Report 5:

Exploring the Relationship Between Community Resilience & Irrigated Agriculture in the MDB:

Changes Over Time (1996-2006)

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This report has been prepared for

Cotton Catchment Communities CRC

by

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Overview of Research Questions and Methodology

This report builds on the first four stages of the study, *Exploring the Relationship Between Community Resilience & Irrigated Agriculture in the MDB*,[1] to address the following research questions:

- Has the relationship between community resilience and irrigated agriculture changed over time, and if so what have those changes been?
- What are the trends and likely drivers of such change?
- What are the implications for communities (at different scales) of the ongoing influence of those trends and drivers?
- Does historical data support the conclusions reached in *Report 4?*

In order to answer these questions, we have examined these changes at different scales, including the national, Basin and local levels through quantitative and qualitative methods. These include:

- An analysis of nationwide trends in agriculture and irrigated agriculture for the period 1966 – 2006;
- A cross sectional statistical analysis of the relationship between agricultural employment and land use across SLAs in the MDB for 1996, 2001 and 2006;
- A cross sectional statistical analysis of the relationship between selected indicators of community wellbeing and resilience with other important exogenous variables and employment mix across SLAs in the MDB for 1996, 2001 and 2006;
- An analysis of basin wide trends in agriculture and irrigated agriculture for the period 1996 – 2006;
- A detailed analysis of changes in eight case study communities relating to changing land use, changing employment and employment mix and selected indicators of community wellbeing and resilience for the period 1996-2006; and
- A comparison of the historical impacts of changing water availability with those impacts predicted in *Report 4.*

[1] JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 4: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Social and Economic Impacts of Reduced Irrigation Water,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

Findings

Time trends in agriculture nationally and in agricultural communities are well documented and understood.[2] This study supports many of those findings, particularly with regard to the importance of larger scale drivers over which public policy is likely to have little or no control. Such large scale drivers include the decreasing relative importance of agriculture to the Australian economy, the aging of the population and trends of increasing urbanisation. However trends and drivers are much more nuanced than the vision contained in simplistic narratives such as 'rural decline'.

In this regard, the most important finding of this study pertains to scaling. The study finds that the importance of agriculture and irrigated agriculture to community resilience depends on the scale chosen, with the importance and the relative impacts at the national level quite different to the importance and relative impacts in a remote community of 3-4,000 population.

The major impact of irrigated agriculture on community resilience is through the provision of employment, and consequently on population growth. The importance of irrigated agriculture, and in particular the cotton industry, in smaller communities is difficult to overstate. For smaller and more remote communities, growth in irrigated agriculture appears to be the only avenue available to reverse or slow longer term trends in employment loss associated with growth of regional centres at the expense of smaller centres.

For many communities, irrigated agriculture is a significant employer, and, although there is a trend of positive employment growth across the study area over time, growth is not generally occurring in such communities, apart from that provided by irrigated agriculture or where they have advantages such as size or proximity to capital cities. Consequently, any reduction in irrigation water will be reflected in loss of employment and consequently population loss in such areas with little opportunity for mitigation by structural change.

With regard to more specific findings, analysis of ABS data across the three years and analysis of GVIAP data strongly supports linearity within irrigation commodity groups. There is effectively a linear relationship between irrigation water and output within each commodity group.

At the same time, there is considerable difference in output and employment per Gl of irrigation water across commodity groups. Regarding employment, if rice and cotton are given a factor of one, then dairy employs four times as many people per Gl and vegetables, fruit and grapes are employ about fifteen times as many people per Gl. In terms of GVIAP the respective factors are 1 for rice, 2 for cotton and livestock, and 5 for permanent plantings. Currently trade in water between commodity groups is restricted by reliability, connectivity and administrative constraints. While the first two are physical restrictions, removal of the last in the highly regulated southern basin would be expected to result in some trade of water from uses such as rice and dairy to vegetables, fruit and grapes. Such trade would be expected to result in an overall expansion of irrigation industries, but with the impacts differentially distributed, with some areas losing and some gaining.

[2] JSA (2010) Report 1 *op cit.* 3.3.2.

In Report 4 of this study the impacts of theoretical reductions in irrigation water were modelled using 2005-06 as a base year. By comparison with observed GVIAP and irrigation water changes between 2005-06 and 2009-10, those estimates were based on even cuts across commodity groups and appear to be about 60% high. The main reason relates to differences in reliability of irrigation water between commodity groups. For example using 2008-09 GVIAP data, of a total reduction of 3,878 Gl of irrigation water in 2008-09, water applied to cotton and rice fell by 68%, whereas water applied to fruit and nuts, grapes, vegetables and nurseries fell by 14%, demonstrating that most of the reduction occurred in commodities with lower levels of employment per Gl.

Other modelling carried out by the MDBA overestimated impacts of reduction by variously 22% and 46% by comparison with the drought. The difference between the two estimates is likely to reflect differences in model parameters, however a general overestimate would be expected as around 86% of reductions to achieve SDLs will come from the 72% of BDL in the southern basin where irrigation uses tend to be higher employers per Gl.

As discussed in Report 4, while reductions in irrigation will result in a net cost to society (when considered in terms of opportunity cost, that is considered on the basis of with and without), over time (that is considered on the basis of before and after) any impacts are likely to be mitigated at the national and basin level by general economic growth. Additionally, removal of administrative constraints to trade are likely to further mitigate impacts.

At the local level however, these mitigations are unlikely to be of any benefit in smaller and remoter irrigation dependent communities as the trend is for economic growth is to take place in less remote areas generally, and communities such as Bourke and Griffith either have limited opportunities to develop commodities such as fruit and grapes, or may lose water from rice and dairy to permanent plantings in other areas downstream.

The impact of agriculture and irrigated agriculture on a range of socio-economic indicators of community well-being and resilience was also considered. As found in Report 3, much of the variation in indicators was explained by the four key variables of remoteness, population, indigenous population and age. Where employment was correlated with indicators, much of the association with agriculture might be considered negative and suggestive of a residualised and less skilled population. However there is also evidence that agriculture provides employment to a less skilled and younger workforce and this could be considered a positive effect.

There were two noteworthy time trends. Firstly, there is a diminishing trend for agriculture to be associated with lower household incomes over time, suggesting a trend of declining rural poverty and in line with trends of amalgamation of farming enterprises. Secondly, the expansion of agriculture (mostly in irrigation) and particularly of cotton between 1996 and 2001 was associated with positive impacts including increased household incomes in smaller remoter areas, population growth in cotton growing areas, and increased levels of employment. Conversely, the contraction of agriculture and the cotton industry between 2001 and 2006 was associated with loss of employment and population.

