values in *Value of Agricultural Commodities Produced, Australia, 2004–05* (ABS 2006d).

Estimating the value of agricultural production arising from irrigation is problematic because water used by crops comes from a variety of sources. In particular, rainwater is usually a component of the water used by irrigated crops, and the timing and location of rainfall affects the amount of irrigation water required. In addition, water is not the only input into agricultural production from irrigated land. Land, fertiliser, labour, machinery and other inputs are also used. To separate the contribution of each of these factors to total production is extremely difficult, even with ideal data. Therefore, estimates of the gross value of irrigated agricultural production presented in table 9 attribute all of the gross value of production from irrigated land to irrigated agricultural production.

Estimates of gross value of irrigated agricultural production in table 9 are not directly comparable with the estimates of Industry gross value added presented in table 8 because gross value of irrigated agricultural production is a measure of output, rather than value added. As such, gross value of irrigated agricultural production should not be used as a proxy for determining the highest value water users—some form of value added measure is instead appropriate for this purpose. At present, the ABS does not produce any value added measure in respect of irrigated agricultural production.

Table 10 shows the value of infrastructure assets of the Water Supply, Sewerage and Drainage Services industry. The total value of these assets at 30 June 2005 was estimated to be $79.1 billion. Urban water infrastructure assets were worth $35.4 billion, and irrigation and drainage assets $6.2 billion. Valuation of these assets is as recorded in the various annual reports, but as valuation methods differ between organisations these estimates should be used with caution.

USE SIDE *continued*

10 WATER SUPPLY AND SEWERAGE INFRASTRUCTURE ASSETS, by State and territory—30 June 2005

	Urban water infrastructure assets	*Waste water & sewerage infrastructure assets*	*Irrigation & drainage infrastructure assets*	*Total*
	$m	$m	$m	$m
New South Wales & ACT	12 159	13 740	743	26 642
Victoria	8 281	8 803	2 740	19 824
Queensland	6 288	6 915	1 976	15 179
South Australia	4 441	3 424	308	8 173
Western Australia	3 079	3 749	367	7 195
Tasmania	846	725	47	1 618
Northern Territory	337	101	—	438
Total	**35 431**	**37 457**	**6 181**	**79 069**

— nil or rounded to zero (including null cells)

Note: Data in this table are considered experimental.

QUALITY OF THE ESTIMATES

Overall, the ABS considers these estimates to be experimental. At the most aggregated level, such as for total revenue from sales of water-related products by the Water Supply, Sewerage and Drainage Services industry, the estimates are of sound quality, but there is less confidence in the quality of estimates at various levels of disaggregation.

Monetary water accounts are in the early stages of development in Australia and a number of data gaps currently exist, most notably for certain aspects of water usage. Also, the estimates contained in this publication were prepared from a wide variety of sources. Many data sources are compatible with the desired accounting basis, however in some instances, this is not the case and some data sources are less than completely satisfactory in terms of concepts measured.

WATER SUPPLY

The majority of data required to compile supply side estimates for the Water Supply, Sewerage and Drainage Services industry were available at the State/territory level, though, as many data sources were used, the terminology and definitions used are not necessarily all consistent.

WATER USE

The data gaps on the use side are greater than on the supply side. In particular, there is little information on expenditure on water by government or by the mining and manufacturing industries. Data for mining and manufacturing could potentially be collected via ABS EAS.

There are no recent data available on expenditure on sewerage services by households, government and industry. This information was published previously in *Environment Protection Expenditure, Australia, 1995–96 and 1996–97* (ABS cat. no. 4603.0), when specific surveys were run to collect information on environmental protection expenditures. There are presently no plans to repeat these surveys.

Considering these data deficiencies, the breakdown of expenditure on water and waste water and sewerage services by industry (shown in table 5) must be used with caution.

The recent drought throughout much of Australia has highlighted the importance of understanding not only physical water availability but also the importance of how water is used within the economy, by whom and to what economic benefit. It is important to understand the economic implications of water scarcity and to generate information supporting soundly based decisions on the use of this natural resource. Integrated environmental and economic accounts as described in the SEEA provide a conceptually robust, coherent and widely accepted framework for collecting and analysing environmental and economic information. While the estimates in this publication are developmental in nature and involve a number of data gaps and data deficiencies (as described earlier), they assist in demonstrating use of the analytical framework and in presenting the available data. The ABS is considering incorporating these types of estimates into future editions of its publication *Water Account, Australia* (ABS cat. no. 4610.0). The following paragraphs describe where the ABS may extend its research as well as other potential areas for development.

