NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Irrigation Profile - Readers' Note

This document is part of a larger publication. The remaining parts and full version of the publication can be found at:

http://www.dpi.nsw.gov.au/agriculture/resources/water/irrigation/regions

Updated versions of this document can also be found at the above web address.

Gwydir Catchment Irrigation Profile

compiled by Meredith Hope and Robert Bennett,
for the Water Use Efficiency Advisory Unit, Dubbo

The Water Use Efficiency Advisory Unit is a NSW Government joint initiative between NSW Agriculture and the Department of Sustainable Natural Resources.

NSW Agriculture (2003)

This Irrigation Profile is one of a series for NSW catchments and regions. It was written and compiled by Meredith Hope and Robert Bennett, NSW Agriculture, for the Water Use Efficiency Advisory Unit, 37 Carrington Street, Dubbo, NSW, 2830.

ISBN 0 7347 1374 6 (individual)

ISBN 0 7347 1372 X (series)

job # 3250
Editorial assistance: Helen Gosper
Cover design: Nicky Parker
Maps: Udai Pradhan

NSW Agriculture, Locked Bag 21, ORANGE NSW 2800 AUSTRALIA
http://www.agric.nsw.gov.au/

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 1

1.1 OVERVIEW OF IRRIGATION IN THE GWYDIR CATCHMENT 1
1.2 IRRIGATION DATA ISSUES 4
1.2.1 Scarcity of data 4
1.2.2 Lack of data at useful scales 4
1.2.3 Reliability of irrigation data 5
1.3 CONCLUSION 5

2. INTRODUCTION 7

2.1 BACKGROUND 7

3. METHODS 9

3.1 SUMMARY OF DATA COLLECTION 9
3.2 RATING DATA RELIABILITY 13
3.3 STRUCTURE OF THE PROFILE 13

4. GWYDIR CATCHMENT OVERVIEW 15

4.1 CATCHMENT DESCRIPTION 15
4.1.1 Soils 16
4.1.2 Climate 16
4.2 POPULATION CENTRES 17
4.3 AGRICULTURE 17

5. IRRIGATION FROM ALL SOURCES OF WATER 19

5.1 DESCRIPTION OF IRRIGATION 19
5.2 NUMBER OF LICENCES (ALL SOURCES) 21
5.3 NUMBER OF ENTERPRISES THAT IRRIGATE (ALL SOURCES) 21
5.4 AREA IRRIGATED AND WATER USED (ALL SOURCES) 22
5.5 IRRIGATION METHODS (ALL SOURCES) 25
5.6 YIELDS OF IRRIGATED CROPS (ALL SOURCES) 26
5.7 VALUE OF IRRIGATED PRODUCTION (ALL SOURCES) 27

6. IRRIGATION FROM REGULATED RIVERS 31

6.1 DESCRIPTION OF THE REGULATED WATER SUPPLY 31
6.2 NUMBER OF IRRIGATION LICENCES (REGULATED) 34
6.3 VOLUMETRIC ENTITLEMENT (REGULATED) 34
6.4 NUMBER OF ENTERPRISES THAT IRRIGATE (REGULATED) 37
6.5 AREA IRRIGATED AND WATER USED (REGULATED) 37
6.6 IRRIGATION METHODS (REGULATED) 38
6.7 YIELDS OF IRRIGATED CROPS (REGULATED) 38
6.8 VALUE OF IRRIGATED PRODUCTION (REGULATED) 38

7. IRRIGATION FROM UNREGULATED RIVERS 39

7.1 DESCRIPTION OF THE UNREGULATED WATER SUPPLY 39
7.2 NUMBER OF IRRIGATION LICENCES (UNREGULATED) 39
7.3 NUMBER OF ENTERPRISES THAT IRRIGATE (UNREGULATED) 41
7.4 AREA AUTHORISED AND VOLUME ENTITLED (UNREGULATED) 41