Increasing economic diversity appears to be associated with less remote areas, larger populations and older populations, while decreasing economic diversity appears to be

associated with grazing, remoter areas, smaller populations and indigenous populations, however the effects are slight and are typically seen in one or two industries. Meaningful trends include lower levels of manufacturing in remote areas, and higher levels of finance, professional and public administration in more populous areas. Increasing urbanisation is associated with more diverse economies.

A multiplier was developed in Report 4 to understand the impact of agriculture on the wider economy at a local level. The 1996 and 2001 analysis consistently showed a multiplier of 1.1-1.2 with size effects at populations less than 5,000, 5,000 to 10,000 and greater than 10,000, with areas with progressively larger populations having higher levels of underlying employment that is independent of agriculture. The multiplier previously calculated from 2006 data appears on review to be an artefact, and the amended relationship was quite out of line with that developed from 1996 and 2001 data. This may be because of the widespread loss of agricultural employment with the drought or (less likely) may reflect some underlying structural change. The release of 2011 census data will further illuminate this point.

Generally, the impacts of drought and reductions in irrigation water across the case study areas were seen in changes in employment and population with any impacts on other indicators not detectable in the light of larger trends. The resilience report card developed in Report 4 was supported, with some communities very sensitive to changes in irrigation water, and others showing little or no impact, and with those impacts in line with Report 4 expectations.

Smaller, remote communities most reliant on agriculture were found to be most sensitive to changes in irrigated agriculture, while those communities with a wider economic base and close to major centres were found to be least sensitive to changes in irrigated agriculture. With regard to Report 4 predictions, the three smaller northern case studies of Balonne Shire, Bourke Shire and Moree Plains were found to be more sensitive to changes in irrigation water than modelled.

Consequently, the impacts of changes in the availability of irrigation water will be felt most markedly in communities where irrigated agriculture forms a significant part of the economy, and which lack mitigating factors such as a large population base or proximity to larger urban areas. The resilience report card developed in Report 4 is supported by temporal data on the response of communities to changes in irrigation water. The 'stickiness' of population change is at odds with notions of frictionless structural change, and supportive of residual populations in communities where employment has been lost.

There were two groups of communities.

The first group included communities found to be sensitive to changes in irrigated agriculture. These included Balonne Shire, Bourke Shire, Moree Plains, Griffith and Mildura. For Bourke and Moree Plains, the impacts of change in irrigated agriculture were overlaid on longer term trends of decline. In Griffith, impacts of reductions in water were mitigated by differences in water security and trade in water between commodity sectors, whereas in the other areas, impacts were greater than modelled. Conclusions for Mildura are based on the impacts of growth in irrigation water use, as there were no significant reductions over the period, and with impacts

mitigated by its role as a regional city. Population change was generally found to be 'sticky' across communities, lagging behind change in employment.

The second group included southern areas in which there was little variation in irrigation water use over the time period or where the data showed little or no impact from changes in irrigated agriculture. These included Dalby-Wambo, Campaspe and Murray Bridge. Campaspe showed little or no variation in irrigation water usage over the period. These three centres were predicted in Report 4 to be quite resilient to changes in irrigation water due to a wider economic base and proximity to other larger centres.

1 Background to the Study

1.1 Overview

This paper reports on the findings from Stage 5 of the study, *Exploring the Relationship Between Community Wellbeing and Resilience and Cotton Production in the Murray Darling Basin (MDB).* This is a five-stage project that aims to describe and predict the social and economic impacts on communities at different geographic scales arising from changes in the availability of water related to Federal Government policy, and to inform the development of appropriate mitigations.

To date, the study has been reported in four previous reports, which should be read in conjunction with this report.

Report 1 is a **Scoping Paper**, which sets out the rationale for the study, the social, economic, environmental and policy context, and the conceptual framework for the study;

Report 2 **quantifies the impact of cotton production on employment** across the MDB compared with other agricultural uses of land and irrigation water. As well as identifying the employment associated with cotton production, this enables the development of a tool that can be used to predict changes in employment at a local and national level as agricultural uses of land and water vary as a result of changes in water availability arising from changes in water policy and climate change. It will be a useful tool in modelling changes associated with policy initiatives such as the *Murray-Darling Basin Plan*, which will set sustainable diversion limits for water, and in understanding the likely impacts of related federal initiatives under *Water for the Future*. Apart from the immediate impact on levels of employment, there will be a secondary effect as the mix of employment changes. That changing mix of employment may have impacts on socio-economic indicators, with such secondary effects explored in the next stage of the study;

Report 3 **quantifies the impact of cotton production on 'proxy' indicators of community wellbeing and resilience** across the MDB, compared with other agricultural uses, including labour force age and participation rate, unemployment, diversity of industry base, household income, quantum of population and employment change, key crime and health indicators, degree of socio-economic polarisation, median age, SEIFA Indices of Socio-Economic Disadvantage, Economic Resources and Education and Occupation, school participation and post-school qualifications, and social capital indicators related to attachment to place and community participation. The impact of changes in the employment base related to water availability are examined controlling for other factors such as indigenous population, median age, and degree of urbanisation (remoteness and population size). This enables the development of a tool that can be used to predict changes in key indicators of wellbeing and resilience as employment mix varies over time with changing agriculture in response to changing water availability;

Report 4 uses the results from previous stages and other relevant data to **quantify and describe the likely social and economic impacts** on irrigated agricultural (including cotton producing) communities in the MDB arising from changes in availability of water for irrigation. This

includes a cost benefit analysis (or identification of whole of community costs and benefits) at different geographic scales and case studies conducted in eight communities with irrigated agriculture industries. This stage of the study also engaged communities and other key stakeholders in the MDB in order to ground-truth findings, share knowledge from the study, and identify more qualitative impacts and past adaptation strategies. It identified appropriate mitigations to respond to adverse impacts predicted, including from the viewpoint of stakeholders at different geographic scales.

Report 5 (this report) uses the results from Reports 2 and 3 and carries out similar analyses using data for the years 1996 and 2001 in order to provide **a temporal context to the relationship between irrigated agriculture and community wellbeing**, to identify trends and possible drivers and to understand the implications for communities (at different scales) of the ongoing influence of those trends and drivers.

1.2 The Conceptual Framework for Stage 5 (this report)

1.2.1 Introduction

It is likely that the social and economic impacts of irrigated agriculture will change with time in response to a range of drivers. Some of these include technological change, international and national outputs, national, state and local government policy and short and long term climatic variation. The primary question of this report is understanding the nature and magnitude of such drivers and their likely impacts.

