Water and the Murray Darling Basin - A Statistical Profile

Australia

2000–01 to 2005-06

Explanatory notes

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INQUIRIES

- For further information about these and related statistics, contact the National Information and Referral Service on 1300 135 070 or Bernard Morrisson on Canberra (02) 6252 5321

EXPLANATORY NOTES

INTRODUCTION

1 This publication presents a range of statistics about the Murray-Darling Basin (MDB) from 2000–01 to 2005–06, and draws on a variety of ABS and non-ABS sources. Care should be taken when comparing data from different sources and from the same sources over time because of differences in the types of collection activity undertaken and varying levels of reliability across these different sources.

CHAPTER 1

Land use and water balance data

2 The land use and water balance data for the MDB were sourced from the Bureau of Rural Sciences (BRS). The digital boundaries of Australia's river basins and drainage divisions fall under the custodianship of Geoscience Australia (Geoscience Australia 2004).

METHOD OF CALCULATION

3 The water balance data were generated for the Australian Water Availability Project, a project involving the BRS, Bureau of Meteorology (BoM) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). These agencies are working together to develop an on-line, operational system for monitoring soil moisture, run-off and other components of water balance, based on the method developed by Welsh et al. (2006). A steady-state catchment water balance model was used to generate the run-off data presented in this publication.

4 The BRS published water balance data on the 'Rural Water' website (see http://adl.brs.gov.au/water2010/index.phtml). The modelling methods used to estimate run-off, evapotranspiration and deep drainage are described in Welsh et al. (2006) and Welsh et al. (2007), and are based on the work of Zhang et al. (2004), Zhang et al. (2005), and Fu (1981).

DATA QUALITY AND RELIABILITY

5 The data on water balances are the result of complex models based on data collected by a range of agencies. Because of the complexity of the models and possible errors associated with the data used, these estimates should be used with a degree of caution. For more information please contact the BRS.

6 Differences in agricultural area data exist between the data sourced from the BRS and the data from ABS Agricultural Surveys and Censuses due to differences in concepts, methods and sources. The BRS data is modelled using satellite and other techniques and relates to land "observed to be crops or pasture". The agricultural land reported in the ABS Agricultural Census for 2005–06 is the total of land held as agricultural holdings, and can include land not used for crops or pasture (including forest plantations, wetlands, and land surrounding houses and buildings).

7 The *1985 Review of Australia's Water Resources and Water Use* (AWRC 1987), by the Australian Water Resources Council, identified 26 river basins which comprise the Murray-Darling Basin Drainage Division. There are variations in the number of river basins identified by other organisations. For example the CSIRO identified 18 catchments for the Murray-Darling Basin Sustainable Yields project and the MDBC identified 23 'valleys' for their Sustainable Rivers Audit.

Climate data

DATA SOURCES

8 Climate (rainfall and temperature) maps were sourced from the BoM National Climate Centre. Analyses are based on observational data which have undergone standard quality control procedures. For more information please contact BoM at: webclim@bom.gov.au.

Environmental Assets

DATA SOURCES

9 Data about environmental assets and biodiversity in the MDB were obtained from the Department of the Environment, Water, Heritage and the Arts (DEWHA). For an explanation of how this information was gathered, and data reliability issues, please contact DEWHA.

