Bringing two water accounts together – an integrated water account for the Canberra region

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Water accounting is a way of arranging water information to suit a variety of management and policy needs. It provides a systematic process of identifying, recognising, quantifying, and reporting information about water and how it has been used. In Australia, there are many types of water accounts produced by a variety of business and government organisations, from catchment management regions to river basins, states, territories and at the national level. As competition for water resources increases so too does the need to fully and consistently account for how water is shared between the economy, people and the environment.

In Australia, two Federal government agencies – the Australian Bureau of Statistics (ABS) and the Bureau of Meteorology (BoM) – produce annual national water accounts of different types, for differing but complementary purposes.

This project utilises the System of Environmental Economic Accounting (SEEA) and Australian Water Accounting Standard 1 (AWAS 1) frameworks to integrate these water accounts, which were individually compiled under the two different frameworks. It provides an excellent example of a National Statistical Office (NSO) working with another government organisation to produce a valuable set of integrated environmental-economic accounts.

This paper outlines four types of integrated water accounts for the Canberra region produced as a result of this ABS/BoM collaboration, including water condition, water assets, physical and monetary supply and use accounts, as well as highlighting the benefits of combining two sets of water accounts constructed under two different frameworks.

1.0 Summary of findings

1. The Australia Bureau of Statistics and the Bureau of Meteorology both produce annual water accounts for the Canberra region using two distinct frameworks. A recent collaboration between these two government organisations involved the production of an integrated set of water accounts, providing an excellent example of an NSO working with another key government organisation to produce a valuable set of environmental-economic accounts.

2. The collaboration highlighted that the two sets of water accounts were quite complementary to one another, and were both developed in accordance with rigorous conceptual frameworks and standards. It assisted in identifying the points where the two products overlapped/connected as well as identifying those areas of non-alignment with the potential for improved connection. Above all, it added value to providing a more robust and thorough information set for informing policy, planning and decision-making by governments and industry by providing a more detailed insight into the management of Canberra's water resources and use.

3. As a result of the collaboration, a joint ABS/BoM publication for the Canberra region will be produced, presenting water accounts using the BoM AWAS 1 framework, including water accounting statements and contextual analysis, as well as four sets of integrated SEEA-Water accounts, for the reference period 2013-14 to 2016-17, including:
    a. water condition/quality,
    b. water assets,
    c. physical supply and use of water,
    d. monetary supply and use of water.

4. There were many benefits as a result of the collaboration, including:
    a. the consolidation and integration of various data sources into one complete product, adding to the robustness, scope and quality of the information set;
    b. providing a "one-stop shop" for water accounts information for the Canberra region, to avoid confusion for data users and to inform policy;
    c. supporting a collaborative governmental national approach to environmental-economic accounting (to mainstream the SEEA framework in environmental decision making in Australia);
    d. bringing together multisector/multidisciplinary expertise;
    e. assisting in a greater understanding and sharing of data sources and data gaps;
    f. presenting the process for and lessons learnt from integrating accounts using different methodologies and frameworks.

5. Some of the challenges faced during this collaborative project were:
    a. integration of the ABS and BoM accounts, as the respective frameworks for the accounts are different, leading to variable definitions, terminology, data sources and estimation methods;
    b. the reporting boundaries for the ABS and BoM accounts do not align exactly – i.e. the ABS reports for the ACT jurisdiction whereas BoM extends this jurisdictional boundary to include the surrounding catchment;
    c. ensuring equivalence of the main area of overlap between the ABS and BoM accounts, i.e. the total volume of water abstracted from the environment (see Figure 1); the BoM accounts for the

Canberra region include a large "balancing item", representing uncertainty in the data, conceptualisation inadequacy and volumes which do not meet recognition criteria, requiring further investigation;

d. the treatment of losses differed between the ABS and BoM water accounts – work is currently underway to reconcile the difference in the treatments;
e. the treatment of wastewater – detailed data was not collected by either organisation on the splits, by household and industries, of wastewater returned to the sewerage system;
f. the ABS and BoM have differing publishing standards, leading to challenges around the production of a joint publication.

6. Some preliminary examples of results are presented in this paper, with final results to be published on 13 December, 2018, in a joint ABS/BoM publication. The main aim of this paper is to present the issues confronted and benefits achieved via this unique collaboration, as well as a summary of the data sources and methods.

2.0 Introduction and background

7. Water is essential for life. It is a key component in growing food, generating energy, producing many industrial products and other goods and services, as well as ensuring the integrity of ecosystems. Growing water scarcity is now one of the leading challenges for sustainable development due to increasing competition for freshwater use in the agricultural, urban and industrial sectors, including through population growth, and worsening water quality (United Nations, 2012).

8. There is growing interest in water accounting based on the premise that 'We cannot plan and manage what we do not measure' – a statement that few would disagree with (Food and Agriculture Organisation of the United Nations). Water accounting is a way of arranging water information to suit a variety of management and policy needs. It is the process of communicating water resources related information and the services generated from consumptive use in a geographical domain, such as a river basin, a country or a land use class, to users such as policy makers, water authorities, managers, etc. (http://www.wateraccounting.org/)

9. In Australia, several state and territory government agencies produce water accounts, while two Federal government agencies – the Australian Bureau of Statistics (ABS) and the Bureau of Meteorology (BoM) – produce annual national water accounts, for differing but complementary purposes. One of the risks to the value of these two sets of accounts is confusion for users around the roles of the respective accounts. The confusion is mostly attributed to the similarity of their names but also to lack of understanding about their content. An aim of this joint ABS/BoM project was to alleviate much of this confusion.

10. The BoM's National Water Account (NWA) and the Australian Bureau of Statistics' Water Account, Australia (WAA) emphasise different aspects of Australian water resources and the use of these resources by the Australian community. The NWA focuses on the volume of water in the environment, its availability, the rights to abstract water and the actual abstraction over time; it includes information on climate and weather impacts on water availability, along with water management policies and practices. The WAA shows how much water is used by human activity. It focuses on flows of water from the environment to the water supply industry and other economic activities, particularly agriculture, and the flows of water within the economy, for example, from the water supply industry to households and businesses. The WAA also records the monetary values associated with water supplied and used in the economy (Figure 1; ABS, 2011). In general terms, relating back to the SEEA-Water framework, the BoM produces "asset" accounts whilst the ABS has more of a focus on "flow" accounts, so an integration of the two provides a more holistic set of accounts.

Water accounting frameworks

11. The System of Environmental-Economic Accounting for Water (SEEA-Water) provides a conceptual framework for organizing hydrological and economic information in a coherent and consistent manner. The SEEA-Water framework is an elaboration of the Handbook of National Accounting: Integrated Environmental and Economic Accounting, commonly referred to as SEEA-2003, which describes the interaction between the economy and the environment and covers the whole spectrum of natural resources and the environment (United Nations, 2012).

12. The ABS water accounts follow the key concepts of the SEEA framework, however they pre-date both the SEEA Central Framework and SEEA-Water and some aspects do not align exactly with these frameworks. The BoM accounts are guided by the Australian Water Accounting Standard 1: *Preparation and presentation of General Purpose Water Accounting Reports* (AWAS 1), developed by the BoM and first issued in 2009.

13. The Australian Water Accounting Standards, based on financial accounting principles, guide the preparation and presentation of the BoM's National Water Accounts, which are designed to inform users about how water has been sourced, managed, shared and utilised, and to enhance public and investor confidence in the amount of water available, allocated, traded, abstracted for consumptive use and recovered and managed for environmental and other public benefit outcomes (BoM 2014). A unique feature of AWAS 1 is that it includes the principle of accrual accounting (reporting water that is promised but not yet delivered). It also provides information in the form of notes to further expand on the data presented in the statements/tables.