Analysis in previous stages of the study was based on cross-sectional data. Analyses of cross sectional data have the advantage of reducing the impact of 'confounders', as drivers varying temporally are fixed across the cross-sectional study, but there is less confidence that findings may be descriptive of other years, for example a drought year may show higher levels of employment relative to area under cultivation as output falls. Temporal drivers may also affect the efficacy of proposed mitigations, or influence policy responses, for example decreasing employment may be a result of technological change and hence harder to address through policy responses.

Because communities are different, and because impacts are experienced at different scales, the implications of these drivers will be different at different scales and in different communities. As in previous stages of the study, Stage 5 will investigate impacts at different scales including national, basin wide and local.

Finally, a fundamental principle of the scientific method is the validation of hypotheses by reference to empirical data.[3] The cross sectional analysis carried out previously is descriptive of data within a particular environment, but it is not axiomatic that such data can be used to predict the impact of changes. (In other words, it is not clear, and probably highly unlikely, that "all other things will be equal"). Historical data, and more recent data published since the 2006

[3] Popper, K (1934), *The Logic of Scientific Discovery.*

census, provide an opportunity for the comparison of empirical data with those outcomes hypothesised in *Report 4* as likely to arise from changes in the availability of irrigation water.

1.2.2 Framework for the Study

The following framework, described in detail in the *Scoping Paper*, brings together selected indicators of community wellbeing and resilience within a sustainability framework. This recognises the inter-relationship of social, economic and environmental factors in understanding community wellbeing and resilience.

The framework also acknowledges the complex nature of factors in the external environment (the 'outer ring') that are impacting upon the wellbeing and resilience of communities in the MDB (proxy indicators in the 'inner rings'). These current and historical factors are explored in more detail in the *Scoping Paper.*

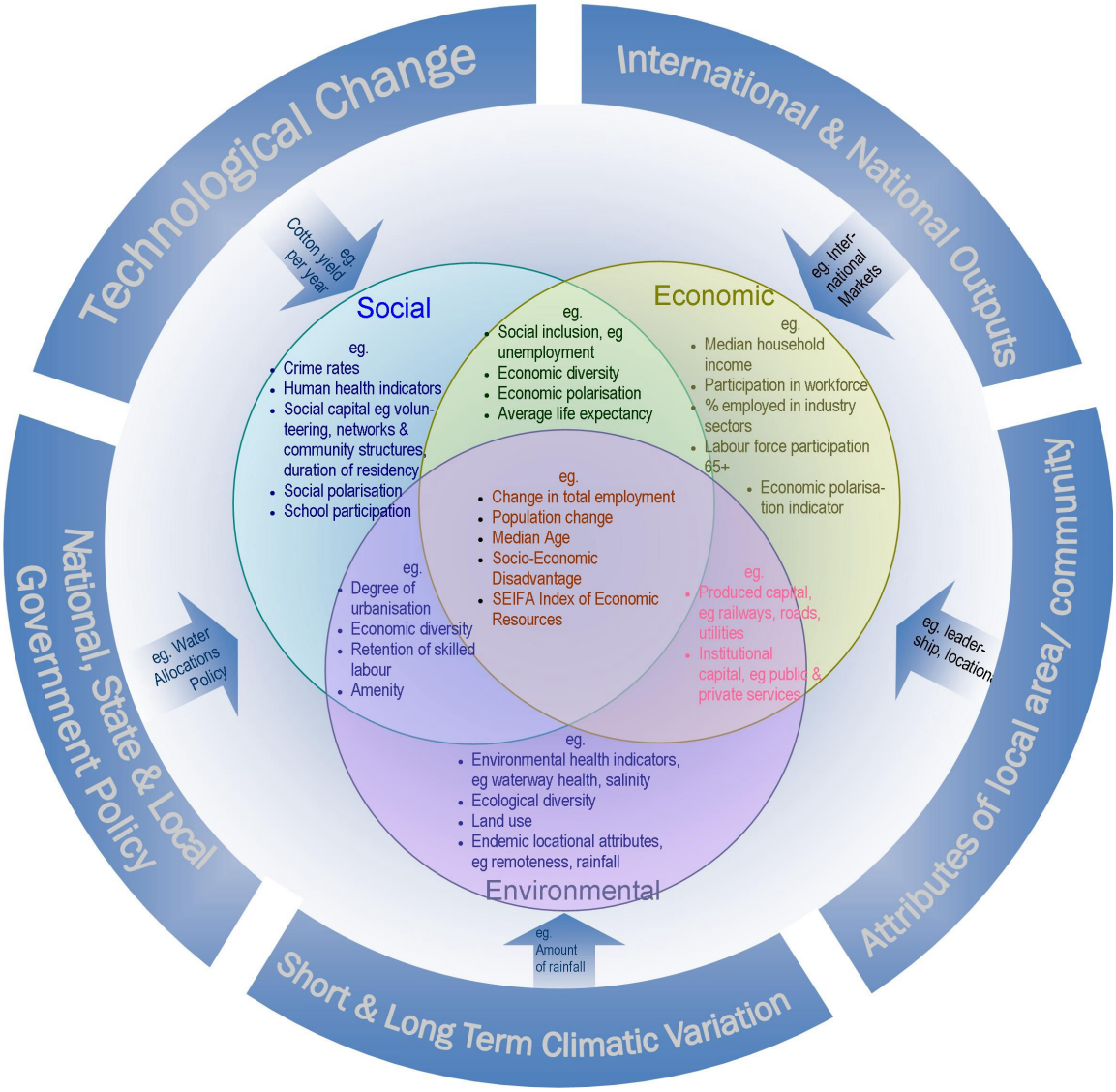

Figure 1: Factors Impacting on Community Wellbeing, Resilience and Sustainability (JSA 2008)

Factors in the outer ring may also be thought of as 'independent variables' - when changed, they can have differing impacts on the indicators in the 'inner ring'. For example, 'technological change' can have a significant impact upon 'total employment', 'labour force participation' and 'unemployment', depending on the nature and intensity of changes. Ongoing changes in technology may also have quite different impacts on certain groups or communities, for example, people with limited education or skills, or communities with varying indicators of 'wellbeing'. The impact of many of these independent variables will not be evident from a cross-sectional study.

