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Water accounting - International standards and ABS experience

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Abstract: An integrated environmental-economic account for water provides the opportunity to analyse and report on the supply and use of water in the economy. The ABS produces an integrated water account; *Water Account, Australia (cat. no. 4610.0),* every four years, with the next one due for release at the end of 2010. The ABS Water Account is compiled using the International *System of Environmental- Economic Accounting for Water* (SEEAW). The latest, *Water Account Australia 2004-05*, in combination with *An Experimental Monetary Water Account for Australia, 2004-05 (cat. no. 4610.0.55.005)*, closely follow SEEAW's recommendations and use the SEEAW framework as much as possible within the constraints of existing data.

The *System of Environmental and Economic Accounting for Water Resources* (SEEAW) is an international framework for organising hydrological and economic information in a consistent way. The SEEAW framework allows for compilation of different "tables" which comprise the accounts. For example there are physical supply and use tables which provide information on the volumes of water abstracted, supplied within the economy and discharged back into the environment by economic activity and households.

The SEEAW framework is a useful tool for supporting Integrated Water Resource Management, by providing information to support decision-making, in a number of ways, for example, how to allocate water resources efficiently and how to improve water efficiency.

The ABS Water Account was compiled using a wide range of administrative data and some major ABS collections, such as the ABS Agricultural Survey.

Water Account Australia, 2004-05 showed that during 2004–05, 79,784 GL of water was extracted from the environment and used within the Australian economy. Of this, 11,337 GL was extracted by the 413 water providers in Australia for distribution to other users, while water users directly extracted 68,447 GL. This paper outlines the types of data that can be made available from water accounts by presenting some of the 2004-05 data released by ABS.

Integrated water resource management requires access to water accounts that are flexible to meet varying requirements. Water accounts can be presented for various regional levels depending on the extent of data available and the quality of that data. For 2008-09 the ABS plans to release water supply and use tables for Australia, States and the Murray-Darling Basin.

Monetary water accounts can also shed light on the cost/benefit of potential alternatives to supplying water harvested from local streams and aquifers, for example from sea water desalination. The ABS produced monetary water estimates for 2004-05 and plans to release similar data for 2008-09.

Keywords*: ABS Water Account, Water Accounting, ABS water statistics, ABS, SEEAW*

1. INTRODUCTION

Reliable information on Australia's water is important for managing this essential resource. Water is important for growing food, generating energy and manufacturing goods. Having access to potable water is important for sustaining a healthy population. Any changes in the abundance, distribution and availability of water across the continent will pose significant challenges to those who manage water resources. Therefore it is important to have frameworks for measuring and reporting water stocks and flows.

2. SEEAW – AN INTERNATIONAL FRAMEWORK FOR PRODUCING INTEGRATED ENVIRONMENTAL-ECONOMIC WATER ACCOUNTS

A water account provides the opportunity to show the supply and use of water in the economy, and the interaction of the economy with the environment. Water availability is strongly linked with socio-economic development, so it is important to take an integrated view of water management and move away from a focus on sectoral development and management of water resources.

The *System of Environmental and Economic Accounting for Water Resources* (SEEAW) is an international framework for organising hydrological and economic information in a consistent way. SEEAW was developed in support of the *System of Integrated Environmental and Economic Accounting 2003* (SEEA), with special focus on water. Both SEEA and SEEAW are satellite accounts of the *System of National Accounts 1993* (SNA), which is the standard system for compiling economic statistics and deriving economic indicators, the most notable being gross domestic product (GDP). As such, both SEEA and SEEAW have a similar structure to the SNA and share many common definitions and classifications. This allows direct links between water information and economic data, thereby facilitating environmental-economic analysis in an integrated framework.

The SEEAW conceptual framework describes a set of standard tables focusing on hydrological and economic information and supplementary tables covering social information. The set of tables are designed to facilitate the compilation of accounts in countries and to obtain information which is comparable across countries and over time. The SEEAW is also structured to allow for compilation of water accounts at various regional levels, depending on the amount and quality of available data.

The SEEAW framework has two components. Part I comprises accounts for which there is considerable international practical experience and a consensus on best practices. It includes internationally agreed concepts, definitions, classifications, accounts and tables. The accounts included in this part include:

- Physical supply and use tables which provide information on the volumes of water abstracted, supplied within the economy and discharged back into the environment by economic activity and households;
- Emission accounts which provide information on the release of pollutants in wastewater in physical units;
- Hybrid supply and use tables which present side-by-side economic information on the use and supply of water within the economy with the corresponding physical flows.
- Asset accounts which provide information on the stock levels of water resources in the environment and their changes brought about human activities (i.e. abstraction and returns) and natural events (such as precipitation and evapotranspiration).