SELF-EXTRACTED WATER

A significant gap in these accounts is the absence of monetary information on the supply and use of self-extracted water. Self-extracted water makes up a large proportion of water used in the Australian economy. Water extracted for own use in 2004–05 totalled 67,634 GL or 85% of all water used, although 59,867 GL or 89% of self-extracted water was used for hydro-electricity generation and is considered 'in-stream use' because once it is used it is discharged and made available for downstream users. In contrast, 8,296 GL was supplied by the Water Supply, Sewerage and Drainage Services industry to other economic units as distributed water. The monetary figures contained in this publication relate only to the 8,296 GL supplied to other units.

In practice it is difficult to calculate a monetary value for self-extracted water. Activities undertaken by firms to produce goods or services for their own use, such as extracting water for own use, are not separately identified in the national accounts and are instead included with the main activity of the business. To value output of such activity separately, all costs associated with the activity need to be identified and this is often difficult. For example, if a manufacturing plant treats its own waste water, the value of the waste water treatment activity could be given by the sum of all the costs associated with operating the treatment plant: energy, chemicals, labour costs, certain taxes, and the depreciation of the capital equipment used. Similarly, a farmer who extracts water for irrigation incurs costs related to labour, materials, fuel, and depreciation of the machinery and equipment used. The information required to value the cost of such self-extraction is generally not available, though it is possible to collect such data through specialised surveys.

It is possible to create 'shadow prices' to apply to self-extracted water volumes and thereby assign values to these volumes. Shadow prices could be based on water trade prices achieved within the same river system for the same time period. In Australia there are markets for trading water on both permanent and temporary bases. However, the majority of water is traded on a 'temporary' basis and this type of trade essentially represents a form of water 'rental'. These rental prices are short term in nature and may be set according to factors other than the marginal cost of water. Nevertheless, water markets in Australia could potentially be used to value water used for irrigation or agricultural purposes, but at present they are very 'thin' and represent a small proportion

SELF-EXTRACTED WATER *continued*

of total water used within the economy. The prices generated do not provide the necessary confidence and this approach is not considered viable at present. If water entitlements were extensively traded within competitive markets, it might become possible to establish a price that represents the marginal value of water at a specific time and place.

The 2006–07 ABS Agricultural Survey will include a number of questions relating to expenditure on water-related products and associated infrastructure. Among the various expected uses of these data, it is anticipated that the information could provide a basis for the valuation of self-extracted water used by Australian farmers. The data may allow an inference of water prices, for example, through providing information on water prices paid by farmers across a range of river systems, and/or allowing use of a resource rent valuation approach of valuing water used by irrigating farmers.

Producers of hydro-electric power are the single largest users of self-extracted water in Australia. As for Agriculture, it is not considered appropriate at present to use shadow prices based on amounts paid for temporary water. There is also a question of whether hydro-electricity producers really 'use' the full amount of the water they self-extract, since the great majority of this water use is not consumed but is instead made available to other users in the system. A potentially viable alternative method is to use a resource rent valuation approach to infer the price of water. Rudimentary applications of such an approach for Australia indicate, in practice, a tendency to yield negative prices for water used by these businesses. This suggests that the full value of water is not currently being reflected in the value of output of hydro-electricity producers. One of the difficulties of this approach is of assigning an appropriate return to produced capital owned by the hydro-electricity producers – difficulties related to both choice of a rate of return and of an appropriate valuation of the produced capital assets of these operators. These observations simply underscore the difficulty of assigning monetary values to water where it is not sold in the marketplace.

OUTPUT AND VALUE ADDED

Ideally, value added for water supply and sewerage operations should be calculated separately from electricity operations. This would involve identifying not only the incomes from each activity (as has been done in this publication), but also the value of goods and services consumed as intermediate inputs through the process of production for each activity. Existing data sources generally don't have the necessary detail to make this possible. There are currently no plans to collect this additional information, however it may be possible to approximate these values through modelling techniques based on the results of selected case studies.