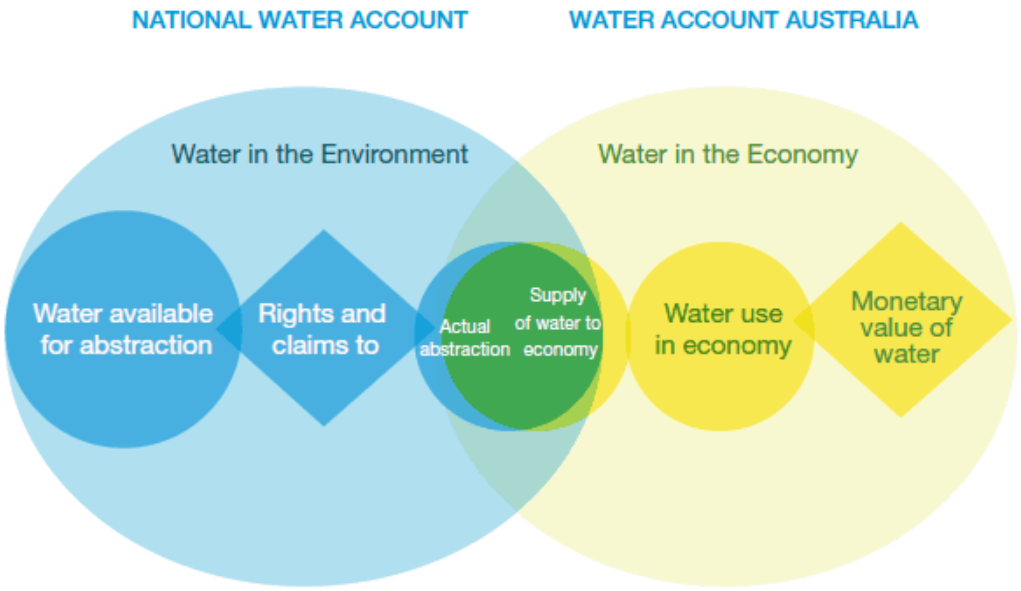

Figure 1 The aspects of, and intersection between, the National Water Account and the Water Account Australia (ABS, 2011).

Water accounts for the Canberra region

14. In 2017, the first iteration of a set of environmental-economic accounts, including water accounts, for the Australian Capital Territory (ACT) was published in the Environmental-Economic Accounts for ACT State of Environment Reporting - Proof of Concept, September 2017, developed and published by the Commissioner for Sustainability and the Environment Reporting (Smith et al., 2017). The current collaboration between ABS and BoM builds on this work by utilising the SEEA framework, the Australian Water Accounting Standards and the methodology used to produce the water accounts in the Environmental-Economic Accounts for ACT State of Environment Reporting - Proof of Concept, September 2017 report. It updates and expands these water accounts, providing a great example of a set of integrated water accounts compiled under two different frameworks by two different government organisations.

Description of the Canberra region

15. The area covered by these accounts is referred to as "the Canberra region", located in the south-east of Australia and capturing the Australian Capital Territory (ACT) and surrounding catchment area, including the cities of Canberra (the capital city of Australia, with a population of around 400,000) and Queanbeyan (a population of around 36,000) (see Figure 2). The boundary of the Canberra region encompasses the ACT and extends into New South Wales (NSW). Canberra is located about 250 kilometres south-west of Sydney and 650 kilometres north-east of Melbourne. It is Australia's largest inland city and the eighth-largest city overall (BoM, 2016; ABS, 2018).

16. The boundary of the Canberra region captures the whole of the catchment and water supply system in and around the ACT. The ACT and NSW governments administer the section of the region that is within their respective jurisdictions. Canberra's water is stored in four major artificial reservoirs - the Corin, Bendora and Cotter dams on the Cotter River, and the Googong Dam on the Queanbeyan River. Although the Googong Dam is located in NSW, it is managed by Icon Water (https://www.iconwater.com.au/~/media/files/icon-water/water-and-sewerage-files/purpose-of-googong-dam-factsheet.pdf?la=en&hash=EB5FAD0F4FD1039C8730065E74BCBDAE354CA878).

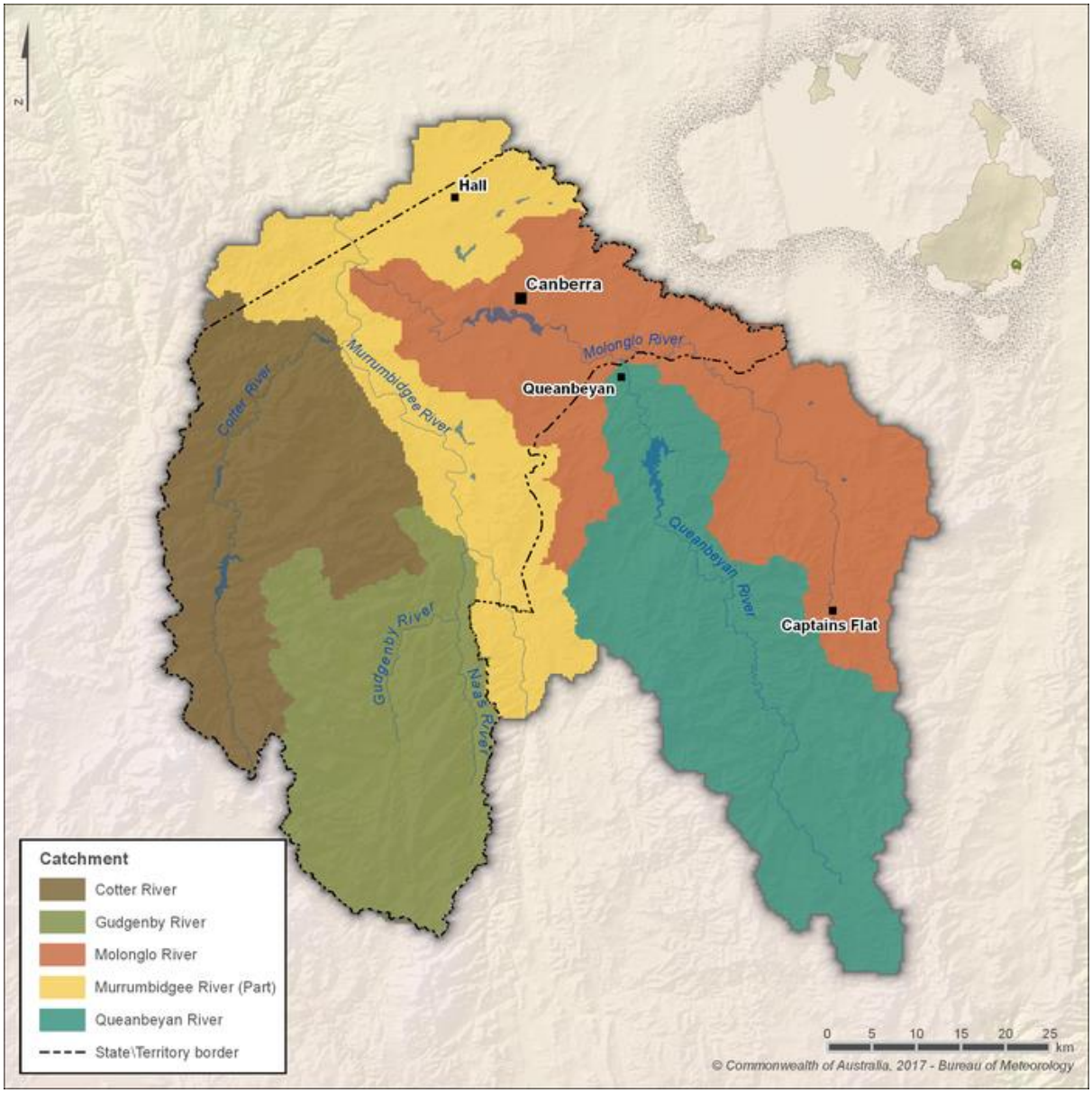

Figure 2 Contextual map of the Canberra region (BOM, 2016)

17. Icon Water (formerly ACTEW Water) is a statutory body of the ACT government. It owns and manages most of the Canberra region's water supply system and waste water system. Icon Water does not manage Queanbeyan-Palerang Regional Council's reticulation system; Queanbeyan-Palerang Regional Council receives bulk water from Icon Water and supplies potable water through its reticulation system to its customers. Queanbeyan-Palerang Regional Council also collects and treats wastewater for its own local government area. Most treated water is discharged to the Molonglo River with the balance recycled for on-site use (Figure 3; BoM, 2016).