The second part of SEEAW covers those accounts that are considered of high policy relevance but are still experimental because accepted international best practices have not yet emerged. One example includes quality accounts which provide information on the quality of water resources in the environment and their changes.

2.1. How SEEAW can assist policy makers

The SEEAW framework is a useful tool for supporting Integrated Water Resource Management, by providing information to support decision-making, in the following ways:

- *How to allocate water resources efficiently.* A SEEAW based water account shows the quantity of water used and who is using it. It also provides information about the economic value added generated by different industries. This allows decision makers to derive water efficiency and productivity indicators, and assists with developing policies for competing users.
- *How to improve water efficiency.* On the demand side, policy makers may introduce economic instruments to change the behaviour of the user. On the supply side, policy makers could encourage efficiency measures. A SEEAW based water account provides a dataset to analyse the impact of changes in regulations that might impact on water resources.

- *How to understand the impacts of water management on all users.* It is important to plan water resources development, allocation and management in an integrated manner. SEEAW, because of its links with the SNA provides the basic information system to evaluate tradeoffs of different policy options on all users.
- *How to get the most value for money from investment in infrastructure.* SEEAW based water accounts help to assess the economic implications of infrastructure maintenance, water services and potential cost-recovery, and also provide information about infrastructure and service charges.
- *Linking water availability and use.* The SEEAW provides information on the stocks of water resources as well as changes in stocks due to natural causes (e.g. inflows, outflows, precipitation) or human activities (e.g. abstraction and returns). In a SEEAW based water account, water abstraction and returns can be presented for different industries.
- *Provides a standardised information system which harmonises information from different sources.* Information on water is often generated, collected, and analysed by different agencies. The individual datasets might be collected for different purposes, use different definitions and classifications and show overlaps in data collection. A SEEAW based water account allows for disparate information to be integrated.

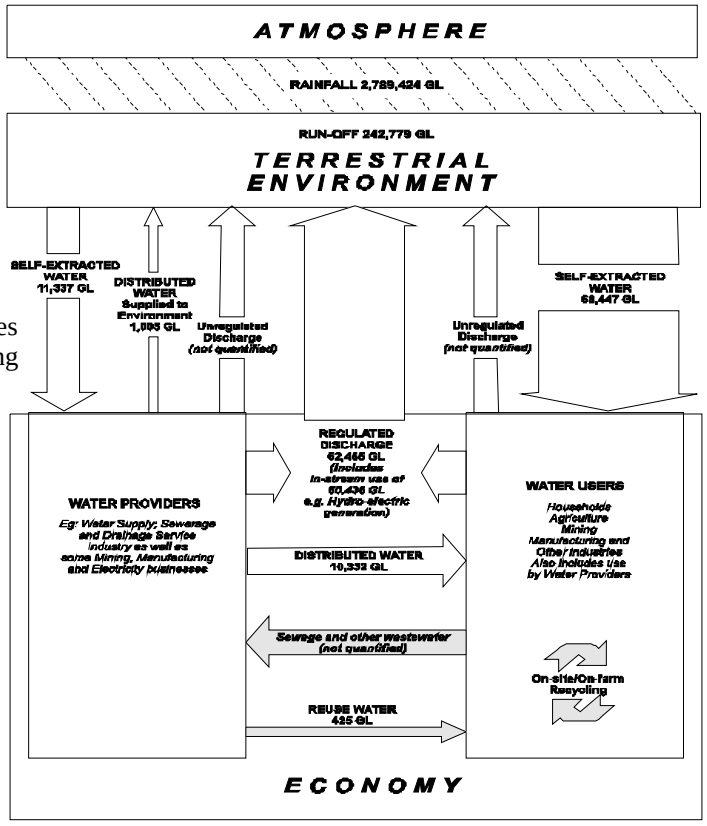
3. THE ABS WATER ACCOUNT

The Australian Bureau of Statistics (ABS) has produced water accounts in respect of 1994-95 to 1996-97, 2000-01 and 2004-05. The next ABS Water Account (for 2008-09) is due for release at the end of 2010. The ABS water accounts were produced in parallel with the development of SEEAW and successive editions reflect the evolution of thought on the role and purpose of accounting for water.