7.5 AREA IRRIGATED AND WATER USED (UNREGULATED) 41
7.6 IRRIGATION METHODS (UNREGULATED) 41
7.7 YIELDS OF IRRIGATED CROPS (UNREGULATED) 42
7.8 VALUE OF IRRIGATED PRODUCTION (UNREGULATED) 42

8. IRRIGATION FROM GROUNDWATER 43

8.1 DESCRIPTION OF GROUNDWATER 43
8.2 NUMBER OF IRRIGATION LICENCES (GROUNDWATER) 44
8.3 NUMBER OF ENTERPRISES THAT IRRIGATE (GROUNDWATER) 45
8.4 VOLUME ENTITLED TO IRRIGATION (GROUNDWATER) 45
8.5 TOTAL AREA IRRIGATED AND WATER USED (GROUNDWATER) 45
8.6 IRRIGATION METHODS (GROUNDWATER) 46
8.7 YIELDS OF IRRIGATED CROPS (GROUNDWATER) 47
8.8 TOTAL VALUE OF IRRIGATION (GROUNDWATER) 47

9. IRRIGATION FROM FARM DAMS 49

9.1 ABOUT FARM DAM WATER SUPPLIES 49
9.2 NUMBER OF IRRIGATION LICENCES (FARM DAMS) 50
9.3 NUMBER OF ENTERPRISES THAT IRRIGATE (FARM DAMS) 50
9.4 AREA IRRIGATED AND WATER USED (FARM DAMS) 51
9.5 IRRIGATION METHODS (FARM DAMS) 51
9.6 IRRIGATED YIELDS (FARM DAMS) 51
9.7 VALUE OF IRRIGATED PRODUCTION (FARM DAMS) 51

10. IRRIGATION FROM RETICULATED WATER SUPPLIES 53

10.1 ABOUT RETICULATED WATER SUPPLIES 53

11. OPPORTUNITIES AND ISSUES 55

11.1 OPPORTUNITIES FOR IMPROVING IRRIGATION DATA 55
11.2 OTHER OPPORTUNITIES FOR IRRIGATED AGRICULTURE 55
11.3 ISSUES 56
11.3.1 Data issues 56
11.3.2 Other issues for irrigated agriculture 57

12. SUMMARY 59

13. REFERENCES 61

14. APPENDICES 67

14.1 DEFINITIONS OF STATISTICAL UNITS USED BY THE ABS 67
14.2 SUMMARY OF ABS DATA COLLECTION 68
14.3 MONTHLY RAINFALL IN THE GWYDIR CATCHMENT 69
14.4 AREA OF LAND IRRIGATED (ALL SOURCES OF WATER) 70
14.5 CHANGE IN THE NUMBER OF ENTERPRISES THAT IRRIGATE AND THE AREA IRRIGATED BETWEEN 1993–94 AND 1996–97 71
14.6 CROP AREA IRRIGATED AND THE NUMBER OF ENTERPRISES 72
14.7 IRRIGATED CROPS IN THE MOREE AREA OF THE GWYDIR CATCHMENT 74
14.8 IRRIGATION METHODS IN THE BARWON REGION – BROADAREA AND DAIRY ENTERPRISES ONLY 75
14.9 VALUE OF IRRIGATED PRODUCTION FOR MAJOR CROPS IN THE GWYDIR CATCHMENT 76

14.10 AREA IRRIGATED AND WATER USED IN THE GWYDIR CATCHMENT (REGULATED SUPPLIES) 78
14.11 ABS QUESTION PROFILE 80
14.12 GWYDIR ALLOCATION ANNOUNCEMENT HISTORY 81
14.13 STRESSED STREAM CLASSIFICATION IN THE GWYDIR CATCHMENT 82
14.14 THE NUMBER OF ENTERPRISES IRRIGATING AND AREA IRRIGATED FROM DIFFERENT SOURCES 86
14.15 AREA IRRIGATED AND WATER USED IN THE GWYDIR CATCHMENT (UNREGULATED) 87