CHAPTER 2

Population Census data

DATA SOURCES

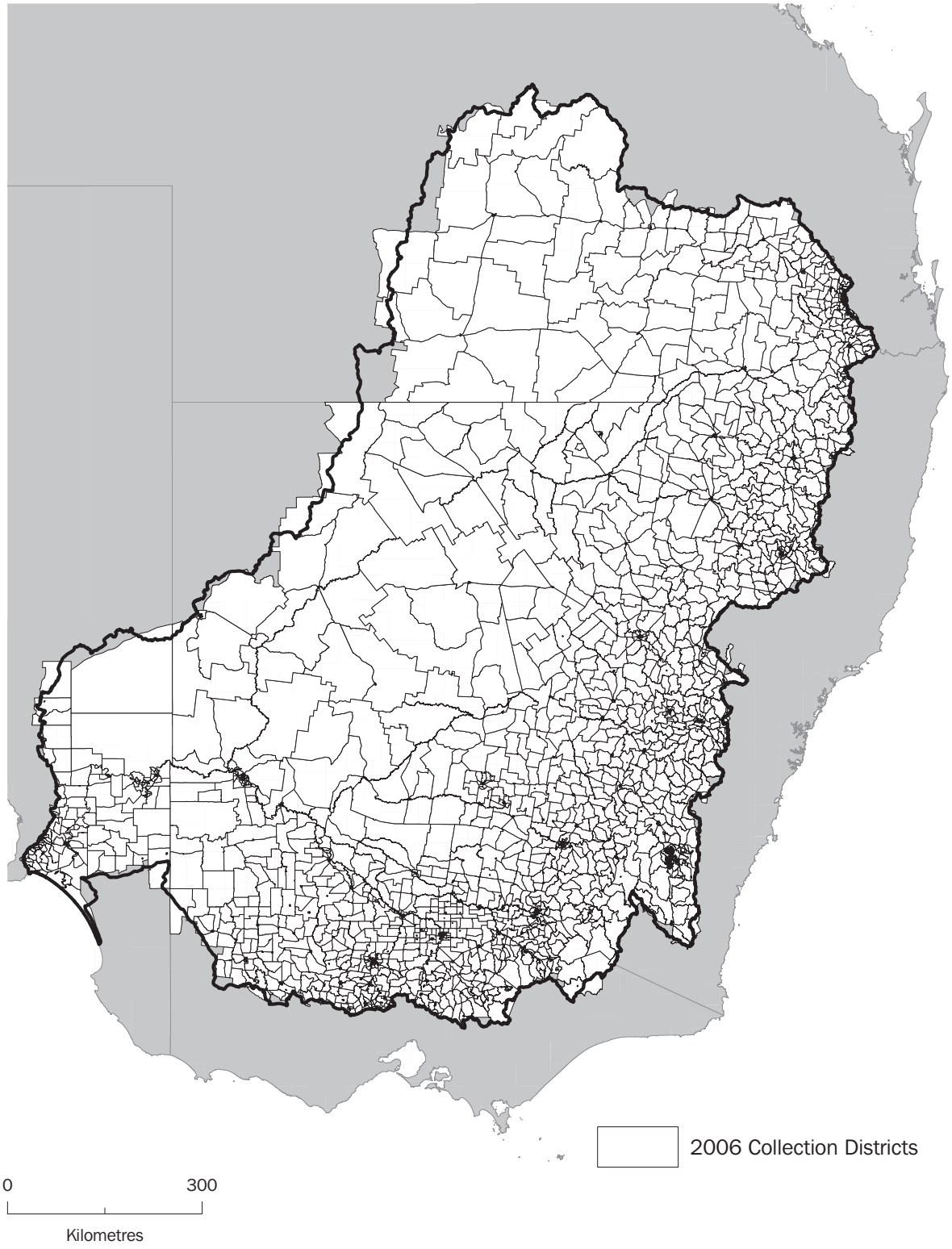
10 The 1996, 2001 and 2006 Censuses of Population and Housing were used to produce MDB estimates of population, employment, age, gender, family and education. Except for the family variable, all data were based on the place people usually live (place of usual residence) rather than the place where people were counted on Census night (place of enumeration). Although overseas visitors in Australia on Census night were included in the Census count, this chapter excludes them in all tabulations.

METHOD OF CALCULATION

11 The Collection District (CD) is the smallest geographic area for the release of Census data. Population data at the CD level were calculated for the MDB and Basin states using a CD-to-MDB concordance. The concordance was area-based; if more than 50% of a CD's area existed within the Basin, it was considered to be in. If not, it was excluded. There were 4,600 CDs determined to be in the MDB for 2006 (map E.1).

12 The relationship between 2006 CD and MDB boundaries are shown in the map below. The map demonstrates that there is a generally a good alignment of CDs to the MDB boundary except in the north western and western areas of the Basin.