The latest, *Water Account Australia 2004-05*, in combination with *An Experimental Monetary Water Account for Australia, 2004-05 (cat. no. 4610.0.55.005)*, closely follow SEEAW's recommendations and use the SEEAW framework as much as possible within the constraints of existing data. The 2004-05 water accounts produced by the ABS include physical supply and use tables, some hybrid accounts, and some partial asset accounts showing water stocks. The observations that follow are drawn mainly from these accounts.

Figure 1 is from the 2004-05 ABS Water Account and demonstrates the interaction of water resources between the environment and the economy.

Figure 1. Interactions in ABS Water Account



3.1. Data sources

The ABS Water Account was compiled using a wide range of administrative data and some major ABS collections. On the supply side of the water account the collections that were conducted for 2004-05 included the ABS Survey of Water Suppliers and the ABS Survey of Electricity Generators. Other data sources were also used, for example, the Australian National Committee on Irrigation and Drainage (ANCID) and the Water Services Association of Australia (WSAA) Benchmarking reports based on their survey activity; State/Territory Government reports, such as the Victorian Water Report; and State/Territory water registers and water allocation databases. On the Use side of the Water account the sources were the the ABS Agricultural Survey and the Economic Activity Survey (for mining, manufacturing and sporting associations), and company annual reports, as well as information from water associations.

These data obtained were compiled into supply and use tables and then evaluated and confronted with other data sources and

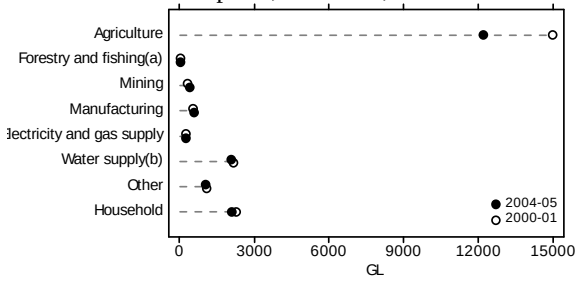
compared to align water supply with use and discharges.

3.2. Examples of information available from ABS Water Accounts

Water Account Australia, 2004-05 showed that during 2004–05, 79,784 GL of water was extracted from the environment and used within the Australian economy. Of this, 11,337 GL was extracted by the 413 water providers in Australia for distribution to other users, while water users directly extracted 68,447 GL.

Total water consumption was 18,767 GL in 2004–05, a decrease of 14% from 2000–01. Figure 2 shows water consumption for industries and households for Australia in 2000-01 and 2004–05. The agriculture industry consumed the largest volume of water in 2004–05 with 12,191 GL, representing 65% of water consumption. Households accounted for a further 11% of consumption (2,108 GL).

Figure 2. Water consumption, Australia, 2000–01 and 2004–05



(a) Includes Services to agriculture; hunting and trapping.
(b) Includes Sewerage and drainage services.

Information on physical water flows and stocks can be combined with monetary information to analyse changes in water use over time. Table 1 presents chain volume measures (CVM) of Australia's industry gross value added, water consumption and the ratio of industry gross value to industry water consumption. Gross value added is the value of output excluding the value of inputs to production. Chain volume measures are estimates that remove the direct effect of changes in price over the period. The relationship between water consumption and value added by industry varies markedly. 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. It should be noted that total water consumption referred to in this table does not include water consumption by the household sector.

Table 1 also indicates changes in overall water consumption by industries over a short time and changes in value added per GL over time. Although agriculture continued to be the lowest water value adding industry, it did increase its average value added per GL used by a third from 2000-01 to 2004-05, while the mining industry value added per GL of water consumed decreased by just over 20% in the period.

Table 1. Industry gross value added (chain volume measures) and water consumption for water using industries, 2000-01 and 2004-05

Industry	Industry gross value added $m		Water consumption GL		Industry GVA per GL of water consumed $m	
	2000-01	2004-05	2000-01	2004-05	2000-01	2004-05
Agriculture	23 206	24 344	14 989	12 191	1.5	2.0
Mining	63 691	64 223	321	413	198.4	155.5
Manufacturing	94 474	99 688	549	589	172.1	169.2
Electricity and gas	13 870	14 444	255	271	54.4	53.3
Water supply, sewerage and drainage services	7 724	7 407	2 165	2 083	3.6	3.6
Other industries	617 593	729 585	1 146	1 110	538.9	657.3
Total	**820 558**	**939 692**	**19 425**	**16 657**	**42.2**	**56.4**

Reference year for chain volume measures is 2005-06. Sources: Water Account Australia 2004-05 (ABS cat. no. 4610.0), Australian System of National Accounts 2006-07 (ABS cat. no 5204.0). Note: Totals in this table do not include water consumption by households.