List of Figures

FIGURE 1. THE GWYDIR CATCHMENT 2
FIGURE 2. RELATIONSHIP BETWEEN THE GWYDIR CATCHMENT BOUNDARY AND ABS SLAS 11
FIGURE 3. EVAPORATIVE DEFICIT AT MOREE AND GUYRA 17
FIGURE 4. NUMBER OF ENTERPRISES IRRIGATING IN THE GWYDIR CATCHMENT 21
FIGURE 5. AREA IRRIGATED IN THE GWYDIR CATCHMENT DURING THE 1980S AND EARLY 1990S 22
FIGURE 6. AREA IRRIGATED (HA) IN THE GWYDIR CATCHMENT BETWEEN 1993–94 AND 1996–97 23
FIGURE 7. AREA OF 'OTHER CROPS' IRRIGATED IN THE GWYDIR CATCHMENT 23
FIGURE 8. AREA OF CEREALS IRRIGATED IN THE GWYDIR CATCHMENT 24
FIGURE 9 VALUE ATTRIBUTED TO IRRIGATION IN THE GWYDIR CATCHMENT AS A PERCENTAGE OF THE TOTAL VALUE 29
FIGURE 10. LOCATION OF SURFACE LICENCES FOR THE PURPOSE OF IRRIGATION IN THE GWYDIR CATCHMENT 34
FIGURE 11. ON-FARM STORAGE CAPACITY IN THE GWYDIR CATCHMENT 36

List of Tables

TABLE 1. SUMMARY OF IRRIGATION DATA FOR THE GWYDIR CATCHMENT FOR 1996–97 BY WATER SOURCE 3
TABLE 2. EVAOS USED BY THE ABS TO COLLECT DATA ABOUT IRRIGATION IN NSW 10
TABLE 3. TOTAL NUMBER OF SURFACE LICENCES IN EACH SLA DISTRIBUTED BY RATIO BETWEEN THE GWYDIR AND SURROUNDING CATCHMENT 12
TABLE 4. SUMMARY OF IRRIGATION DATA - ALL SOURCES OF WATER 20
TABLE 5. IRRIGATION REQUIREMENT OF CROPS IN THE GWYDIR CATCHMENT 25
TABLE 6. IRRIGATION YIELDS IN THE GWYDIR CATCHMENT 26
TABLE 7. VALUE ($) OF AGRICULTURAL PRODUCTION IN THE GWYDIR CATCHMENT IN 1996–97 29
TABLE 8. CHANGES IN MEAN DAILY STREAM DISCHARGES IN THE GWYDIR RIVER AT PALLAMALLAWA SINCE THE CONSTRUCTION OF COPETON DAM 31
TABLE 9. MAJOR STRUCTURES FOR RIVER REGULATION IN THE GWYDIR CATCHMENT 32
TABLE 10. SUMMARY OF IRRIGATION DATA - REGULATED WATER SUPPLIES 33
TABLE 11. ENTITLEMENT BY PURPOSE IN THE GWYDIR CATCHMENT 35
TABLE 12. OFF-ALLOCATION AND ON-FARM STORAGE CAPACITY IN THE GWYDIR CATCHMENT 36
TABLE 13. SUMMARY OF IRRIGATION DATA (UNREGULATED) 40

TABLE 14. IRRIGATED CROP AREA IN THE GWYDIR CATCHMENT (UNREGULATED)..... 42
TABLE 15. SUMMARY OF IRRIGATION DATA - GROUNDWATER SUPPLIES..... 44
TABLE 16. AREA IRRIGATED (HA) USING GROUNDWATER BETWEEN 1982–83 AND 1989–90 IN THE GWYDIR CATCHMENT..... 46
TABLE 17. SUMMARY OF IRRIGATION DATA – FARM DAMS 50
TABLE 18. STRESS MATRIX 84
TABLE 19. STRESS RATINGS FOR SUBCATCHMENTS IN THE GWYDIR CATCHMENT 85

Acknowledgments

Thanks to the Water Management Fund for providing initial financial support to undertake this work.