VALUATION OF WATER STOCKS

Information presented in this publication generally relates to the 'flow' of water in the economy, or the amount of water used in a year. Estimates of the value of water and sewerage infrastructure assets at 30 June 2005 are also provided. Estimates of the value of assets at a point in time are termed 'stocks', and complete monetary accounts would include values for stocks at the beginning of the accounting period, the value of monetary flows and other changes in assets during the accounting period, and the value of stocks at the end of the period. The value of water stocks would thus be included in complete monetary accounts for water. However, no estimate of the value of the stock of water stored in dams, rivers, etc., is provided at present.

VALUATION OF WATER STOCKS *continued*

Water not only has economic value, but also environmental and social or cultural values. Environmental values are associated with ecosystem health, and social values are related to such things as scenic values, preservation of the resource for future generations and recreational uses. Environmental and social values of water are very difficult to measure, so work on the valuation of water has concentrated on economic values. Economic values can be used to address efficiency in the development and allocation of water resources and are useful for setting water pricing policy and in the design of economic instruments to achieve better use of water resources.

While it is more feasible to measure the economic value of water rather than social and environmental values, there are still many difficulties associated with assigning an economic value to water, particularly at a national level.

The SNA and the SEEA recommend that goods and services generally be valued according to their market value, which, in a competitive market, is the value of the marginal (or last) unit sold. However, there are barriers, both social and economic, that prevent water from operating in competitive markets. The government is usually the owner of the water and often provides it to the community at a subsidised price. Governments will often ration the resource through regulation (e.g. water restrictions) rather than through pricing mechanisms. The natural characteristics of water also inhibit competitive markets since water cannot be easily transferred from one system to another, so water supply often has the characteristics of a natural monopoly.

Draft chapters of the revised SNA (SNA93 Rev.1) recommend that a range of natural assets be included on the balance sheet of the nation, "to the extent that they have been recognized as having economic value that is not included in the value of the associated land". 'Water resources' are explicitly identified within the draft revised SNA as one such natural asset. The ABS is considering its response to this draft recommendation, though at present it would be very challenging to produce balance sheet estimates for water resources in Australia.

A key objective of the National Water Initiative (2004) is increasing the efficiency of water markets and extending the opportunities for trading within and between States and territories where water supply systems and hydrological conditions permit. It may become possible to value the stock of water if water prices are set to more fully reflect the value of water itself, and if a greater volume of water is traded between users. The Intergovernmental Agreement on a National Water Initiative sets out pricing objectives for water. It states that the

> "States and Territories agree to bring into effect pricing policies for water storage and delivery in rural and urban systems that facilitate efficient water use and trade in water entitlements through the use of consumption based pricing and full cost recovery for water services to ensure business viability and avoid monopoly rents, including recovery of environmental externalities, where feasible and practical."

The ABS has not yet attempted to assign a value to the stock of water although estimates for the physical volume of water stored in large dams are presented in the 2004–05 Water Account. Valuation of water stocks is considered important and will receive further attention by the ABS.