E.1 CENSUS COLLECTION DISTRICTS WITH MORE THAN 50% OF THEIR AREA IN THE MURRAY-DARLING BASIN—2006



Source: Statistical Geography Volume 1 - Australian Standard Geographical Classification, July 2006, ABS cat. no. 1216.0, Geoscience Australia 2004

GEOGRAPHICAL AREAS

13 The geographical areas used in this publication are predominantly from the main structure of the Australian Standard Geographical Classification (Australia, and states and territories) but areas from the remoteness structure are also frequently used. For further information see *Australian Standard Geographical Classification (ASGC), 2007* (ABS cat. no. 1216.0).

DATA QUALITY AND RELIABILITY

14 Population Census data are used in Chapter 2 because it allows for a better approximation of the total MDB area than is possible with Labour Force Survey or Estimated Residential Population data. It also allows for more detailed analysis of variations between smaller population groups and small geographic areas. For further information see *Information Paper: Population concepts, 2008* (ABS cat. no. 3107.0.55.006) and *Australian Labour Market Statistics* (ABS cat. no. 6105.0).

15 Census data are affected by undercounting (see *Census of Population and Housing - Details of Undercount, Australia, August 2006* (ABS cat. no. 2940.0). In 2006, the net undercount rate (i.e. people missed in the Census, minus those counted more than once) for the whole of Australia was estimated at around 2.7%. This may have an impact on data presented for very remote areas. In addition, around 6% of people did not report their Indigenous status on the Census form.

NON-SCHOOL QUALIFICATION

16 Non-school qualifications refer to educational attainments other than pre-primary, primary or secondary education, and include Certificates (I–IV), Advanced diplomas and Diplomas, Bachelor degrees, Graduate certificates, and Post graduate degrees as shown in table 2.12 of Chapter 2. For further information see *Australian Standard Classification of Education (ASCED), 2001* (ABS cat. no. 1272.0).

INCOME

17 The mean equivalised gross weekly household income was used in measuring income as this variable best allows the comparison of the relative economic wellbeing of people in households of different sizes and compositions. For more information on equivalised income, see *Household Income and Income Distribution, Australia, 2005–06* (ABS cat. no. 6523.0).

Socio-Economic Indexes

DATA SOURCES

18 The Index of Relative Socio-Economic Disadvantage was used for analysis in this publication. Data were sourced from the Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia - data only 2006. For further information refer to http://www.abs.gov.au/websitedbs/D3310114.nsf/home/Seifa_entry_page.