18. The Mount Stromlo water treatment plant receives water from the Corin, Bendora, and Cotter reservoirs, all located on the Cotter River, and water from the Murrumbidgee River at the Cotter pump station. Water diverted from Googong Reservoir receives treatment at the Googong water treatment plant. Excess treated water from the Mount Stromlo plant can be transferred to the Googong Reservoir for storage (BoM, 2016).

19. In 2013 the Cotter dam was expanded to increase in the total storage capacity of the Cotter Reservoir from 3,865 ML to 79,374 ML, and to secure water resources for the future of the Canberra region. As the Cotter Reservoir continued to fill during the 2015–16 year, its water storage increased from 84% to 99%, close to its full capacity. On 7 July 2017, the reservoir spilled for the first time since its construction (BoM, 2016).

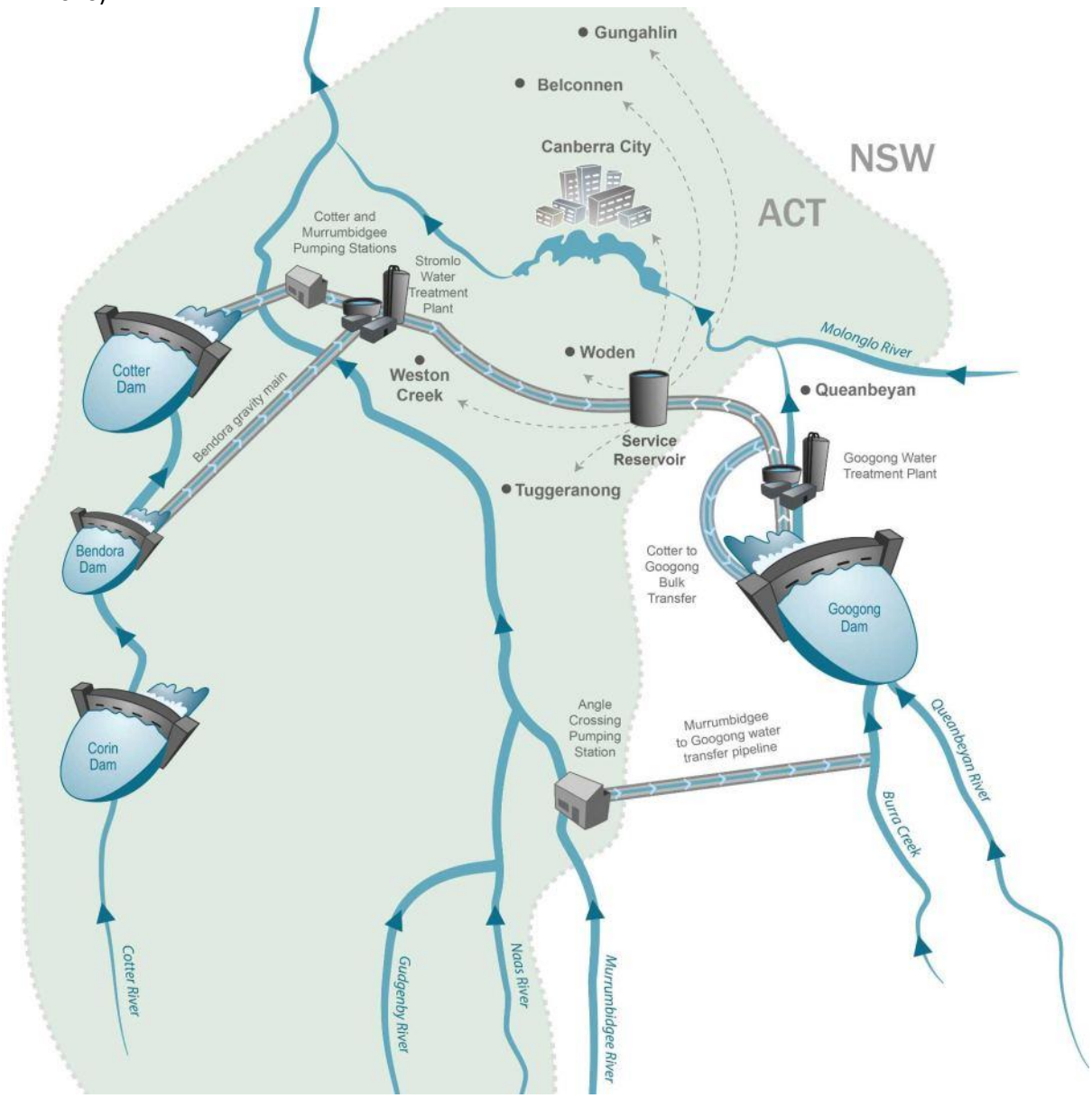

Figure 3 ACT Water Supply Map (Source: Icon Water)

20. This paper outlines the content of the joint publication; that is, a set of water accounts for the Canberra region using the BoM AWAS 1 framework, including water accounting statements and contextual analysis, as well as four types of integrated SEEA-Water accounts, for the reference period 2013-14 to 2016-17:
    - A water condition account, covering the condition of reservoirs, lakes, rivers and streams using a range of ecological measures (e.g. water bugs, turbidity and pH).
    - A water asset account, detailing the amount of water occurring in the environment, including artificial reservoirs, inflows from rainfall and upstream sources and the amount abstracted from the environment for use.

- Physical supply and use tables for water, displaying the amount of water abstracted from the environment by households and industry, how this flows through the economy, and the volumes that are returned to the environment (e.g. the discharges of treated sewerage water).
- Monetary supply and use tables for water, presenting information on the monetary supply and use of water in the Australian economy, including valuation of natural inputs (ecosystem service of water provisioning) revenue from sales of water and the provision of water and sewerage services expenditure on water and sewerage services by industries and households.

3.0 Data Sources and Methodology

The water condition account

21. The main data source for the water condition accounts for the Canberra region is the annual Catchment Health Indicator Program (CHIP) report Developed by the Upper Murrumbidgee Waterwatch program. The CHIP report provides a score of waterway health using data relating to water quality, water bugs (macroinvertebrates), and riverbank (riparian) vegetation. The base unit of reporting for CHIP score is the 'reach' (an individual stretch of waterway). The accounts present information on large water bodies and rivers by aggregating the individual reach scores (Upper Murrumbidgee Waterwatch Program, 2017).

Water asset accounts

22. The compilation of the BoM water accounting statements for the Canberra region are based on measured data provided to the BoM by lead water agencies and model data produced by the Australian Water Resources Assessment (AWRA) modelling system. The accounts produced by BoM can be easily mapped to the SEEA-Water asset accounts, forming the basis of the water asset accounts produced for this joint project.

Physical and monetary supply and use tables

23. The compilation of the physical and monetary supply and use tables was mainly based on data published by the ABS in the annual Water Account, Australia. The data were sourced from a range of ABS surveys as well as territory and local government agencies, water authorities and industry organisations. The main ABS sources include: ABS Water Supply and Sewerage Services (WSSS) Survey; ABS Environmental Indicators Survey (EIS); ABS Agricultural Census (ACS); and ABS Electricity Generators Survey (EGS). The main non-ABS data sources were the NSW Water Supply and Sewerage Benchmarking Report (NSW Department of Industry), the National Performance Report - Urban Water Utilities (BoM), and Annual/environmental reports from major water providers and businesses (ABS, 2017).

24. In the joint accounts, the physical and monetary supply and use tables are aligned with the data presented in the water asset tables/statements. This alignment provides a transparent way to report the water availability, sourced, and supplied to the users and the value of that water used.

Geographical boundaries

25. The ABS produces water accounts for Australia and all of its six states (New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania) and two territories (Northern Territory and the Australian Capital Territory) on an annual basis. The BoM produces annual water accounts for eleven nationally significant water regions, including the Canberra region.