The inner circles are examples of the proxy indicators of wellbeing and resilience set out earlier (the 'dependent variables' for this stage of the study). These are quantitative or 'measurable' indicators of community wellbeing and resilience that may change as factors in the wider environment or internal community dynamics (outer circle) change over time. Many of these indicators overlap, and are not readily divided into purely 'social or 'economic' characteristics.

For example, 'retention of skilled labour' is an indicator of the likely resilience or adaptive capacity of a community, but is *itself* a function of a range of factors including age profile, economic diversity, availability of local educational opportunities and the like. Indicators that are likely to sit at the intersection of the 'social', 'economic' and 'environmental' are shown between the circles.

The above framework provides a useful way of thinking about the impact of various factors on indicators of community wellbeing and resilience, but also clearly shows that such analysis needs to be understood as multi-dimensional. For example, a reduction in water *may* lead to a reduction in employment, a subsequent reduction in population and social diversity, and flow on to reduced adaptive capacity. However, in reality, social impacts on communities are rarely as straightforward to predict. The relationship between changes in the external 'environment' or internal social relationships and changes in socioeconomic conditions of communities would rarely be linear.

2 Summary of Key Findings from Stage 5 (this stage)

2.1 Overview

The remainder of this report seeks to understand temporal aspects of the relationship between community resilience and irrigated agriculture. This will assist in understanding the universality of findings from previous work in the context of temporal variation such as drought and technological change. As a secondary question, it compares the predictions of *Report 4* to historical changes in the availability of irrigation with empirical data related to such changes and hence provides increased confidence in the validity of the predictions of that report.

An overview of the main research questions for Stage 5 of the study is first provided. This is followed by a summary of key results and a statement of the methodology used in the current stage of the research. More detailed data and discussion then follows.

2.2 Research Questions for Stage 5 of the Study

2.2.1 Overview

This stage of the study seeks to address ten key research questions:

1. Has the relationship between community resilience and irrigated agriculture changed over time at the national level, and if so, what have those changes been?
2. What are the trends and likely drivers of such change at the national level?
3. What are the implications at the national level of the ongoing influence of those trends and drivers?
4. Has the relationship between community resilience and irrigated agriculture changed over time at the basin level, and if so, what have those changes been?
5. What are the trends and likely drivers of such change at the basin level?
6. What are the implications at the basin level of the ongoing influence of those trends and drivers?
7. Has the relationship between community resilience and irrigated agriculture changed over time at the local level, and if so, what have those changes been?
8. What are the trends and likely drivers of such change at the local level?
9. What are the implications at the local level of the ongoing influence of those trends and drivers?
10. Are the predictions of *Report 4* supported by historical data?

Each of these questions is answered briefly in turn below, and explored in detail in the body of the report.

2.2.2 Research Questions 1, 2 and 3

Research Questions 1, 2 and 3 ask: *Has the relationship between community resilience and irrigated agriculture changed over time at the national level, and if so, what have those changes been?*

What are the trends and likely drivers of such change at the national level? and

What are the implications at the national level of the ongoing influence of those trends and drivers?

Over time, the contribution of agriculture (and irrigated agriculture) to community resilience at the national level has decreased in relative terms, largely due to growth in the service sector and to limited opportunities to further develop land and water resources for agriculture. At the national level, the relative contribution of agriculture to the economy has decreased markedly, from 12.4% of GNP in 1966 to 3.1% of GDP in 2006, largely because of growth in the service sector. The net value of agricultural production (adjusted for inflation) has increased from $25.8 billion in1966 to $28.2 billion in 2006, including about $4.0 billion from irrigated agriculture in the MDB, with much of the general growth in agriculture a result of the expansion of irrigated agriculture. The contribution of agriculture nationally is likely to plateau in quantum, as further increases in water diversions in the MDB are unlikely (and decreases are expected); however there is scope for further increases in the contribution of irrigated agriculture to GDP in the MDB through removal of administrative constraints on the trade of water between different users. As the national economy continues to grow, probably from continuing growth in the service sector, the relative importance of agriculture, and irrigated agriculture, will continue to decrease.

2.2.3 Research Questions 4, 5 and 6

Research Questions 4, 5 and 6 ask: *Has the relationship between community resilience and irrigated agriculture changed over time at the basin level, and if so, what have those changes been?*

What are the trends and likely drivers of such change at the basin level? and

What are the implications at the basin level of the ongoing influence of those trends and drivers?

Employment

The primary relationship between irrigated agriculture and community resilience is through the provision of employment. In Report 4, a relationship was developed between irrigation water use and employment on a commodity by commodity basis. Within the bounds of statistical analysis and various confounders, that relationship, and the relativities between commodity groups, appears robust across years.

Three major employment trends are evident. These are the diversification of the study area economy away from agriculture with time, the increasing importance of irrigated agriculture within the agricultural sector (with irrigation appearing to provide most or all of the growth in agricultural employment) and the impacts of the drought leading to reduced agricultural employment.

With time, the importance of irrigated agriculture will continue to decrease at the basin level due to overall economic growth, however the importance will still be marked in agriculturally dependent communities, where irrigation provides the sole source of economic growth. Conversely, loss of irrigation water will lead to economic declines in communities with irrigated agriculture industries.

The relativities between commodity sectors are significant, and overall employment growth at the basin level would be expected with removal of administrative constraints to trade in irrigation water (within physical constraints of stream regulation, reliability and connectivity). However at a local level, increased trade will mean the decline of some communities at the expense of others, as irrigation water is traded for example from communities engaged in rice growing or dairy to communities engaged in vegetable, fruit and grape growing.

Total employment across the study area increased between 1996 and 2001 by around 7.4%. In the same period, agricultural employment increased by 5.3%. Between 2001 and 2006 there was a decrease in agricultural employment of 16.4% as a result of the drought, however overall employment increased by 13.7%, and 12.7% with the exclusion of the ACT. The importance of agriculture in the study area has decreased, with agriculture providing 17.8% of employment in 1996, 16.9% in 2001 and decreasing to 12.4% in 2006. Excluding the ACT, the proportion decreased from 21.5% in 1996, 20.4% in 2001 and 15.2% in 2006. The downward trend was exacerbated by drought conditions in 2006 and some recovery from the 2006 values would be expected in 2011 census data. Despite the downward trend, agriculture is a significant part of the study area economy, comprising around one fifth of direct employment in areas outside the ACT. With multipliers, around 40% of the economy of the study area is dependent on agriculture.

Irrigated agriculture (vegetables, fruit, grapes, dairy and cotton) comprised at least 30% of agricultural employment in 2001 and (assuming 2001 values for dairy) at least 32% in 2006. Similarly, these industries comprised around 5% of the total economy of the study area in 2001 and 4% in 2006.