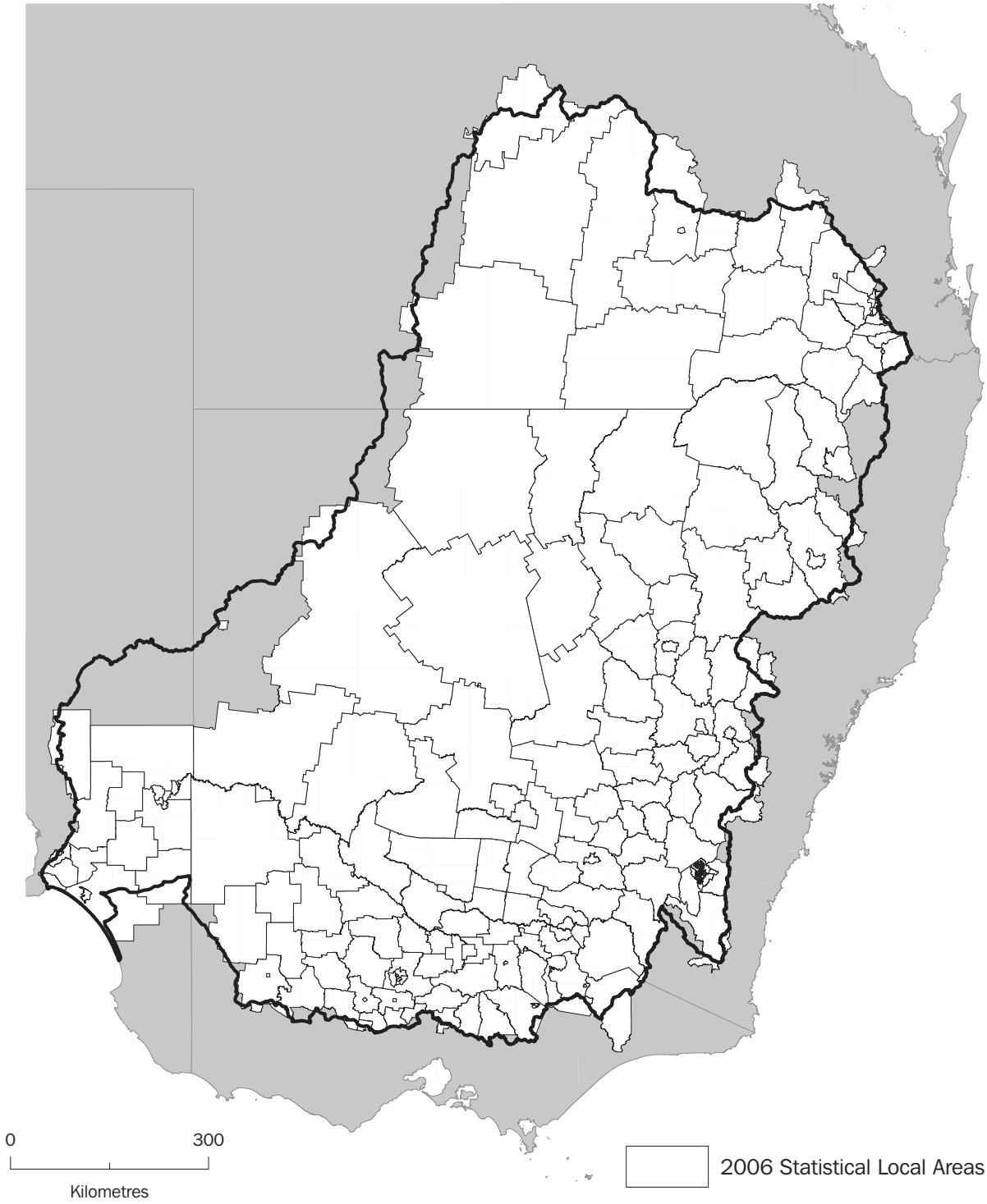
METHOD OF CALCULATION

19 SEIFA data for MDB Statistical Local Areas (SLAs) were selected based on an SLA-to-MDB concordance. The concordance was area-based; if more than 50% of an SLAs area existed within the Basin, it was considered to be inside the Basin. If not, it was excluded. There were 406 SLAs determined to be in the MDB in 2006 (map E.2).

20 For more information about the compilation of SEIFA indexes please refer to *Socio-Economic Indexes for Areas (SEIFA) - Technical Paper 2006* (ABS cat. no. 2039.0.55.001).

21 The relationship between 2006 SLA and MDB boundaries is shown in map E.2 below. The map demonstrates that there is a relatively good fit alongside the MDB boundary except in the north western and western areas of the Basin.

E.2 STATISTICAL LOCAL AREAS WITH MORE THAN 50% OF THEIR AREA IN THE MURRAY–DARLING BASIN—2006



Source: Statistical Geography Volume 1 - Australia Standard Geographical Classification, July 2006, ABS cat. no. 1216.0, Geoscience Australia 2004

CHAPTER 3

Water use by industries and households

DATA SOURCES

22 Water use by industries and households in the MDB was calculated using data published in *Experimental Estimates of Regional Water Use, Australia 2004–05* (ABS cat. no. 4610.0.55.002).

Agricultural water consumption

DATA SOURCES

23 The water use data for Agriculture were obtained from ABS Agricultural Surveys and Censuses from 2000–01 to 2005–06. These data are consistent with that presented in *Water use on Australian Farms* (ABS cat. no. 4618.0) *2002–03, 2003–04, 2004–05* and *2005–06*.

24 In 2005–06, regional Agriculture water consumption was calculated more accurately than for previous years. This was a consequence of improved collection methodologies, the complete enumeration of Australian farms in 2005–06, and the geographic coding of the location of each farm's main agricultural activity. Users should be aware that not all of the agricultural activity of the farm always occurs at one location.