26. One of the challenges with integrating the ABS and BoM water accounts for the Canberra region is that the reporting boundaries for the respective accounts do not align exactly - the geographical boundaries for the two accounts have been designed for two different reporting purposes and therefore are not the same. The boundaries can, however, be reconciled to one another. The ABS reports on the ACT boundary whereas the BoM extends this jurisdictional boundary to include the Canberra water supply catchment, which includes sections of NSW. This joint project uses the same boundaries as BoM - this has required both the ABS and BoM to disaggregate data in a way that can easily be traced between both set of statements/tables.

4.0 Results to date (full results to be published in December 2018)

The water condition account

27. Integrating water condition accounts with ABS and BoM water accounts enables the community to better understand water quality and riparian health issues in the catchment, as well as providing an ongoing baseline assessment of catchment health to assist natural resource managers and policymakers in addressing some of these issues. The CHIP is recognised in the ACT Water Strategy 2014-44 as a way to 'Enhance knowledge and spatial planning for water and catchment management' (ACT Government, 2014).

28. The water condition account provides information related to quantitative changes in water condition and the health of waterways (creeks, rivers, lakes and wetlands) across the ACT using aggregate CHIP scores. This provides further insight into the state of waterways and possible issues influencing the score. The CHIP score encompasses physiochemical properties of water, in-stream water bug diversity and abundance, and riparian vegetation condition. The CHIP scores and the individual indicators are scored from one to five. A score of one signifies an 'excellent' condition system, two a 'good' condition, three a 'fair' condition, four a 'poor' condition and 5 is 'degraded' (Upper Murrumbidgee Waterwatch Program, 2017; Smith et al., 2017).

29. The Murrumbidgee and Cotter rivers provide drinking water and important habitats for the Canberra region; while the Molonglo River is the major source of water for Lake Burley Griffin, which is located in the centre of Canberra – this lake was designed to create an ornamental water feature for the city. All three rivers received 'good' aggregate CHIP score in 2016-17 and the water quality has improved in 2016-17 compared with 2015-16 (Figure 4).

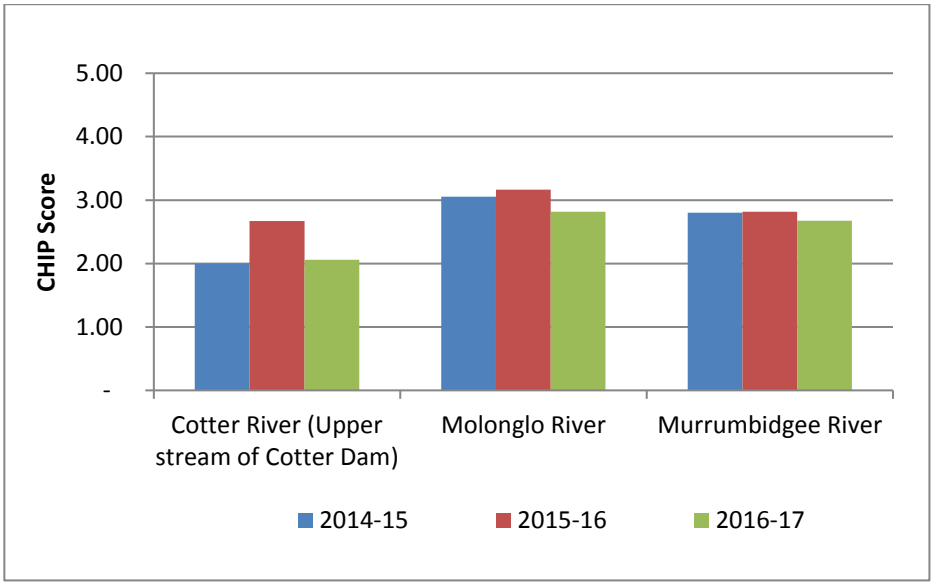

Figure 4 Catchment health Indicator Program Scores aggregated for select rivers across the ACT

30. The individual water quality indicators and aggregate CHIP scores for the catchments and lakes within the Canberra region are presented in Appendix 1.

Water asset accounts

31. The ABS has not published water asset account tables as a component of its WAA in the past. BoM's NWA presents the water asset account in a different format to the SEEA framework, presenting a water balance for surface water store, ground water store and urban water system separately for the Canberra region (Appendix 5). This collaborative project provided the opportunity for the ABS to work closely with BoM to align the data from both the ABS and BoM frameworks to produce a set of statements/tables that complement each other, and to integrate BoM's NWA data into SEEA-style water asset account tables.

32. Water asset accounts present information, in physical units (e.g. ML), on the stocks (assets) of water resources at the beginning and end of an accounting period, and present various water resource types as well as origins and destinations of water inflows (e.g. from rainfall and upstream sources) and outflows (e.g. abstractions and evaporation). They link information on abstraction and returns with information on the stocks of water resources.

33. In the SEEA-Water, the water resources considered in the inland water resource system are surface water (rivers, lakes, artificial reservoirs, snow and ice), groundwater and soil water. Note that soil water estimates have not been included in this paper due to a lack of available data.

34. Table 1 presents estimates of water stored in major artificial reservoirs (Bendora, Corin and Cotter dam) in the Canberra region from 2009-10 to 2016-17. The volume increased by 100% from 56,055 ML in June 2010 to 112,303 ML in June 2016, mainly due to completion of the Cotter Dam expansion in 2013-14. The Canberra water supply system includes Googong Dam, located in NSW - the volume stored in this dam has increased by 107% from 58,593 ML in June 2010 to 121,259 ML in June 2016, also due to the

enlargement of the dam. Water abstraction levels in the Canberra region have been stable at around 40,000 ML since 2010-11. Note that in the set of integrated asset accounts compiled as part of this ABS/BoM collaboration, data for each major artificial reservoir were separated, rather than just presenting a combined total for "artificial reservoirs". This was possible due to the fact that the region of interest is relatively small in area and contains only four major artificial reservoirs.

35. Water provisioning is an ecosystem service, defined in this project in physical terms by the runoff or water yield from the catchments in the study area, which provides inflows to the reservoirs (Keith et al., 2016). Although the ecosystem service of water provisioning is not generally included as a component of SEEA water asset accounts, it is a significant service provided to society. The water provided by this service is used (abstracted) by the water supply industry as an input to the production of water supplied and used in the economy and is therefore valuable information for inclusion in an asset account. In the Canberra region the average volume of the water provisioning service since 2010-11 was about 35,000 ML, slightly lower than the water volume abstracted from the environment each year.

Table 1 – Water stored in reservoirs in the ACT region (ML)

	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Stock - Googong (NSW)	58,593	121,068	121,406	121,084	121,084	121,259	121,259
Stock - Cotter, Bendora and Corin (ACT)	56,055	80,184	84,733	60,206	98,364	104,637	112,303
Extractions	-	42,045	36,008	43,995	39,305	40,541	40,546
Ecosystem service of water provisioning	-	34,234	66,381	31,697	29,100	29,100	29,100

36. BoM's NWA provides complementary information to ABS's WAA and the standard SEEA water asset account. NWA is guided by the Australian Water Accounting Standards, which set out the requirements for the recognition, quantification, presentation and disclosure of items to ensure comparability with reports over time and to reports prepared by other reports prepared in accordance with AWAS 1. The objective of AWAS 1 is to provide information for making and evaluating decisions about the allocation of resources. NWA contains general contextual water and climate information (Appendix 5), water trades, allocations and entitlements, water availability, environmental water legislation and provisions and outlook (Appendix 5). NWA also drills down to regional areas (e.g. river basins), providing water management information that is tailored to a more local perspective, while ABS WAA includes state and territory level water accounting.

37. The urban water system (including wastewater collected) is not usually one of the "water resources" described in a standard SEEA-Water asset account (SEEA-W, page 95 – the standard display features surface water, groundwater and soil water) but is able to be included using AWAS 1. Expanding the SEEA water asset account by including the urban water system provides users with a useful disaggregation of its water resources and a more complete picture of the water assets in a region (e.g. volume of waste water collected and discharged, volume held in local small reservoirs), and is also helpful with regards to constructing the physical supply and use tables.