Impacts of the recent drought can be seen in the differences between 2001 and 2006 data. The major impact of the drought appears to have been experienced in the grazing sector, with employment in dryland grazing probably dropping by around 24% during the drought. Of the 25,000 agricultural jobs lost between 2001 and 2006, around 19,000 (76%) were in the grazing sector. High security irrigation sectors were protected from the drought up until 2006, however the drought appears to have had significant impacts on other irrigated crops such as cotton, rice and vegetables with these sectors experiencing reductions of 43%, 42% and 17% in area respectively between 2001 and 2006. The impacts on other broadacre crops were less in quantum, with area increasing by 7%.

Analysis of time trends within commodity categories is confounded by the high percentage of agricultural employment coded to "balance of agriculture" in 1996; changes in classification of employment between 1996/2001 and 2006 data; and lack of data on water use. As a result, trends are difficult to establish or relate to changes in employment and areas under cropping.

Within the bounds of the statistical accuracy of the analysis and the various confounders noted above, assumptions of linearity between area under cultivation and employment appear to be supported. That is, the relationships between employment and water use developed using 2006 data appear to be generally applicable and have not been inflated by the effects of the drought. This linearity is particularly evident in the case of cotton. The assumption of linearity is further supported by reference to ABS GVIAP data for the Murray Darling Basin.

The categories of vegetables, fruit and grapes had a 39% increase in area between 1996 and 2001, with employment increasing by 71% but then dropping between 2001 and 2006 by 14%. Although not simple, employment per '000 ha generally increased between 1996 and 2001, and then dropped between 2001 and 2006, both by the average of areas and the MDB average. The reason for this is not obvious. The proportion of processing employment compared to direct agricultural employment is relatively constant between 1996 and 2001,[4] but halving with 2006 data however wholesale trade was not included in 2006 data, accounting for the apparent fall in vegetables but not in fruit and grapes. Other possible explanations include higher levels of employment per '000 ha associated with bringing new plantings on line; and a loss of jobs from efficiency gains between 2001 and 2006, with potential mechanisms including consolidation of smaller farms resulting in economies of scale and increasing mechanisation.

Grazing data is inconclusive because there is a wide range of intensity of grazing uses and land use data differs from year to year regarding the inclusion of rangelands. Understanding the contribution of irrigation is important in understanding grazing employment however data were not available for 1996 and 2001. The impact of the drought is marked, with a 24% drop in employment between 2001 and 2006.

The regression results for 2001 are of particular interest for broadacre crops, as data were available for land use across three categories, cereals etc., other crops (including oilseeds and legumes) and rice. By considering the average of areas, a hierarchy is apparent for broadacre irrigated crops, with rice having the highest employment at 10.6 people per 1,000 ha, followed by cotton at 6.5 people per 1,000 ha and finally other crops at 5.6 people per 1,000 ha. Dryland cereal crops are much lower employers at 0.8 people per 1,000 ha.

The area cropped to cotton increased by 70% between 1996 and 2006, with the addition of 1,600 jobs in cotton and cotton related industries. Employment per '000 ha fell by 7% between 1996 and 2001, probably as a result of technological change, but employment per '000 ha was constant between 2001 and 2006 even though the area cultivated fell by 43%.

ABS has calculated Gross Value of Irrigated Agricultural Production for the Murray Darling Basin for 200-01 and for 2005-2010. This data has been adjusted for inflation and analysed in total and by commodity group.

[4] 17% for 1996, 18% for 2001 and 8% for 2006.

The most important finding is the strong evidence for a linear relationship between irrigation water and GVIAP for all commodities except for grazing. The ranking of commodity groups in terms of GVIAP per 10 Ml of irrigation water applied is permanent plantings (vegetables, fruit and grapes) ($23.8 million) followed by livestock ($5.2 million), cotton ($4.9 million), cereals ($4.7 million) and rice ($2.3 million). These latter results should be treated with caution, as the 95% confidence intervals for livestock, cotton, cereals and rice overlap and the permanent planting data is obtained by treating the 2007-08 data as an aberration.

Within a range of 4,000 Gl to 11,000 Gl, the analysis predicts a reduction of GVIAP of $_{2009}$250 million for each 1,000 Gl reduction in irrigated water. The Murray Darling Basin Plan currently proposes a 20% reduction in Baseline Diversion Limit (BDL) of 2,750 Gl in determining Sustainable diversion limits (SDLs).[5] Using time trend analysis of GVIAP data, this reduction is equivalent to a reduction in GVIAP of about $_{2009}$680 million, or around 11% reduction in GVIAP in 2000-01.

Indicators of community well-being and resilience

In *Report 3,* we conducted an analysis of relationship between a variety of indicators of community well-being and resilience with key independent variables and with agricultural industries. We have carried out a similar analysis using ABS data for 1996 and 2001.

Time trends may be evident within these relationships, and these have been identified. In addition the agricultural multiplier was estimated for the three years and economic diversity was examined.

Additionally, because of generally low levels of variance in data and evident multi-collinearity between independent employment variables, it is possible for identified relationships to be data artefacts rather than reflecting any underlying causal relationship. Accordingly, those relationships evident across the three years or showing an appropriate trend have been taken as robust and indicative of an underlying causality, while those not found in all years are treated as data artefacts and disregarded.

Generally across the data set and the three years, much of the variation in the dependent variables was accounted for by the four key variables of remoteness, population, indigenous population and age.

For most indicators, the relationship with employment variables was slight, and in many cases the relationship is more likely to be with the type of community (e.g. regional centre) associated with employment patterns, rather than with the employment variable itself. However, for some indicators there was a significant and plausible causal relationship with employment variables.

For irrigated agriculture in particular, the commodity groups of fruit, vegetables and grapes are consistently associated with a younger less skilled workforce, suggesting that these sectors provide employment to the lower end of the labour market. Conversely, such jobs may be hard

[5] Murray Darling Basin Authority (2011) *Plain English Summary of the proposed Basin Plan,* Schedule 2 Matters relating to surface-water SDL resource units, Table S2.1.

to replace within overall economic growth, as the new jobs may require higher levels of skills and experience.

The impact of cotton on employment and population growth is particularly striking, with growth in cotton associated with increasing population and positive employment change; and decline associated with the converse. This is probably reflective of the types of communities where cotton is grown, with those communities typically smaller and more remote, and consequently more subject to the vagaries of agricultural production.

The Table below shows the relationship between key variables and indicators of well-being and resilience. A positive relationship means that an increase in the independent variable is associated with an increase in the dependent variable.