It should be noted that the industry gross value added (CVM) per GL of water presented in the table above excludes the embodied water content of the various inputs to these production processes and does not show the cumulative water consumption associated with the manufacture of these products.

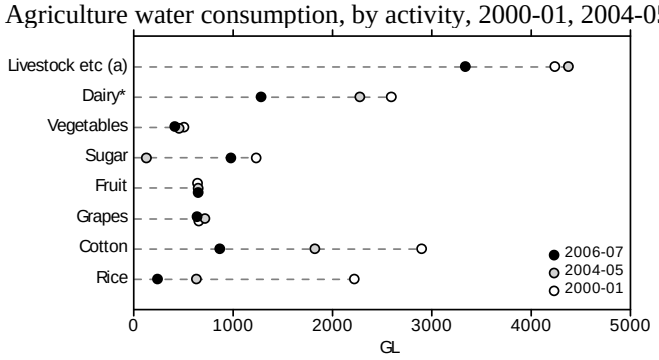
3.2.1 Agriculture

All industries require water to some extent, however for agriculture, the availability of water is a key determinant of the output and value added of the industry. The agriculture industry is the single largest consumer of water in Australia, accounting for nearly two-thirds of Australia's total water (including household) consumption. Water consumption by agriculture was 12,191 GL in 2004-05, which was 65% of total water used (including households) for 2.6% of total value added.

Water accounts provide a wide range of information about both water uses by agriculture and changing patterns of production. Water usage within the agriculture industry varies widely and is sensitive to both the availability and cost of water. Figure 3 illustrates changes in consumption of water within agriculture between 2000-01, 2004-05 and 2006-07. To calculate the amount of water used by the agriculture industry, ABS used information collected from the ABS Agricultural Survey, data from irrigation authorities, and additional information from State and Territory agriculture departments.

Some crops such as rice, cotton and grapes are highly dependent on irrigation. For other crops such as grazing pasture and sugar cane, irrigation water supplements natural rainfall or provides moisture at critical periods of plant growth. The area to be irrigated and the volume of water applied depend on the crop type and location. The most significant change in water consumption was for cotton and rice production, both water intensive crops. Water consumption for rice fell from 2,222 GL to 631 GL (-72%) between 2000-01 and 2004-05 and then to 239 GL in 2006-07 – a fall of 89% since 2000-01. Consumption for cotton fell from 2,896 GL to 1,822 GL (-37%) between 2000-01 and 2004-05 and then to 868 GL in 2006-07.

Figure 3. Agriculture water consumption, by activity, 2000-01, 2004-05, 2006-07



(a) Includes Livestock, pasture, grains and other agriculture (excluding Dairy farming).

Source: Water Account Australia, 2004-05 (ABS cat. no. 4610.0). Water Use on Australian Farms, 2006-07 (cat. no. 4618.0).

Water accounts can help inform decisions about the cost-effectiveness of irrigating different crops. Nevertheless, estimating the value of irrigated agricultural production is difficult 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 irrigated agricultural production; 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 2 attribute all of the gross value of production from irrigated land to irrigated agricultural production.

The estimates of gross value of irrigated agricultural production (GVIAP) in Table 2 are not directly comparable with the estimates of industry gross value added presented in Table 1 because GVIAP is a measure of output, rather than value added, and also GVIAP is presented in current price terms, not as chain volume measures. GVIAP should not be used as a proxy for determining the highest value water users - some form of value added measure is appropriate for this purpose, however at present, the ABS does not produce any value added measure in respect of irrigated agricultural production.

Table 2. Gross value of irrigated agriculture production and water consumption, 2000-01 and 2004-05

Activity	Gross value of irrigated production $m		Water consumption GL		Gross value per GL of water consumed $m	
	2000-01	2004-05	2000-01	2004-05	2000-01	2004-05
Dairy farming	1 499	1 632	2 593	2 276	0.6	0.7
Vegetables	1 817	1 761	507	455	3.6	3.9
Sugar	284	477	1 235	1 269	0.2	0.4
Fruit	1 590	1 777	645	648	2.5	2.7
Grapes	1 355	1 314	655	717	2.1	1.8
Cotton	1 222	908	2 896	1 822	0.4	0.5
Rice	350	102	2 223	631	0.2	0.2
Livestock, pasture, grains & other	1 500	1 104	4 235	4 374	0.4	0.3
Total	**9 618**	**9 076**	**14 989**	**12 191**	**0.6**	**0.7**

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

3.2.2 Other Industries

Mining consumed 413 GL of water in 2004-05, 2.2% of Australian consumption, compared with 321 GL in 2001-02, 1.5% of total Australian industrial consumption. *Manufacturing* consumed 589 GL in 2004-05, 3.1% of Australian consumption, compared with 549 GL in 2001-02 which was 2.5% of total consumption.