38. Complete water asset account tables for the Canberra region (the 2015-16 reference period is presented as an example) are presented in Appendix 2, displaying detailed information on the opening stocks, closing stocks, and additions and reductions to stocks for different water types (surface water, groundwater, urban water).

Physical and Monetary Supply and Use Tables (SUTs)

39. Water accounts underpinned by the SEEA framework can present time series data using a framework that is consistent with broader economic data, such as the System of National Accounts (SNA). They provide a system into which monetary valuations and environmental related flows can be incorporated with physical data, to assess the monetary implications of environmental actions and vice versa.

40. The area of intersection between the ABS and BoM accounts was identified as the amount of water abstracted from the environment by the water supply industry and other economic activities. Within a region, the volume of actual water abstraction presented in BoM's National Water Account is equal to the volume of water abstracted for own use (agricultural irrigation) plus water abstracted for supply to others, in the ABS Water Account, Australia. This equivalence facilitates the integration of information from the two accounts.

41. The treatment of water flows across administrative boundaries as imports and exports (i.e. including water flows to and from Googong dam and water supply and use across the NSW/ACT border) in the SEEA SUTs has assisted in addressing the issue of the non-alignment of boundaries across the two sets of water accounts (i.e. ABS jurisdictional boundaries compared to BoM's catchment boundaries).

42. During 2015-16, the total natural inputs from the inland water resource system were 50,403 ML to support the ACT economy, with more than 95% from surface water. Of this amount, 40,546 ML were abstracted for distribution (or supply) to industry and households, largely by the Water Supply, Sewerage and Drainage Services industry, and 8,271 ML was imported from NSW (Figure 5 and Appendix 3).

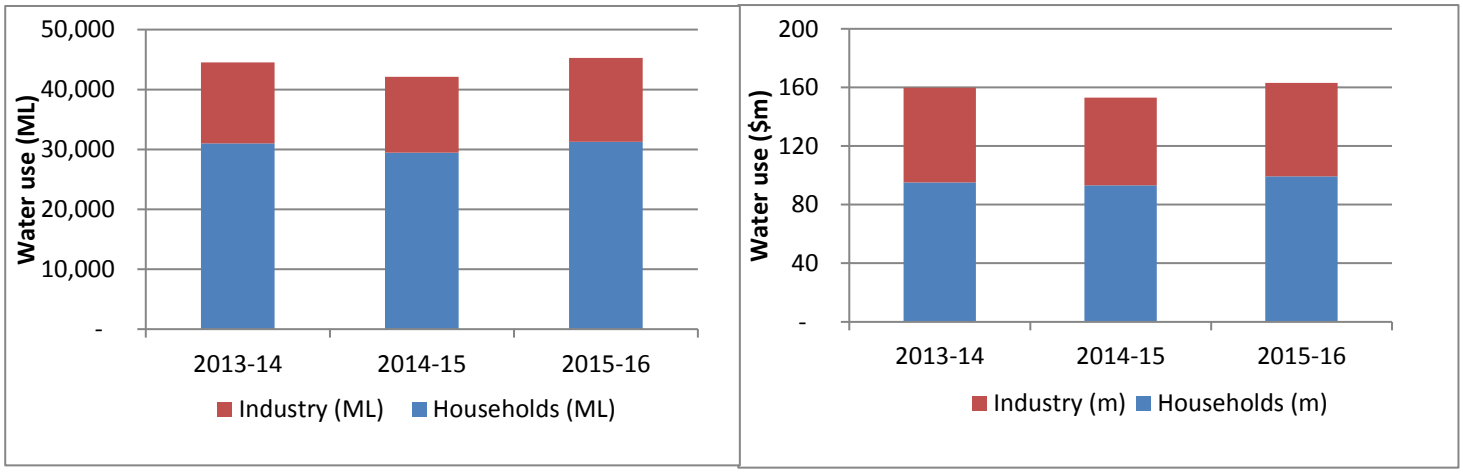

Figure 5: Consumption and expenditure on distributed (supplied) water in the ACT, 2013-14 to 2015-16

43. Households and businesses in the Australian Capital Territory used 48.6 gigalitres (GL) of water (93% of this was distributed water) in 2015-16, an increase of 7% (3 GL) from 2014-15. This increase is comprised of an 11% increase for Other industries (1.2 GL) and a 6% increase (1.8 GL) for household consumption.

44. Households were the main users of distributed water, accounting for 69% of the ACT's total water use and 61% of total water expenditure, with the next largest contributor being Other industries. Distributed water use has increased faster than the ACT population and economic activity (i.e. Gross State Product) between 2010-11 and 2015-16 (Figure 6), mainly due to increased rainfall from 2011 leading to increased water availability, after the a long period of drought. For the complete physical and monetary supply use tables please see Appendix 3 and 4.

45. It was identified that the treatment of losses differed between the ABS and BoM water accounts – work is currently underway to reconcile the difference in the treatments. Another challenge in compiling the SUT's was the treatment of wastewater – detailed data was not collected by either organisation on the splits, by household and industries, of wastewater returned to the sewerage system.

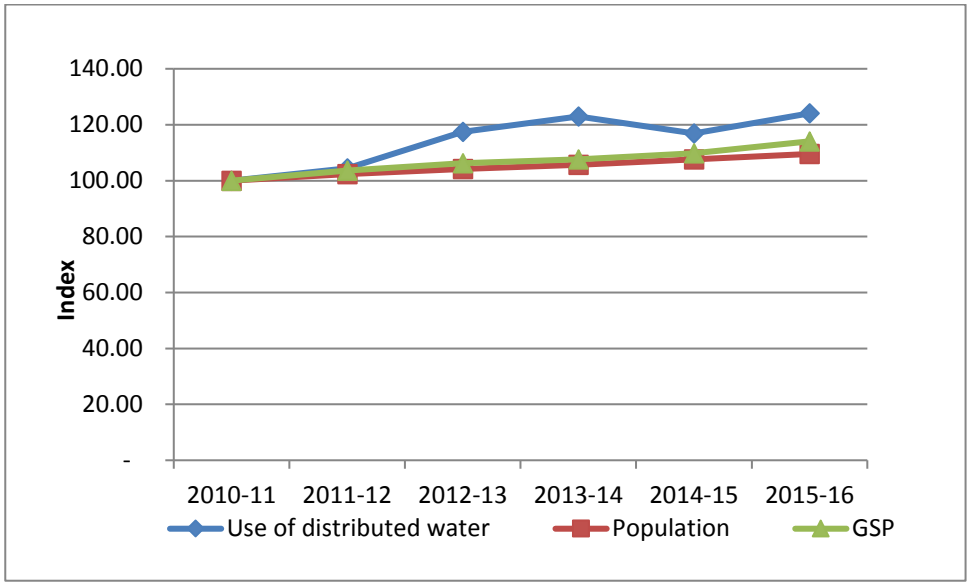

Figure 6: Index of ACT population, Gross State Product (GSP) and use of distributed water

4. Questions for discussion

46. Questions posed to the London Group for discussion are:

- Do other countries have experiences to share around integrating SEEA accounts with other environmental accounting frameworks?
- Are there any comments on the inclusion of the urban water system (including collection of wastewater) in the asset account?
- Are there any comments on the presentation of the physical SUT's, which differs slightly from those presented in the SEEA CF and the SEEA-Water?

- Have any countries adapted the SEEA's concept of water consumption, which differs from the concept of consumption that is used in the national accounts?
- Wastewater returned to the sewerage system – what is the best method to split wastewater by households and industries?
- Should water provisioning, as an ecosystem service, be included in the physical and monetary supply and use tables?