The main predictor of indicators of community wellbeing was indigenous population, followed by age. For indicators of community resilience (economic growth) the main predictor was population followed by remoteness. For indicators of community resilience (resource distribution) the main predictor was age followed by remoteness. Finally age was the main predictor of indicators of community resilience (social capital).

Table 1: Relationship between key variables and indicators of well-being and resilience

	Remoteness	**Population**	**Indigenous population**	**Age**
Indicators of Community Wellbeing				
SEIFA (disadvantage)	Negative relationship		Positive relationship	Positive relationship
SEIFA (economic resources)			Negative relationship	Negative relationship
Premature death			Positive relationship	
Assault (Non domestic violence)			Positive relationship (*with remote indigenous*)	
Assault (domestic violence)			Positive relationship (*with remote indigenous*)	
Property crime		Positive relationship	Positive relationship	
Labour force participation 15+	Positive relationship		Negative relationship	Negative relationship
Median household income			Negative relationship	Negative relationship
Disability support pension			Positive relationship	Positive relationship
Profound or severe disability	*Data not available*	*Data not available*	*Data not available*	*Data not available*
Chronic ill health		Positive relationship	Positive relationship	Positive relationship
Indicators of Community Resilience – Economic growth				
Employment change		Positive relationship (*with population change*)		
Labour force participation 65+	Positive relationship	Negative relationship		

Median age		Negative relationship	Negative relationship	
Skills base	Negative relationship			Negative relationship
Secondary school participation 12-17	Negative relationship		Negative relationship	Positive relationship
SEIFA (education and occupation)		Positive relationship		
Economic diversity	Negative relationship	Positive relationship	Negative relationship	Positive relationship
Indicators of Community Resilience – Resource distribution				
GINI coefficient (increasing polarisation)	Positive relationship			Positive relationship
Youth unemployment	Negative relationship		Positive relationship	Positive relationship
General unemployment	Negative relationship		Positive relationship	Positive relationship
Indicators of Community Resilience – Social Capital				
Change of address			Negative relationship	Negative relationship
Population change	Negative relationship			Negative relationship
Indicators of Community Resilience – Citizen participation				
Voluntary work	*Data not available*	*Data not available*	*Data not available*	*Data not available*

Source: JSA

The table below shows the relationship between employment variables and indicators of well-being and resilience. The indicators are ranked by the degree to which employment variables account for variation on average across the three years. In no case did employment account for more than 50% of the variation in the dependent variable.

For many of the variables considered, industry had no discernible impact. For the balance, agriculture in total, and different agricultural sectors in particular, were typically associated with indicators of economic growth. Much of the association might be considered negative and suggestive of a residualised less skilled population associated with communities dependent on

agriculture; with agriculture, grazing and cereal associated with an older workforce; agriculture and grazing associated with an older population; fruit and grapes associated with lower status education and occupation; agriculture, vegetables, fruit and cereal associated with a lower skills base; and fruit associated with lower levels of secondary school participation. However this is not always the case, with fruit and vegetables associated with a younger workforce; and cereal associated with higher levels of secondary school participation.

The picture is somewhat different with regard to indicators of wellbeing and resource distribution. Grazing and total agriculture is associated with higher levels of labour force participation and lower levels of unemployment however this may be a mixed finding as the effect could reflect an older workforce or tendency for people to leave smaller rural centres in search of work.

There are two trends of particular interest. First there is a diminishing trend over time for agriculture to be associated with lower household incomes. This reflects a trend of diminishing rural poverty and is in line with the larger trend towards amalgamation of smaller farms.

Secondly, the expansion of agriculture and particularly the cotton industry between 1996 and 2001 had a number of positive effects. These included increased household incomes in smaller remote areas, population growth in cotton growing areas, and increased levels of employment. Conversely the contraction of agriculture and the cotton industry between 2001 and 2006 was associated with loss of employment and population. This is in line with the predictions of modelling carried out in report 4 which found that one of the effects of reductions in irrigation water would be loss of employment and population.

Table 2: Relationship between employment variables and indicators of well-being and resilience

Variable	Industry	Comments
Employment accounting for more than 35% of variation		
Labour force participation 65+	Agriculture, grazing and cereal	Consistently associated with an older work force.
	Fruit and vegetables	Consistently associated with a younger work force.
Median age	Agriculture and grazing	Consistently associated with an older population.
SEIFA (education and occupation)	Fruit, grapes, mining	Consistently associated with lower levels of skills
Employment accounting for more than 20% of variation		
Median household income	Agriculture	Appears to show a trend of diminishing rural poverty associated with farming over time
	Cotton	The expansion of the cotton industry between

		1996 and 2001 appears to have had a positive impact on household incomes in smaller remote centres.
Skills base	Agriculture, vegetables, fruit and cereal	These industries are consistently associated with a lower skills base.
GINI coefficient	No trend	
Change of address	Construction	Consistently associated with higher levels but probably acting as a proxy for an area with increasing population or where new industries are being developed.
	Utilities, retail	Consistently associated with lower levels but probably acting as a proxy for regional centres.
Population change	Construction and rental	Associated with increase but probably acting as a proxy for an area with increasing population or where new industries are being developed.
	Cotton	Growth in the cotton industry between 1996 and 2001 is associated with increasing population, while decline from drought between 2001 and 2006 is associated with decreasing population.
Employment accounting for more than 5% of variation		
SEIFA (disadvantage)	No trend	Industry probably acts as a proxy for types of communities where disadvantaged people congregate or are found.
SEIFA (economic resources)	Construction	The industry variable probably indicates an area with increasing population or where new industries are being developed.
Premature death	No trend	
Labour force participation 15+	Grazing	Associated with higher levels but may suggest an older workforce
	Total agriculture	Associated with higher levels but may suggest an older workforce
	Retail, wholesale, communications, education and health	Associated with lower levels but probably acting as a proxy for regional centres with concentrations of retired people

Disability support pension	No trend	
Chronic ill health	No trend	
Secondary school participation	Fruit	Associated with lower levels
	Cereal	Associated with higher levels
Youth unemployment	Retail	Consistently associated with higher levels
General unemployment	Agriculture	Associated with lower levels
	Retail and finance	Associated with higher levels but the relationship is probably to do with unemployed people congregating in regional centres
Balance		
Assault (non-domestic violence)	No trend	
Assault (domestic violence)	No trend	
Aggregate property crime	No trend	
Employment change	Cotton and agriculture	Expansion of the industry between 1996 and 2001 is associated with employment growth, while contraction from drought between 2001 and 2006 is associated with loss of employment.