Thanks also to:

- Water Analysis and Audit Branch, Sustainable Water Management, Department of Land and Water Conservation (DLWC), Parramatta, now Water Management Systems, Natural Resources Products Division, Bridge Street, Sydney)
- Licence Administration Branch, DLWC, Parramatta, now Water Use and Approval Unit, Water Management Systems, Bridge Street, Sydney
- NSW Agriculture staff, especially Nick Austin, Udai Pradhan, Peter Smith and Eddie Parr.

1. EXECUTIVE SUMMARY

The *Gwydir Catchment Irrigation Profile* was developed from a study to obtain regional and industry-based assessments of on-farm water use efficiency (WUE)[1] and irrigation efficiency (IE)[2].

The Profile details (where possible, by water source and catchment) what is known about:

- the number of licences
- the number of enterprises that irrigate
- the entitled volume or area authorised for irrigation
- the area irrigated and water used in total and by crop type
- irrigation methods
- irrigated crop yields
- the value of irrigated agriculture in the Gwydir catchment.

Irrigation data in the public domain were collected from State and Commonwealth sources, published research and industry reports and unpublished reports. These data were assigned a reliability rating using a system developed by the National Land and Water Resources Audit (1999).

This Profile does not attempt to develop or analyse regional and industry-based estimates of WUE. This will be carried out in a subsequent report.

Users of this document are advised to proceed with caution. The data presented in this report should be treated carefully and with respect for the various collection, storage and retrieval processes that can impact on information reliability.

1.1 Overview of irrigation in the Gwydir catchment

The Gwydir catchment shown in Figure 1 is in northern inland New South Wales (NSW), west of the Great Dividing Range. The catchment has an area of 25,900 km^2, representing 2% of the Murray–Darling Basin (MDB). The Gwydir River is the main watercourse, beginning near Uralla on the Northern Tablelands. The river drains west for 330 km before joining the Barwon River north of Collarenebri. Copeton Dam on the Gwydir River is the main irrigation storage in the catchment, with a capacity of 1,364,000 ML. There are a further six weirs that regulate water along the Gwydir River.

---

[1] WUE refers to the volume of crop produced (harvested dry matter) per unit of water delivered to the crop. This is usually expressed as tonnes per megalitre (t/ML) (Alexander & Foley 1998).

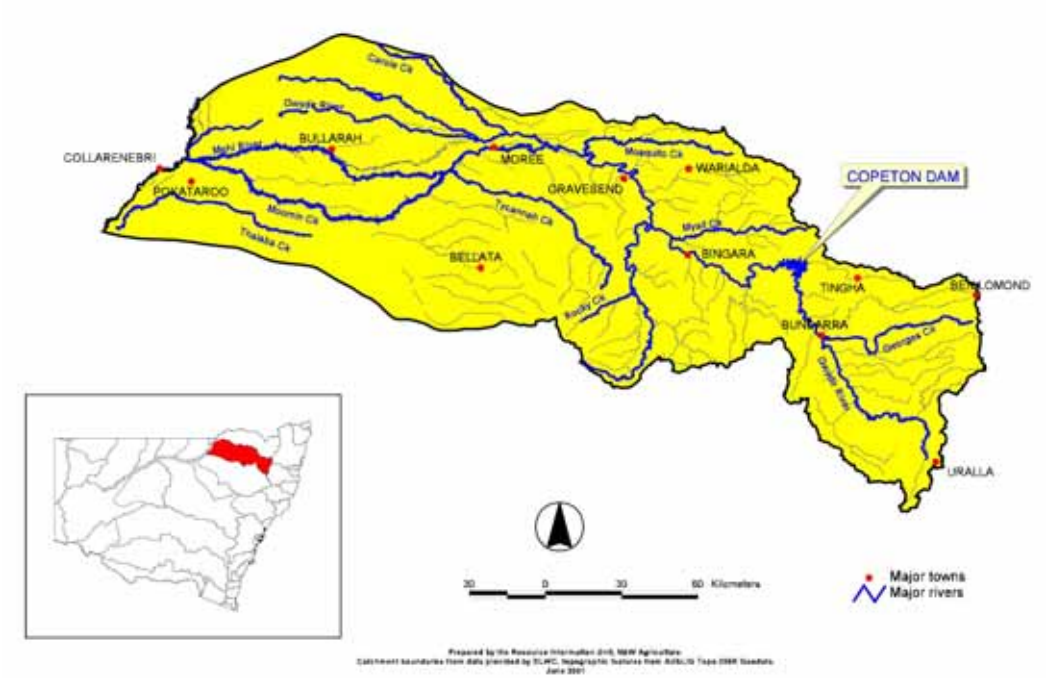
[2] IE is a measure, expressed as a percentage, of the volume of water used or delivered by a system relative to the total volume of water entering the system (Alexander & Foley 1998).