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Appendix 1 Detailed results – Water Condition Account

1) The number of reaches and the scores for the different water condition metrics

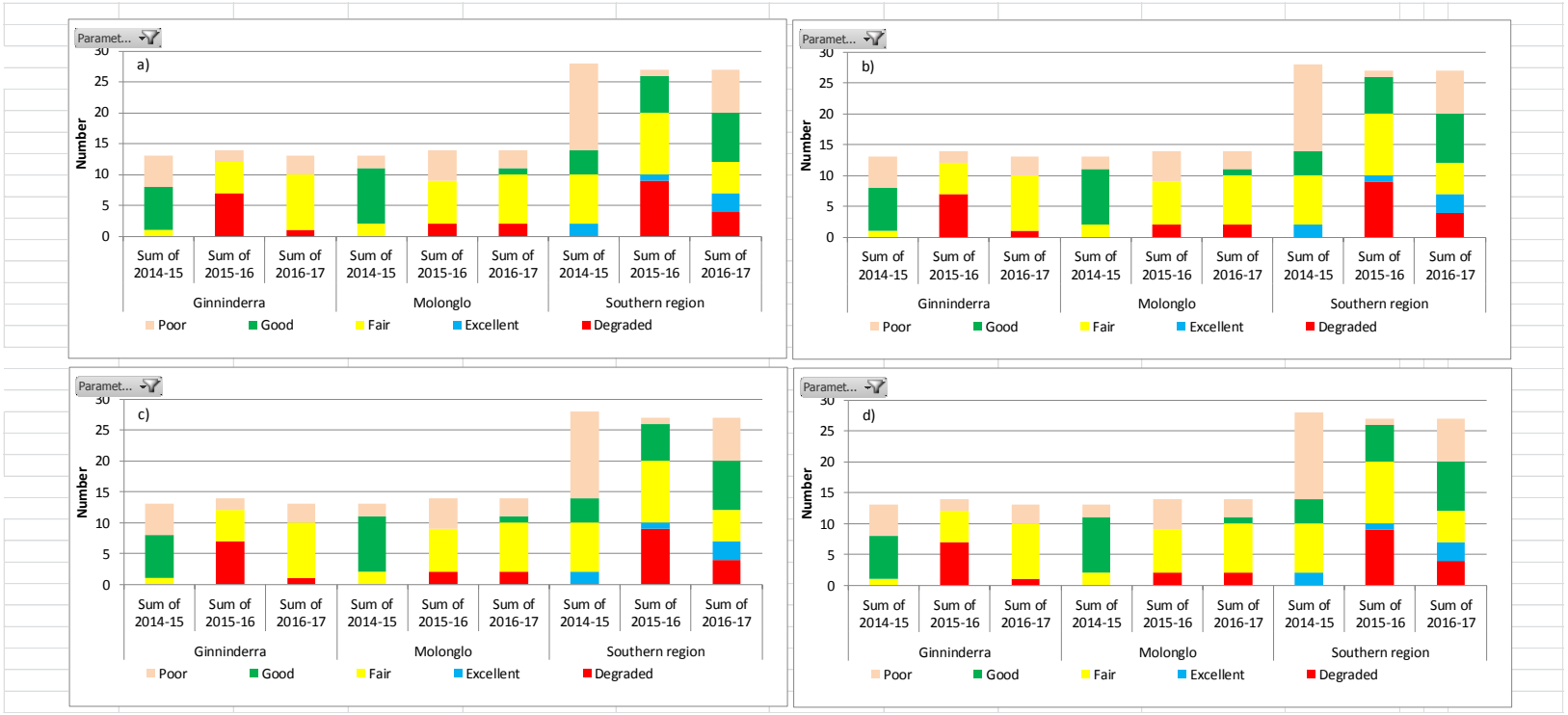

Figure 7 The number of reaches and the scores for the different water condition metrics (CHIP (a), RARC (b), Water Quality (c), and Water Bug (d)) within the ACT from 2013-14 to 2015-16

2) Catchment Health Indicator Program Scores aggregated for select lakes across the ACT

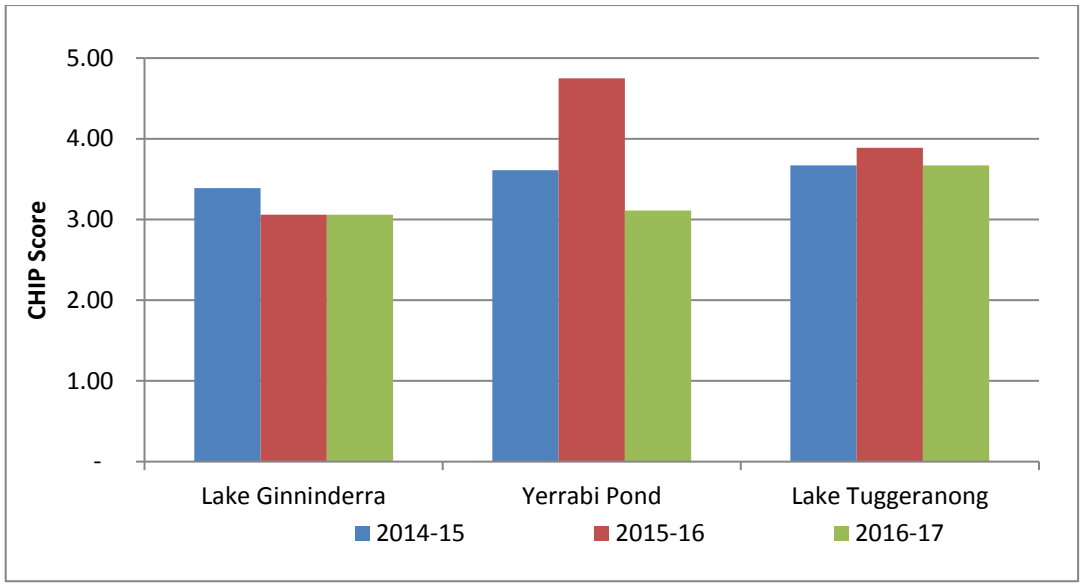

Figure 8 Catchment Health Indicator Program Scores aggregated for select lakes across the ACT

3) Catchment Health Indicator Program Scores aggregated for major catchments

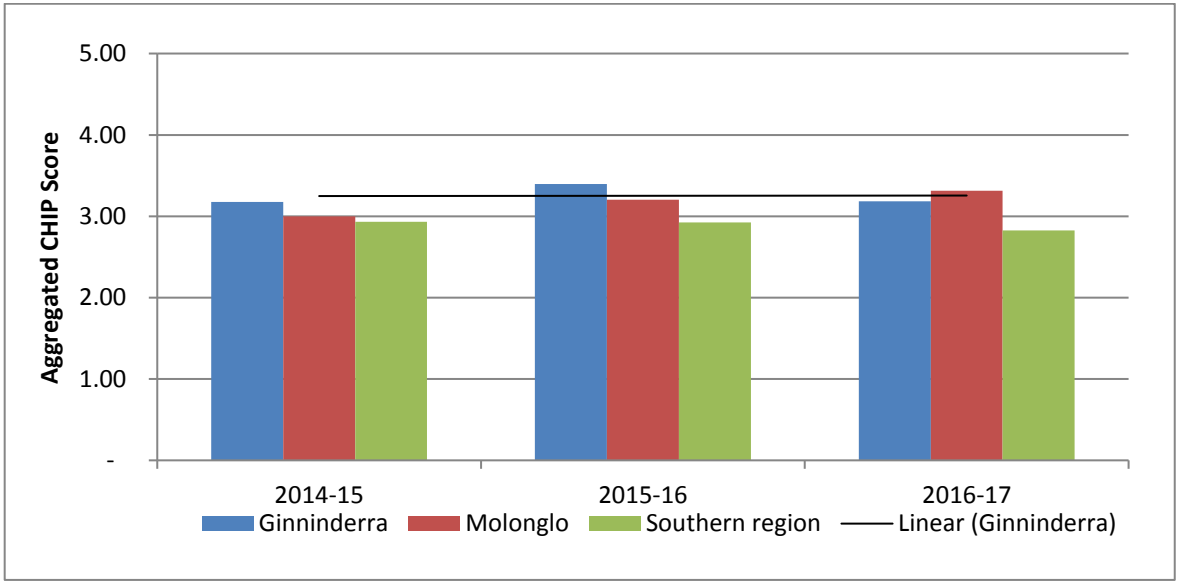

Figure 9 Catchment Health Indicator Program Scores aggregated for major catchments

Appendix 2 Detailed results – Water Asset Account

Table 5: ACT water asset account for 2015-16 (ML)