METHOD OF CALCULATION

25 For 2000–01 and 2001–02, the irrigated area of individual crops and pasture was collected in the ABS Agricultural Census/Survey. This information was combined with regional crop specific application rates for 2002–03 derived from the ABS Water Survey, Agriculture 2002–03 to produce estimates of water consumption for 2000–01 and 2001–02. This was the same methodology (applying application rates to irrigated areas) as that employed for the *Water Account, Australia 2000–01* (ABS cat. no. 4610.0). From 2002–03 to 2005–06 water use data (both area irrigated and volume applied) were directly collected. Estimates for 2002–03 used data collected in the Water Survey, Agriculture, while estimates for 2003–04 and 2004–05 used data collected in the Agricultural Survey. Data for 2005–06 were collected in the 2005–06 Agricultural Census.

26 For each year from 2000–01 to 2005–06, either water use data or irrigated area data were modelled to create estimates of agricultural water use for the MDB, at the Statistical Division (SD) level. For those SDs partially within the MDB, the share of SD-based estimates attributed to the MDB were based on irrigated agricultural land use information sourced from the BRS Australian Management Land Use Programme. The model was validated by comparing modelled estimates produced for 2005–06 with geo-coded 2005–06 Agricultural Census water use data estimates for the MDB. Estimates produced using the two methodologies differed by less than 1% at the MDB level for irrigated crops and pasture.

DATA QUALITY AND RELIABILITY

27 The ABS published data relating to water consumption by the Agriculture industry in both *Water Use on Australian Farms, 2004–05* (ABS cat. no. 4618.0) in July 2006, and *Water Account, Australia 2004–05* (ABS cat. no. 4610.0) in November 2006. While both contained estimates of agricultural water use, small differences existed between the two due to different data sources and compilation methodologies. For this reason, the data compared across the economy and for households in this publication use proportions according to the Water Account methodology. Agricultural comparisons, i.e. irrigated area and volume data, use data that are consistent with *Water use on Australian Farms, 2004–05* (ABS cat. no. 4618.0). Comparisons should therefore be made with caution.

28 Due to differences in collection methodologies between the Agricultural Surveys and Censuses used to collect the 2000–01 to 2005–06 water use and area irrigated data, care should be taken when comparing water use over time.

29 The agricultural water use and irrigated area data were derived from the ABS 2005–06 Agricultural Census and can be used with a high degree of confidence. Of the

Agricultural water consumption continued

approximately 190,000 farms in scope of the Census, the response rate was 93.2%. For more details refer to *Water use on Australian Farms 2005–06* (ABS cat. no. 4618.0).

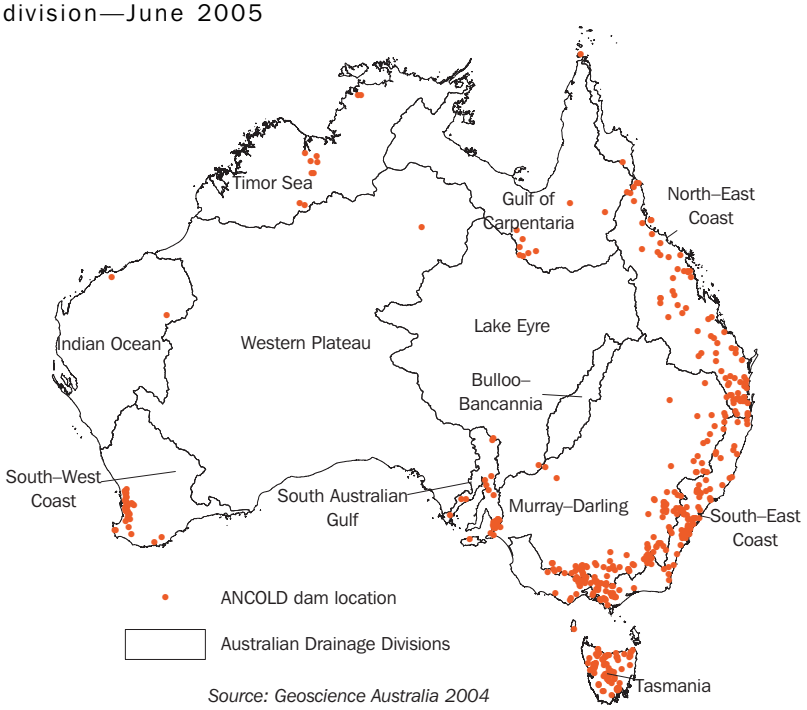
Dam storage

DATA SOURCES

30 Information on the storage capacity of large dams was sourced from the *ANCOLD Register of Large Dams* (ANCOLD 2008). Data from the register were confronted against dam owners' administrative data and adjusted accordingly. The data has been published previously in *Water Account, Australia 2004–05* (ABS cat. no. 4610.0) and *Australian Water Resources 2005* (NWC 2007).