EXECUTIVE SUMMARY

The catchment has a summer-dominant rainfall pattern and annual falls decrease from nearly 900 mm in the east to less than 600 mm in the west. Falls are extremely variable, and flooding and drought occurring periodically.

Cotton is the major irrigated commodity in the catchment and irrigation water is mostly sourced from regulated surface supplies. The industry also relies heavily on surplus flows. Cotton is grown on the alluvial plains, while lucerne and pasture are grown in the upper catchment along the small alluvial floodplains close to the Gwydir River and its tributaries.

Figure 1. The Gwydir catchment



Of the total value of agriculture in 1996–97 ($592 million), $245 million could be attributed to irrigation (Table 1). Of that, $221 million was attributable to irrigated cotton.

In 1996–97, ABS figures suggest nearly 60,000 ha were irrigated each year from all sources of water (that is, groundwater, regulated and unregulated supplies, farm dams and reticulated water supplies). However, that figure may be an underestimate, as the data from the Department of Land and Water Conservation (DLWC) estimate the area irrigated from regulated supplies alone to be 73,000 ha.

The area irrigated varies considerably depending on climate and access to water. For example, anywhere between 12,000 ha and 80,000 ha are planted to cotton each season.

Table 1. Summary of irrigation data for the Gwydir catchment for 1996–97 by water source

Source of water	Total irrigated area (ha)	Total water used by irrigated agriculture (ML)	Number irrigation licences	Number enterprises irrigating	Yield of major irrigated crop (t/ha)[a]	Value of irrigation ($ million)
All sources of water	57,564	nd *450,000 (estimate)*	663	92	1.6 (cotton)	245
Regulated	72,680	404,900	193	nd *82 (1993–94)*	1.6 (cotton)	nd
Unregulated	7,150	nd *10,000 (avg. 1989–90 - 1994–95)*	280	nd *105 (1993–94)*	nd	nd
Groundwater	nd *15,152 (1993–94)*	nd *35,747 (avg.)*	190	173	nd	nd
Farm dams	nd *806 (1993–94)*	nd	na	nd *12 (1993–94)*	nd	nd
Reticulated	nd *0 (1993–94)*	nd	na	nd *0 (1993–94)*	nd	nd
NSW total (all sources of water)	1,150,000	7,700,000	24,000	7,846	1.8 (cotton)	2,496

nd= no data, na = not applicable a. 1 bale of cotton equals approximately 225 kg. 1 ha equals 2.47 acres.

The total volume extracted from all water sources by irrigated agriculture cannot be stated with any accuracy but was estimated to be around 450,000 ML in 1996–97. This volume would vary considerably with climate each year. For example, between 1988–89 and 1993–94, the volume of water used from all sources on cotton alone was estimated to be between 74,400 ML and 413,000 ML.

There are 663 irrigation licences and 92 enterprises irrigating crops in the catchment (Table 1). Of these, 65 are thought to be irrigating cotton. Cotton yields have ranged from 0.7 t/ha to 1.8 t/ha (1988–89 to 1994–95). Data on yields of irrigated crops other than cotton were scarce. Cotton and cereal crops in the lower catchment are generally

watered using surface methods. In the upper catchment, where lucerne and pasture crops dominate, pressure systems are used.