Source: JSA

Increasing economic diversity appears to be associated with less remote areas, larger populations and older populations while decreasing economic diversity appears to be associated with grazing, remoter areas, smaller populations and indigenous populations, however the effects are slight and are typically seen in one or two industries. Meaningful trends include lower levels of manufacturing in remote areas, and higher levels of finance, professional and public administration in more populous areas. Increasing urbanisation is associated with more diverse economies.

On review the multiplier estimated in Report 3 appeared to be an artefact of the population partitions used, however using population partitions of less than 5,000, 5,000 to 10,000 and

greater than 10,000, a consistent multiplier of 1.1-1.2 was estimated using 1996 and 2001 data. The 2006 data appears to have been confounded by the marked loss of agricultural employment resulting in a multiplier of 2.5, with the higher value attributable to the drought and to lag effects of other industries in responding to downturns. An examination of 2011 census data is required to determine whether the 2006 analysis reflects an anomaly due to drought conditions or whether it reflects a trend.

Using the 1996 and 2001 data, smaller communities (population less than 5,000) are highly reliant on agriculture and are becoming more so with time, medium communities (population between 5,000 and 10,000) are quite reliant on agriculture and are becoming more so with time, while larger communities are less reliant on agriculture and are becoming less reliant with time.

2.2.4 Research Questions 7, 8 and 9

Research Questions 7, 8 and 9 ask: *Has the relationship between community resilience and irrigated agriculture changed over time at the local level, and if so, what have those changes been?*

What are the trends and likely drivers of such change at the local level? and

What are the implications at the local level of the ongoing influence of those trends and drivers?

Generally, the impacts of drought and reductions in irrigation water across the case study areas were seen in changes in employment and population with any impacts on other indicators not detectable in the light of larger trends. The resilience report card developed in Report 4 was supported, with some communities very sensitive to changes in irrigation water, and others showing little or no impact, and with those impacts in line with Report 4 expectations.

Smaller, remote communities most reliant on agriculture were found to be most sensitive to changes in irrigated agriculture, while those communities with a wider economic base and close to major centres were found to be least sensitive to changes in irrigated agriculture. With regard to Report 4 predictions, the three smaller northern case studies of Balonne Shire, Bourke Shire and Moree Plains were found to be more sensitive to changes in irrigation water than modelled.

Consequently, the impacts of changes in the availability of irrigation water will be felt most markedly in communities where irrigated agriculture forms a significant part of the economy, and which lack mitigating factors such as a large population base or proximity to larger urban areas. The resilience report card developed in Report 4 is supported by temporal data on the response of communities to changes in irrigation water. The 'stickiness' of population change is at odds with notions of frictionless structural change, and supportive of residual populations in communities where employment has been lost.

There were two groups of communities.

The first group included communities found to be sensitive to changes in irrigated agriculture. These included Balonne Shire, Bourke Shire, Moree Plains, Griffith and Mildura. For Bourke and Moree Plains, the impacts of change in irrigated agriculture were overlaid on longer term trends of decline. In Griffith, impacts of reductions in water were mitigated by differences in water

security and trade in water between commodity sectors, whereas in the other areas, impacts were greater than modelled. Conclusions for Mildura are based on the impacts of growth in irrigation water use, as there were no significant reductions over the period, and with impacts mitigated by its role as a regional city. Population change was generally found to be 'sticky' across communities, lagging change in employment.

The second group included southern areas in which there was little variation in irrigation water use over the time period or where the data showed little or no impact from changes in irrigated agriculture. These included Dalby-Wambo, Campaspe and Murray Bridge. Campaspe showed little or no variation in irrigation water usage over the period. These three centres were predicted in Report 4 to be quite resilient to changes in irrigation water due to a wider economic base and proximity to other larger centres.

2.2.5 Research Question 10

Research Question 10 asks: *Are the predictions of Report 4 supported by historical data?*

By comparison with GVIAP data, the loss of jobs from reductions in irrigated agriculture predicted in Report 4 suggests that those estimates are about 59% high. This is probably because of the Report 4 assumption of equal reductions across all commodity groups, however different commodity groups have varying reliability of irrigation water, and the differential in productivity per Gl of water between commodity groups suggests that trade is likely as a response to decreases in irrigation water. Additionally, drought impacts were not evenly distributed geographically. Other modelling carried out by the MDBA also overestimates impacts of reductions in irrigation water on GVIAP by variously 22% and 46%, with the variations probably arising from differences in model parameters and in differences between the distribution of irrigation water reductions between those modelled and those experienced in the drought.

3 Detailed Findings and Discussion

This section seeks to identify the temporal aspects of changing water availability within the MDB at three different scales, the local level, the MDB level and the national level and to compare the predictions of *Report 4* with historical data.

3.1 The National Level

3.1.1 Summary of trends

At the national level, there are a number of relevant trends when considering the relationship between resilience and irrigated agriculture. These trends are illustrated below by reference to ABS data for the census years of 1966 and 2006.[6]

The major demographic trends include:

- increasing population;
- an aging population;
- increasing urbanisation;
- increasing wealth; and
- a rapidly increasing aboriginal population.

The major agricultural trends include:

- a significant proportional reduction of agricultural industries as a component of the Australian economy, with a threefold reduction in the contribution of agriculture to employment in relative terms and a fourfold reduction in the contribution of agriculture to GNP/GDP in relative terms;
- an increase in the efficiency of agricultural industries with an approximate halving of absolute employment in agriculture, a 10% increase in the absolute net value of production and a 10% decrease in the area under agriculture;
- consolidation and amalgamation of family farms, with a halving of the number of agricultural establishments; and
- a doubling of the area of irrigated agriculture.

With regard to other industries, growth in the Australian economy has largely been through service industries, with manufacturing and agriculture both falling as a proportion of the economy and by the same degree. The other major primary industry, mining, has displaced agriculture at the national level and has gone from one fifth the size of agriculture to 1.5 times the size. Agriculture still directly employs nearly three times as many people, however when

[6] Direct comparison is not necessarily simply due to changes in categories and methods over time.

indirect employment is included, the impact of mining would most likely be in line with the contribution to GDP, that is 50% greater than the agricultural sector.

3.1.2 Implications of trends

At the national level, it is likely that the contribution of irrigated agriculture to community resilience, and by extension to wellbeing, will continue to decrease. There are a number of reasons for this.