	Surface water			Subtotal surface water	Groundw	Urban water system	**ACT total**	Googong Dam	**Total ACT+ Googong Dam**
	Reservoirs	Lakes	Rivers						
Opening Stocks	**104,637**	**39,223**	**-**	**143,860**	**-**	**966**	**144,826**	**121,259**	**266,085**
Increases in stocks	33,234	79,278	939,465	1,051,976	4,454	80,079	1,136,509	5,182	1,141,691
Returns from the economy	-	-	30,558	30,558	4,454	34,796	69,808	-	69,808
Precipitation	4,134	5,002	-	9,135	-	-	9,135	5,182	14,317
Inflows	29,100	74,276	908,907	1,012,283	-	45,283	1,057,566	-	1,057,566
from upstream territories	-	74,276	356,494	430,770	-	4,737	435,507	-	435,507
from other resources in the territory	29,100	-	552,413	581,513	-	40,546	622,059	-	622,059
Decreases in stocks	49,458	110,476	729,252	889,186	38	80,499	970,363	12,600	985,680
Abstraction	40,546	-	1,593	42,139	679	-	42,817	4,737	47,554
Evaporation/Actual evapotranspiration	6,321	10,863		17,184	-	-	17,184	10,580	27,764
Outflows	2,591	99,613	727,659	829,863	-	80,499	910,362	-	910,362
to downstream territories	2,591	99,613	727,659	829,863	-	30,558	860,421	-	860,421
to other resources in the territory		-	-	-	-	49,941	49,941	-	49,941
Other changes in volume	23,891	31,548	-	55,439	-	420	55,859	7,418	63,277
Net change	7,666	350	-	8,016	-	-	8,016	-	**8,016**
Closing Stocks	**112,303**	**39,573**	**-**	**151,876**	**-**	**966**	**152,842**	**121,259**	**274,101**

Appendix 3 Detailed results – Physical Supply and Use Table

Table 4: Australian Capital Territory water physical supply and use tables for 2015-16

Physical Supply table (ML)

	Industry											
	Agriculture	Mining	Manufacturing	Energy	Water supply	Sewerage	Other industries	*Industry Total*	Households	Imports	Environment	**Total**
Natural inputs												
Surface water											46,869	**46,869**
Groundwater											652.5703407	**653**
Rainwater tanks											1,100	**1,100**
Subtotal natural inputs											*48,621*	***48,621***
Products												
Distributed water	-	-	-	-	40,546	-	-	40,546	-	4,737		**45,283**
Reused water	-	-	-	-	-	3,296	-	3,296	-	-		**3,296**
Wastewater	-	-	-	-	-	-	11,631	11,631	27,015	-		**38,646**
Subtotal products	-	-	-	-	*40,546*	*3,296*	*11,631*	*55,473*	*27,015*	*4,737*		***87,225***
Return flows												
Surface water	-	382	-	-	-	35,431	-	35,813	-	-		**35,813**
Groundwater	-	-	-	-	4,454	-	-	4,454	-	-		**4,454**
Subtotal return flows	-	-	-	-	*4,454*	*35,431*	-	*39,885*	-	-		***39,885***
Total supply	-	-	-	-	45,000	38,727	11,631	95,358	27,015	4,737	48,621	**175,731**

Physical Use table (ML)

	Industry											
	Agriculture	Mining	Manufacturing	Energy	Water supply	Sewerage	Other industries	*Industry Total*	Households	Exports	Environment	**Total**
Natural inputs												
Surface water	169	540	2	-	45,283	-	875	46,869	-	-	-	**46,869**
Groundwater	41	4	0	-	-	-	607	653	-	-	-	**653**
Rainwater tanks									1,100			**1,100**
Subtotal natural inputs	*210*	*544*	*2*	-	*45,283*	-	*1,482*	*47,521*	*1,100*	-		***48,621***
Products												
Distributed water	144	13	250.5808881	-	2,970	-	10,633	14,011	31,272	-	-	**45,283**
Reused water	-	-	0	-		3,200	96	3,296	-	-	-	**3,296**
Wastewater						38,646		38,646				**38,646**
Subtotal products	*144*	*13*	*251*	-	*2,970*	*41,846*	*10,729*	*55,953*	*31,272*	-		***87,225***
Return flows												
Surface water											35,813	**35,813**
Groundwater											4,454	**4,454**
Subtotal return flows											*39,885*	***39,885***
Total use			**252**	**-**	**48,253**	**41,846**	**12,211**	**103,474**	**32,372**	**-**	**39,885**	**175,731**

Appendix 4 Detailed results – Monetary Supply and Use Table

Monetary Supply table ($ m)	Industry												
	Agriculture	Mining	Manufacturing	Energy	Water supply	Sewerage	Other industries	*Industry Total*	Rest of the World	Taxes less subsidies on products, trade & transport margins	Actual Consumption		**Total**
											Households	Governments	
Valuation of natural inputs (Ecosystem service of water provisioning)													92.1
Total supply of water Products ($m)													
Distributed water			-	-	145.8	-	-	**145.8**	17.0	0.4	-	-	163.2
Reused water			-	-	5.2	-	-	**5.2**	-	-	-	-	5.2
Natural water	-	-	-	-	**151.0**	-	-	**151.0**	**17.0**	**0.4**	-	-	**168.4**
Sewerage Services	-	-	-	-	-	122.0	-	122.0	-	0.7	-	-	122.7
Total products					**151.0**	**122.0**		**273.0**	**17.0**	**1.1**			**291.1**
Intermediate consumption and final use ($m):													
Distributed water	0.0	0.0	0.6	0.0	-	0.0	63.3	**63.9**	-	-	99.2	-	**163.2**
Reused water	-	-	0.0	-	-	5.1	0.2	**5.2**	-	-	-	-	**5.2**
Natural water	**0.0**	**0.0**	**0.6**	**0.0**	**-**	**5.1**	**63.4**	**69.1**	**-**	**-**	**99.2**	**-**	**168.4**
Sewerage Services	-	-	-	-	-	38.2	-	**38.2**	-	-	84.5	-	**122.7**
Total products	**0**	**0.0**	**0.6**	**0.0**	**-**	**43.3**	**63.4**	**107.4**	**-**	**-**	**183.7**	**-**	**291.1**

Appendix 5 – BOM's NWA data

1) **Canberra: Climate and Water**

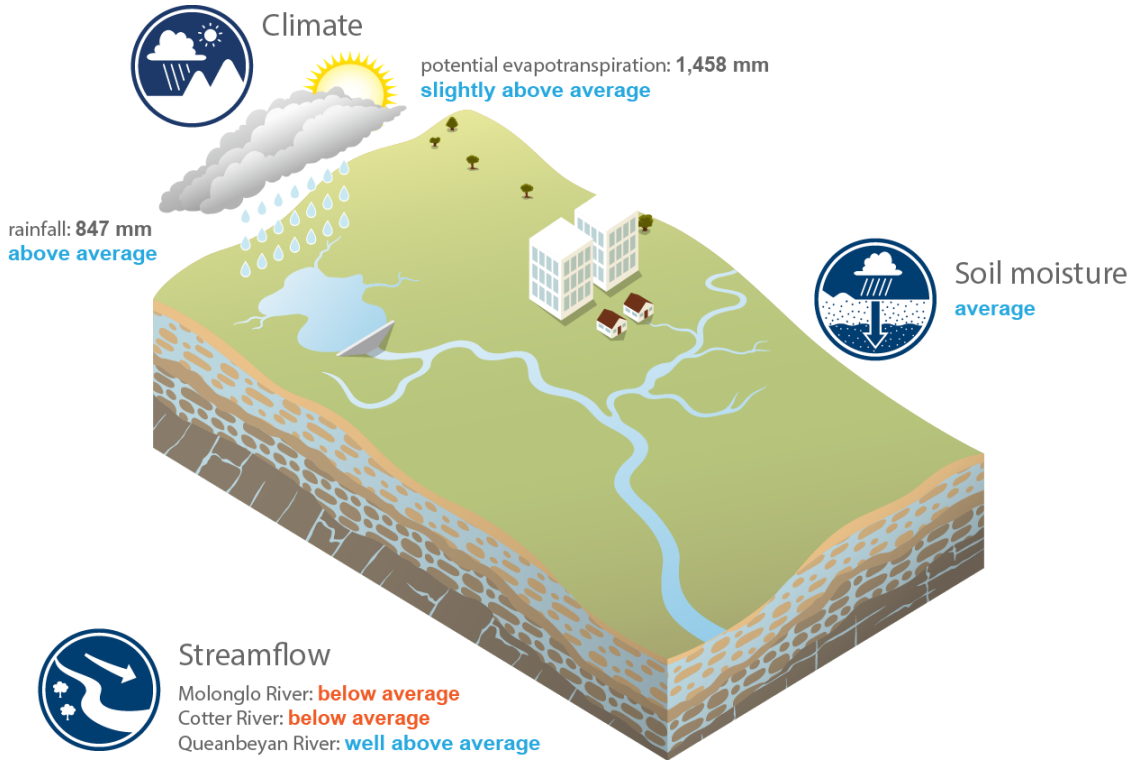

Figure 10 Canberra: Climate and water (Source: BOM's National Water Account 2016)