31 The location of large dams in the Murray-Darling Basin, and other drainage divisions throughout Australia, are shown in map E.3 below.

E.3 LOCATION OF AUSTRALIA'S LARGE DAMS, by drainage division—June 2005



Source: Geoscience Australia 2004

32 Large dams are defined as dams with a crest or wall height of greater than 15 metres, or as dams with a dam wall height of greater than 10 metres while also meeting another size criteria e.g. having a crest more than 500 metres in length; creating a reservoir of no less than 1,000 ML; being able to deal with a flood discharge of no less than 2,000 cubic metres per second; or being of unusual design (ANCOLD 2008).

METHOD OF CALCULATION

33 Information on the volume of water in storage in large dams was sourced from publicly available information e.g. from state/territory governments, supplemented by a direct collection of data by the ABS. For large dams for which there was no information available, the ABS derived an estimate using a standard statistical imputation process. The imputed data contributed less than 7% of the Murray-Darling Basin total.

34 Using the large dams identified in the *Cotton Yearbook 2007* (The Australian Cottongrower 2007), dam storage levels were aggregated consistent with the method used in *Water Account, Australia 2004–05* (ABS cat. no. 4610.0). The purpose of undertaking this calculation was to enable comparison with aggregated area of cotton grown and the volume of water used.

Dam storage continued

DATA QUALITY AND RELIABILITY

35 The data on the capacity of large dams, and dam storage levels, is based on publicly available information and direct collection by the ABS. Imputed storage volumes accounted for less than 7% of the MDB total dam storage. These estimates may be used with a high degree of confidence.

36 Patterns of dam storage can be compared with changes in the area of cotton and changes in water consumption with a moderate degree of confidence. This is because the majority of cotton grown is irrigated, and the majority of water from these dams is used for growing cotton.

37 When examining the relationship between water storage in large dams servicing major cotton growing areas, and area or production of cotton, it should be noted that:

- some cotton grown is not irrigated;
- not all water used to irrigate cotton is stored in the large dams identified in the *Cotton Yearbook 2007*; and
- some of the water stored in these large dams is used for purposes other than irrigation.

CHAPTER 4

Agricultural commodities

DATA SOURCES

38 The 2000–01 and 2005–06 ABS Agricultural Censuses were used to calculate area of crops and pasture, numbers of livestock and levels of production for these time periods. The 2000–01 and 2005–06 ABS Apples and Pears Survey was used to source production data and number of trees. The 2000–01 and 2005–06 ABS Vineyards Surveys were used for grape production data by weight (tonnage).

METHOD OF CALCULATION

39 Different methods were used for deriving regional estimates for 2000–01 and 2005–06. The method used to produce 2005–06 agricultural commodity data for the MDB and other regions of interest was the ABS 'geographic coding' project. This project spatially located (geo-coded) Australian farms with an Estimated Value of Agricultural Operations (EVAO) of greater than $5,000. This resulted in the most reliable and accurate regional level agriculture statistics produced by the ABS.

40 To calculate 2000–01 MDB agricultural production and area data that were comparable with 2005–06, Statistical Local Area (SLA)-level information and an SLA-to-MDB concordance were used. To evaluate the accuracy of using the SLA-to-MDB concordance methodology, this method was also used to derive 2005–06 Agricultural Census data. This enabled an evaluation of whether the level of difference (using the SLA concordance methodology) compared to the equivalent geo-coded MDB data was significant. Where the difference was relatively small (<3%) the 2000–01 data were considered appropriate.

41 Irrigated area data for 2000–01 were compared using the SLA-concordance methodology described in paragraph 39 above, and the SD methodology described in paragraph 25 above. When the results of the two methods were compared, minor differences were observed, therefore the SD methodology was used because it was considered to be more accurate.

DATA QUALITY AND RELIABILITY

42 The 2005–06 Agricultural Census data should be used with a high degree of confidence because farms have been geo-coded to a point location, rather than classified to an area.