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GLOSSARY

ANZSIC	The Australian and New Zealand Standard Industrial Classification (ANZSIC) is the standard classification used in Australia and New Zealand for the collection, compilation, and publication of statistics by industry.
Australian Water Resources 2005 (AWR 2005)	Australian Water Resources 2005 is the baseline assessment of water resources for the National Water Initiative.
Bulk water	Water supplied by a water provider to another water provider.
Depletion	Represents the reduction in value of the natural resource asset as a result of the physical removal and using up of the asset.
Degradation	Effect of a decline in the quality of an environmental resource on its monetary value.
Distributed water	Distributed water is water supplied to a user including through a non-natural network (piped or open channel), and where an economic transaction has occurred for the exchange of this water. The majority of distributed water is supplied by the Water Supply, Sewerage and Drainage Services industry (ANZSIC group 370). The water supply component consists of units mainly engaged in storage, purification or distribution of water by pipeline or carrier. It also includes the operation of irrigation systems that supply water to a farm and the supply of steam and hot water.
Environmental accounts	Accounts presenting integrated environmental and economic stocks and flows in a coherent, consistent and systematic manner. SEEA is an integrated environmental and economic accounting system which operates as an extension of the SNA.
Environmental externalities	Outcomes impacting on the natural environment which are not the objective of economic production but which are nevertheless associated with such activity, for example, air and water pollution. Environmental externalities are not measured in the national accounts because there is no transaction associated with their appearance.
Gigalitre	One thousand million litres.
Hybrid accounts	Accounts that juxtapose physical quantities of environmental resources with matching economic (monetary) aggregates.
Industry Value Added (IVA)	The value of an industry's output at basic prices, minus the value of goods and services consumed as inputs during the process of production. Basic prices valuation of output removes the distortion caused by variations in commodity taxes and subsidies across the output of individual industries.
Irrigation	Water artificially applied to soils (i.e., does not include precipitation/rainfall).
Irrigation/Rural water supplier	A water provider undertaking the supply of retail irrigation water in rural areas. Functions of irrigation/rural water providers include the delivery of water for the purpose of irrigation and the collection of drainage off agricultural land through surface or sub-surface drainage systems. In addition most supply water for stock and domestic purposes and either bulk or reticulated water to service rural towns. Delivery systems can range from channel/canal to pipes to carriers and natural streams/water courses.
Kilolitre	One thousand litres.
Megalitre	One million litres.
National Water Initiative (NWI)	An intergovernmental agreement on water reform created in June 2004.
Natural capital	According to natural capital theory, the environment contributes to human development through various material and service flows. Accordingly, the focus of measurement in a sustainable development information system must be on the distinct stocks of natural resources and various ecosystems supporting these material and service flows. These stocks and ecosystems are what must be maintained over time if human development is to be sustainable. Collectively, they are labelled natural capital.

Net water supply	The quantity of water supplied to customers of the water supplier. This comprises the distributed water supply less: losses, water provided for environmental benefits, and water used directly by the industry.
Permanent water trading	A transaction that permanently affects some aspect of a water access entitlement, such as changes to the ownership, water source, size of share, or reliability.
Reuse water	Drainage, waste or storm water that has been used again without first being discharged to the environment. It may have been treated to some extent.
Satellite account	Satellite accounts are a SNA construct generally designed to support an expanded analytical capacity within the national accounts using SNA categories and concepts. They are kept separate from the central system to avoid overburdening or disrupting that system. SEEA is a satellite system of the SNA.
SEEA	SEEA is the System of Integrated Environmental and Economic Accounting. It is a framework used to develop environmental accounts by integrating environmental information into a national accounting framework. The SEEA provides the conceptual basis for developing a framework to describe the interrelationship between the natural environment and the economy.
SEEAW	SEEAW is the System of Integrated Environmental and Economic Accounting for Water resources. It is an elaboration of the SEEA and provides a conceptual framework for organising hydrological and economic information in a coherent and consistent framework. SEEAW became an interim international statistical standard in early 2007.
Sewerage	Infrastructure used to remove sewage (waste water).
Supply–use framework	An accounting framework utilising the basic principle that the total supply of a product is equal to its total use.
System of National Accounts (SNA)	The System of National Accounts (SNA) is an international framework which can be used to develop a comprehensive, consistent and flexible set of macro-economic accounts.
Temporary water trading	A transaction that affects only the seasonal water allocation associated with a water access entitlement.
Total water use	Total water use is equal to distributed water use plus self-extracted water use plus reuse water use.
Waste water	Any water that has been used once and cannot be used again without treatment, for example untreated effluent, sewage water and trade waste.
Water access entitlement	A perpetual or ongoing entitlement to exclusive access to a share of water from a specified consumptive pool as defined in the relevant water plan.
Water allocation	The specific volume of water allocated to water access entitlements in a given season, defined according to rules established in the relevant water plan.
Water consumption	Water consumption is equal to distributed water use plus self-extracted water use plus reuse water use minus distributed water supplied to other users minus in-stream use (where applicable).
Water extracted	Water extracted directly from the environment for use (including rivers, lakes, groundwater and other bodies). Some of this water may then be distributed via water providers to others. Excludes water supplied by water suppliers via regulated systems.
Water license	A type of water access entitlement.
Water provider	A business or organisation that provides a reticulated water supply, irrigation water, reuse/recycle water and/or bulk water supply service. Water suppliers may be government or private and often operate water storage, purification and supply services. They may also provide sewerage or drainage services.

Water right A type of water access entitlement in Victoria issued to individuals in rural water authority supplied irrigation districts.

Water trading Transactions involving water access entitlements or water allocations assigned to water access entitlements.

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