Electricity generators are a significant user of water in Australia. Most of the water is used for hydro-electricity power generation, but coal-fired power stations also use considerable amounts of water in their boilers and cooling towers. Hydro electricity accounted for 99.6% (or 59,867 GL) of all water use in this industry.

Water accounts have a valuable role to play in assessing the potential impacts of water availability on the *water supply industry*. Water supplied by the water supply industry, by water type for 1996-97, 2000-01 and 2004-05 is shown in Table 3. Reuse or recycled water is considered an important option for securing water supply into the future. There are a variety of water sources that may be supplied as reuse water, including waste water (from sewerage systems), drainage water, storm water or other water providers (i.e. a 'bulk' reuse water supply).

Table 3. Water supplied by the Water supply industry, by type, 1996-97, 2000-01 and 2004-05

	1996-97		2000-01		2004-05	
	GL	%	GL	%	GL	%
Distributed	11 525	98.9	12 934	96.2	11 337	96.4
Reuse	134	1.1	507	3.8	425	3.6
Total	**11 659**		**13 441**		**11 762**	

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

3.2.3 Households

Households used 11% of Australia's water in 2004-05 (2,108 GL). Of the total water used by households, 1,874 GL of this was distributed water, for which households paid 61% of the total cost of distributed water. Water accounts can tell us a great deal about household responses to changes in water availability. Even in the short period between 2000-01 and 2004-05, Australian households made quite significant changes to their consumption f water, as illustrated in Table 4. This reduction in household water consumption from 2000-01 to 2004-05 was due to a combination of factors – the drought, mandatory water use restrictions, and water conservation information campaigns.

Table 4. Household water consumption, Australia, 2000-01 and 2004-05

	Household water consumption GL		Household water consumption, per capita Kl/capita	
	2000-01	2004-05	2000-01	2004-05
Household consumption	2 278	2 108	120	103
Change over period	-	-7.4%	-	-14.2%

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

3.3 Regional water accounts

The SEEAW allows for water accounts to be produced for various geographic levels depending on available data. The ABS water account is produced for Australia, and States and Territories. For 2004-05 the ABS also released water consumption estimates for Water Management Regions. The ability of the ABS to produce regional estimates for 2008-09 will be dependent on the availability of high quality data at fine regional levels.

The Murray-Darling Basin (MDB) is vitally important to Australian agriculture, contributing 39% of Australia's gross value of irrigated agricultural production in 2005-06. In 2005-06, farmers in the MDB used around 66% of Australia's agricultural water consumption. The MDB spans parts of New South Wales, Victoria, Queensland, and South Australia, as well as the ACT. ABS recently released a publication about the MDB – *Water and the Murray-Darling Basin – A Statistical Profile 2000-01 to 2005-06 (cat. no. 4610.0.55.007)*, which filled the information gap on this region. For 2008-09 the ABS is aiming to include a supply and use table for this important region.

3.4 Monetary water accounts

As already mentioned water accounts can be used to chart changing patterns of water use associated with evolving water pricing and trading policies, particularly when such policies target specific sectors of the economy. In the past, water allocation in Australia was largely based on a series of administrative systems anchored in incremental allocation and 'first in' principles (i.e. those who accessed the water first took priority). Now, trading is the primary means of reallocating available water resources between sectors, regions and communities. Monetary accounts can demonstrate the relationship between the physical flows of water in the economy and the value of transactions associated with those flows. The ABS produced monetary water estimates for 2004-05 and plans to release similar data for 2008-09.

4 CONCLUSION

This paper has provided a brief overview of the benefits of using an environmental–economic framework for water accounting. ABS water accounts are compiled in an external environment where available water information is always changing. For the next ABS water account to be released at the end of 2010, ABS will make use of data made available through the Bureau of Meteorology in its expanded water information role. The key changes to the ABS strategy will be that ABS will not run a Water Suppliers collection, and an economy wide survey of industry water use will be conducted to provide better comparative information about water use across all industries.

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