43 Caution should be used when comparing 2000–01 and 2005–06 agriculture data for two reasons. Firstly, 2000–01 data were calculated for the MDB using a concordance-based methodology which reduced the degree of accuracy compared to using the geo-coding methodology. Secondly, between 2000–01 and 2005–06, the

Agricultural commodities continued

method of establishing the population of agricultural holdings to be surveyed (referred to as the business "frame") was changed. In 2000–01, a register of agricultural holdings (frame) maintained by the ABS was used; in 2005–06 the ABS drew the frame from the Australian Business Register. The influence of the frame change is not thought to be significant; some analyses suggest that the frame used for 2005–06 included more small-sized farms than previously.

Gross Value of Agricultural Production

DATE SOURCES

44 Estimates of the Gross Value of Agricultural Production (GVAP) were compiled using data from *Value of Agricultural Commodities Produced 2005–06* (ABS cat. no. 7503.0).

METHOD OF CALCULATION

45 Estimates of GVAP for the MDB have been derived using similar techniques for calculating MDB agricultural commodities estimates as described in the paragraphs above. The statistics presented are in current price terms, so changes over time are affected by both inflation and changes in the volume of agricultural production.

DATA QUALITY AND RELIABILITY

46 GVAP also includes some non-irrigated commodities which are not considered in calculations of the Gross Value of Irrigated Agricultural Production (GVIAP). They include:

- sheep for wool;
- pigs;
- goats;
- poultry;
- eggs;
- domesticated buffalo; and
- all other livestock.

Gross Value of Irrigated Agricultural Production

DATA SOURCES

47 GVIAP was estimated using data from the ABS 2005–06 Agricultural Census as well as other ABS collections and administrative data used to calculate the value of agricultural commodities produced (see *Agricultural Commodities, Australia, 2005–06* (ABS cat. no. 7121.0) and *Value of Agricultural Commodities Produced, Australia, 2005–06* (ABS cat. no. 7503.0)).

METHOD OF CALCULATION

48 The methods used to estimate GVIAP in this publication are consistent with the methods used in the *Water Account, Australia 2004–05* (ABS cat. no. 4610.0), therefore the estimates are directly comparable.

49 Different methods were used for different commodities, with the method used dependent on the nature of the commodity and the availability of data. For rice, 100% of the gross value of agricultural production was attributed to irrigation. For cotton, the volume of the production from irrigated land was collected directly via the ABS Agricultural Censuses and Surveys. This volume was then applied to the value of cotton in the MDB.

50 For the remaining commodities, the value of irrigated agricultural production was determined using two general methods.

Gross Value of Irrigated Agricultural Production continued

- Method 1. The area of the commodity that was irrigated was divided by the total area of the commodity (i.e. irrigated plus non-irrigated area) and multiplied by the total value of the commodity produced. This method has an under-estimating bias as it is likely that commodities grown on irrigated land will be more productive in terms of tonnage per hectare than the same commodity grown on non-irrigated land.
- Method 2. The proportion of irrigating agricultural establishments (farms) within a particular industry (classified according to ANZSIC, see Glossary) was determined and this proportion applied to the total gross value of the particular commodities produced by that industry. This method is likely to over-estimate the value of irrigated production as not all production on all irrigated farms is from irrigated land.

51 The following approaches were taken for particular commodities:

- The simple average of these methods was used to estimate the value of irrigated production for vegetables, fruit (including nuts), grapes, other livestock, sugar and 'other agriculture'.
- Method 1 was used to estimate the value of cereals other than rice as investigations of the data revealed that the irrigated area made up only a small fraction of the production area on most farms. As such, attributing all production from irrigated farms to irrigation was likely to lead to a large over-estimate of irrigation production. A combination of methods was used for other crops.
- Method 2 was used to estimate the value of milk production from dairy pasture as data from the Victorian Dairy Industry Survey of 1999 and Armstrong et. al. (1998) indicated that where a dairy farm was irrigated, nearly all milk production can be attributed to irrigation.

52 A new method for calculating GVIAP is currently being developed by the ABS and experimental estimates for 2000–01 through to 2006–07 will be released later in 2008.