2) Canberra: Water Rights

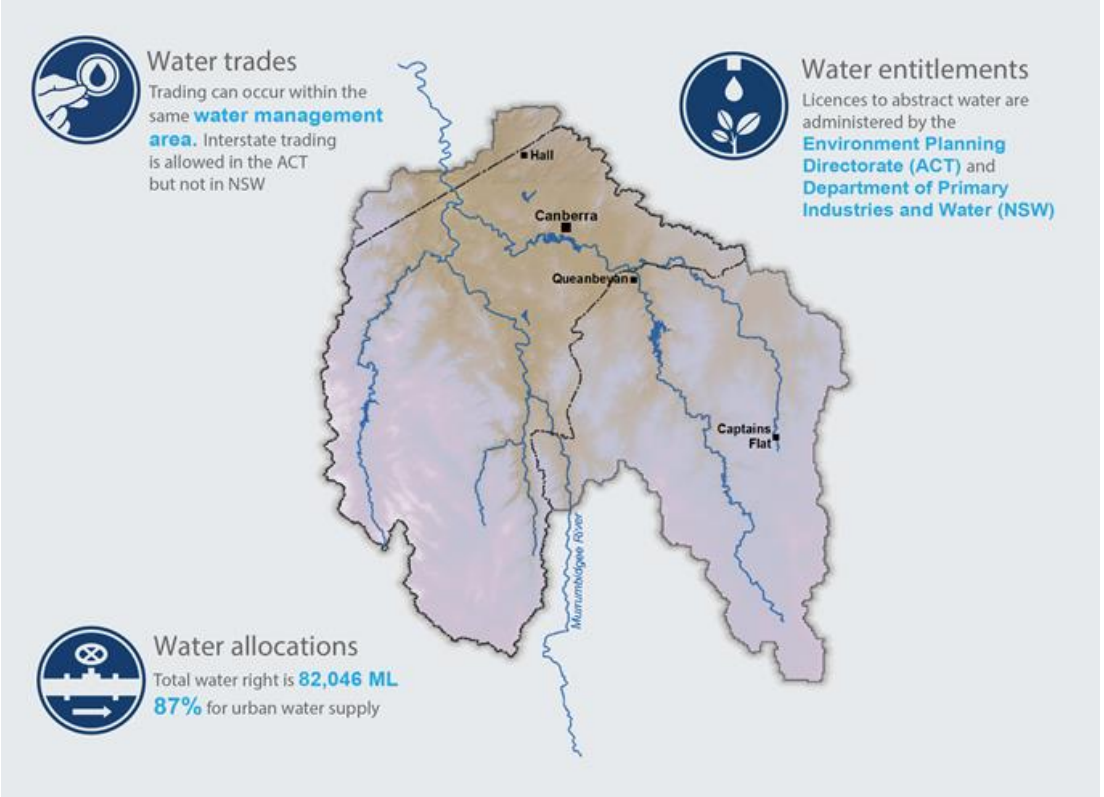

Figure 11 Canberra: Water Rights (Source: BOM's National Water Account 2016)

3) **Total storage volume in the ACT region**

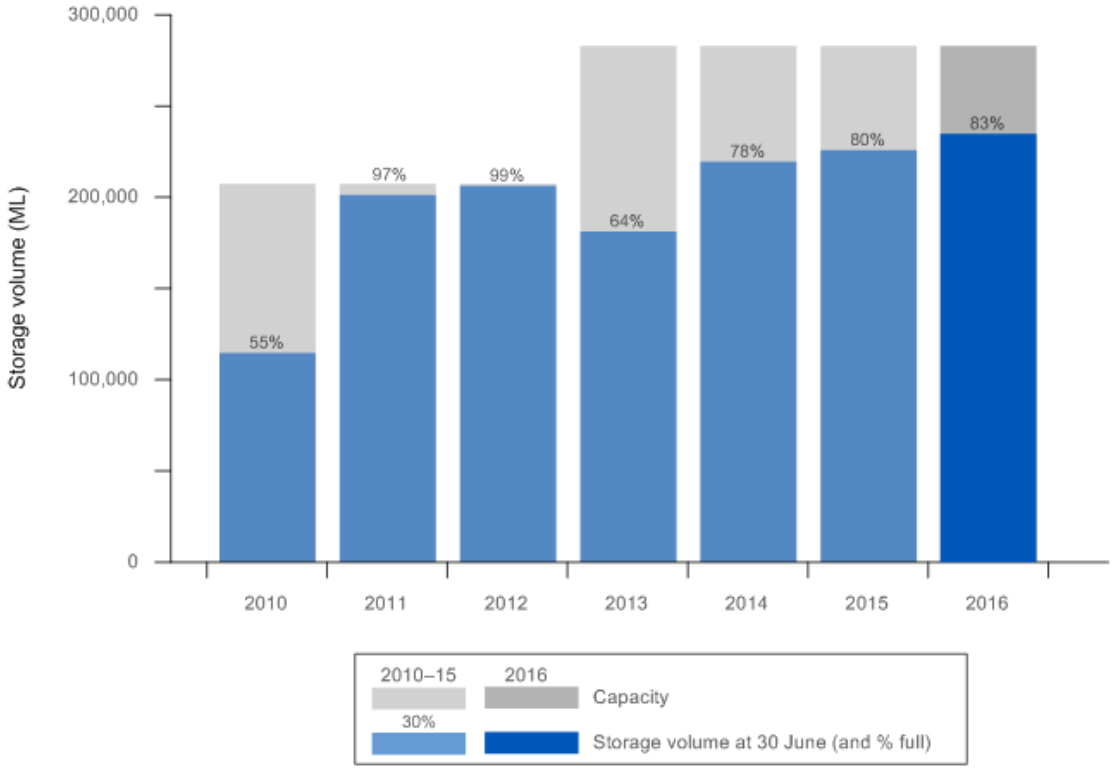

Figure 12 Total storage volume in the region at 30 June 2016 compared with the previous 6 years (Source: BOM's National Water Account 2016)

4) Water balance for the surface water, ground water and urban water system in the ACT region

Table S5 Water balance for the surface water store	2016 ML	2015 ML
Opening surface water store	265,119	258,190
Inflows	957,231	815,068
Outflows	(805,417)	(695,899)
Balancing item	(143,798)	(112,240)
Closing surface water store	**273,135**	**265,119**

Table S6 Water balance for the groundwater store	2016 ML	2015 ML
Opening groundwater store	–	–
Inflows	4,454	2,920
Outflows	(1,276)	(1,061)
Balancing item	(3,178)	(1,859)
Closing groundwater store	**–**	**–**

Table S7 Water balance for the urban water system	2016 ML	2015 ML
Opening urban water system	–	–
Inflows	89,049	84,400
Outflows	(85,518)	(84,305)
Balancing item	(3,531)	(95)
Closing urban water system	**–**	**–**

(Source: BOM's National Water Account 2016)