Table 1 summarises irrigation data in the Gwydir catchment in 1996–97, the most recent season with the greatest amount of data. Where there were no data, estimates from other years have been used to complete the picture.

1.2 Irrigation data issues

There were a number of data issues raised in the *Gwydir Catchment Irrigation Profile*. Generally, these relate to the scarcity of data, the lack of data at useful scales and the reliability of available data.

1.2.1 Scarcity of data

Information as fundamental as the volume of water applied to crops is needed to inform the water-sharing debate, to help monitor the impact of policy implementation and to assist the sustainable development of the irrigation industry.

In the past, data have been collected for different purposes to those currently needed. Data are now required for natural resource planning and for the planning and management of irrigation industry (for example, Water Management Plans and Catchment Blueprints).

Of critical importance is information on crop water use and crop area. These data are needed to underpin government programs that have been initiated in all Australian states to improve WUE in irrigated agriculture. This Profile demonstrated difficulty in estimating the volume of water used on crops over the last decade. To summarise, there was:

- a lack of information on volumes applied to crops from groundwater and unregulated streams. Some information was collected on crop areas irrigated from regulated supplies between 1989–90 to 1993–94
- a lack of information on the volume of water used on crops extracted from regulated supplies after the 1993–94 season.

Great care is needed when determining crop application rates based on information presented in this Profile. An accurate assessment requires detailed information about a property water supply and where it used that water. Enterprises may supplement their major water supply (for example, the regulated system) with another source (groundwater). Application rates based on the major water supply only could easily be underestimated.

1.2.2 Lack of data at useful scales

Point-scale data collected by the ABS and ABARE (for example, irrigation value and yield) are confidential and have been reported at SLA, catchment or Agro-Ecological Region scales (AER). These scales limit usefulness to data users who often need information at much finer scales, such as river reach or subcatchment. Finer scale data are extremely useful in, for example, modelling the economic impact of changes to

water sharing rules on irrigators or to understanding the variation in the irrigation industry across geographic and climatic zones.

1.2.3 Reliability of irrigation data

Reliability of irrigation data varied:

- according to water source. For example, data about regulated rivers were more reliable than data about unregulated, groundwater and farm dam sources.
- with collection strategy. For example, the ABS collects information from enterprises with an Estimated Value of Agricultural Operations (EVAO)[3] of $5000 or greater. The DLWC collects information from individual licences. The ABS used definitions of regulated and unregulated water sources for the 1993-94 survey that were different to those used by the DLWC. Consequently, irrigation area and enterprise number tended to be overestimated for regulated water supplies and underestimated for unregulated water supplies.

1.3 Conclusion

A more comprehensive and consistent approach to the collection of irrigation statistics is needed. This would help to ensure that data are comparable across different water sources and industries. The following are needed to improve the situation.

- Data need to be collected at scales that are coarse enough to protect point-scale confidentiality (for example, enterprise level) but fine enough to allow users to aggregate information to useful scales (river reach, subcatchments).
- Protocols for provision of data to users are needed. For example, information providers need to attach reliability ratings to data. This will help users make better decisions about the usefulness of the data and prevent inappropriate manipulation.
- Two-way flow of information between agencies and irrigators needs to be fostered. Collections of irrigation data need to flow back to irrigators in forms that might

[3] The smallest unit collected by ABS is the SLA and the population to be surveyed is determined from the EVAO. The EVAO is estimated from a procedure that takes into account the value of the area of crops sown and the numbers of livestock on holdings at a point in time as well as the crops produced and the livestock turnoff during the year. The resultant aggregation of these commodity values is termed the EVAO.

help them make better water management decisions. This could in turn, over time, improve the reliability of information that is collected from irrigators.

Any approach that deals with information at this fine-scale would need to comply with the provisions in the Privacy Act.

Finally, such a comprehensive approach can only be developed with the full involvement of the many irrigators, agencies and community groups that require these data.