DATA QUALITY AND RELIABILITY

53 Calculation of GVIAP is based on several assumptions so these estimates should be used with caution.

54 GVIAP data for 2000–01 differs slightly from that published in the *Water Account Australia, 2000–01* (cat. no. 4610.0), due to slight changes in the methodology which were made to enable a better comparison of 2000–01 and 2005–06 data.

55 Comparisons of GVIAP between 2000–01 and 2005–06 must be made with caution for the following reasons:

- differences in the two Census forms used to collect the data impact slightly on the methodology;
- different frames were used for the two Censuses (as described above in paragraph 42); and
- inflationary factors are not taken into account (i.e. 2000–01 data are based on 2000–01 prices and 2005–06 data are based on 2005–06 prices).

56 For tables and graphs showing GVIAP estimates there were slight differences in the definitions of the commodity groups between 2000–01 and 2005–06:

- In 2000–01 'cereals (excluding rice)' included cereals for grain/seed AND cereals for hay, however in 2005–06 it only included cereals for grain/seed. In 2005–06 cereals for hay was apportioned to 'dairy farming' and 'pasture for other livestock', as explained below.
- In 2000–01, 'dairy farming' and 'pasture for other livestock' included:
  - pasture for grazing;
  - pasture for seed production; and
  - pasture for hay and silage.

Gross Value of Irrigated Agricultural Production continued

- In 2005–06, 'dairy farming' and 'pasture for other livestock' included:
  - pasture for grazing; and
  - pasture, cereal and other crops for hay,

57 Care also needs to be taken when comparing the GVIAP data with the water consumption data presented in Chapter 3 because consumption data includes livestock drinking and washdown water, whilst GVIAP data only considers irrigation water.

CHAPTER 5

Natural Resource Management data

DATA SOURCES

58 Natural Resource Management (NRM) data included in Chapter 5 and irrigation practice data included in Chapter 3 are sourced from either the ABS publication *Natural Resource Management on Australian Farms, Australia, 2004–05 (Reissue)* (cat. no. 4620.0) or unpublished data from the Natural Resource Management Survey 2004–05.

59 The NRM Survey vehicle is a biennial sample survey collecting data about NRM issues, activities, expenditure and effort from approximately 20,000 establishments (farms) conducting agricultural activity.

METHOD OF CALCULATION

60 To determine the NRM regions comprising the MDB, MDB and NRM boundaries were overlaid to assess the level of 'fit'. This analysis revealed that:

- there were fifteen regions fully contained within the MDB; and
- there were six regions partially within the MDB.
  - Of the six NRM regions partially within the MDB, four contribute more than 70% of their area to the Basin. These are: South West region in Queensland (71%); Wimmera region in Victoria (72%); Western region in New South Wales (72%); and, SA Murray Darling Basin in South Australia (98%).
  - There were two NRM regions that contributed an area of less than 10%: South East (SA) (6%) and SA Arid Lands (2%).

61 Therefore, when presenting statistics by NRM region, the fifteen regions entirely in the MDB and the four regions with the vast majority of their area within the MDB are included, however the two regions with small areas in the MDB are excluded.

62 In Chapter 5, the NRM data relates to number of farms rather than area. Therefore, given there are relatively low numbers of farms in the South West, Wimmera and Western regions, these regions have a relatively minor impact on MDB estimates. Furthermore, proportionally more farms exist within the 70% of area within the MDB, than the 30% that is located outside the MDB.

DATA QUALITY AND RELIABILITY

63 Much of the data published at the NRM region level have been presented as proportions within ranges due to data quality (i.e. level of error associated with estimates). These ranges have been set to:

- maximise the probability that data for NRM regions in one range category are significantly different from other categories; and
- maximise the functionality of the data.

64 Data at the MDB level is of suitable quality and can be used with a medium degree of confidence. Data for NRM regions should be used with caution.

MAPS

65 Each map contains a legend and shows the colour and values for each class of the mapped data. For simplicity the ranges are shown as '0 to 600', '600 to 3,700', '3,700 to 18,700' and so on. These should be read as 'from 600 to less than 3,700', and 'from 3,700 to less than 18,700' etc. Individual values appear in one range only.

EFFECTS OF ROUNDING

66 Figures have been rounded and discrepancies may occur between totals and the sums of the component items.

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