By comparison with the economy as whole, the agricultural sector has only grown slightly over the last forty years and as an employer the agricultural sector has reduced markedly. While there has been some growth in output, this is probably because of increasing technology and increasing area under irrigation. In both cases diminishing returns would be anticipated, with the Water Act 2007 and the 1999 imposition of a "Cap" on water diversions[7] suggesting that there is limited or no capacity to take further irrigation water from the Murray Darling River system. At the same time, administrative constraints on trade of water is likely to mean that not all irrigation water is used for the most productive use, so that introduction of free trade could be expected to lead to a significant increase in the irrigated agriculture sector.

Agriculture comprises a small proportion of the Australian economy, representing around 3% in 2006.

Irrigated agriculture provides around 30% of the Gross Value of Agricultural Production in Australia so that an increase in irrigated agriculture will have an impact on the agricultural sector as a whole, e.g. a 10% increase in output in irrigated agriculture will lead to a 3% increase in output of the agricultural sector as a whole.[8]

Nonetheless the quantum of the contribution to the Australian economy is significant, with the agricultural sector contributing $28.2 billion to GDP in 2006, and, by proportion of gross value of agricultural production, irrigated agriculture contributing around $9.0 billion, with around $4.0 billion coming from irrigated agriculture in the MDB.

3.1.3 General trends

Between 1966 and 2006, the Australian population increased from 11.7 million[9] to 20.7 million,[10] a 77% increase in total and an annual increase of 1.4%. The population has also aged markedly, from a median age of 27 years in 1966 to 37 years in 2006.[11] Australia has become increasingly urbanised. In 1966, 58% of the population lived in capital cities,[12] increasing to 64% for 2006.[13] In 1906, 48.5% of the Australian population lived in rural areas and centres

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[7] http://www2.mdbc.gov.au/nrm/the_cap.html accessed 17 February 2012.

[8] ABS (2010), *Gross Value of Irrigated Agricultural Production, 2000-01 to 2008-09.*

[9] Commonwealth Bureau of Census and Statistics (1968), *Official Year Book of the Commonwealth of Australia, No 54, 1968,* Commonwealth Bureau of Census and Statistics, Canberra, page 122.

[10] Australian Bureau of Statistics (2008), *2008 Year Book Australia, No 90,* Australian Bureau of Statistics, Canberra, page 180.

[11] Commonwealth Bureau of Census and Statistics (1968), *op cit*, page 137 and JSA calculation; and ABS Census 2006.

[12] Commonwealth Bureau of Census and Statistics (1968), *op cit*, page 123.

[13] Australian Bureau of Statistics (2007), *3218.0 Regional Population Growth Australia*, Australian Bureau of Statistics, Canberra, page 4.

with populations below 3,000 decreasing to 18.2% by 1996. Over the same time period, the proportion of the population in centres with population above 950,000 increased from 0.0% to 53.1%.[14]

Australians have become much wealthier, with CPI adjusted per capita GNP/GDP increasing from $17,770 in 1966 to $44,530 in 2006, an increase of 150%.[15] The number of people identifying as indigenous has also increased rapidly, from 85,610 in 1966 to 455,027 in 2006, a 429% increase and an annual increase of 4.3%. This increase is likely to reflect an increasing propensity of people to record aboriginality, as well as a younger age structure and higher fertility rate among aboriginal communities. [16]

3.1.4 The changing importance of agriculture

There have also been considerable changes in agricultural production and employment. The proportion of employment in agriculture has decreased. In 1966, 9.4% of the workforce (456,651 people) was engaged in primary production (predominantly rural industries),[17] but by 2006, the proportion had reduced to 3.1% (280,922 people), a two thirds reduction as a proportion of total employment and a reduction of 38% in absolute numbers of people employed in agriculture.[18] Over the same period, manufacturing employment as a proportion of total employment also decreased by around 61% (from 27.0% to 10.5%), with most of the increase in employment taking place in service industries and retail.

The total area under agriculture reduced from 486 million ha across 252,162 holdings in 1966 to 443 million ha across 129,934 establishments.[19] The area fell by 8.8% (although some of the reduction may be due to definitional changes) and the number of establishments nearly halved, falling by 49%.

The proportional contribution of primary industry to GNP was 12.4% in 1966, but had fallen to 3.1% of GDP in 2006. In absolute terms (adjusted for CPI to 2006), the net value of production increased from $25.82 billion (in 2006 dollars) in 1966 to $28.2 billion in 2006, an increase of 9.3% or 0.2% per annum.[20]

The area of irrigated agriculture has nearly doubled, with some sectors, such as cotton, showing dramatic growth. Details are shown in the table below.

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[14] Australian Bureau of Statistics (2001), *2001 Year Book Australia,* Australian Bureau of Statistics, Canberra, page 203.

[15] Calculated from population data above and data in Australian Bureau of Statistics (2008), *op cit*, page 467, Commonwealth Bureau of Census and Statistics (1968), *op cit*, page 1268, and ABS (September 2010) 6401.0 *ConsumerPrice Index, Australia.*

[16] Commonwealth Bureau of Census and Statistics (1968), *op cit*, page 150 and ABS Census 2006.

[17] Commonwealth Bureau of Census and Statistics (1968), *op cit*, page 1156.

[18] ABS Census, 2006 (Note that the comparison is not straightforward due to category changes).

[19] Australian Bureau of Statistics (2008), *op cit*, pages 96 and 478; and Commonwealth Bureau of Census and Statistics (1968), *op cit*, page 853.

[20] Australian Bureau of Statistics (2008), *op cit*, page 467, Commonwealth Bureau of Census and Statistics (1968), *op cit*, pages 1262 and 1268, and ABS (September 2010) 6401.0 *Consumer Price Index, Australia.*

Table 3: Area irrigated by commodity 1966 and 2006 for Australia

Commodity	Irrigated area 1966 ('000 ha)	Irrigated area 2006 ('000 ha)	Increase in area ('000 ha)	% increase	Annual % increase
Pastures	818	811	-7	-0.9%	0.0%
Rice	30	100	70	233%	3.1%
Cotton	17	277	260	1,539%	7.2%
Fruit (1)	58	140	82	141%	2.2%
Grapes	38	180	142	374%	4.0%
Vegetables	48	126	78	163%	2.4%
Sugar Cane	58	222	164	283%	3.4%
Other crops	292	727	435	149%	2.3%
Total	1,359	2,583	1,224	90%	1.6%

Source: Commonwealth Bureau of Census and Statistics (1968), *op cit*, page 961 and Australian Bureau of Statistics (2008), *op cit* page 480.

Table Notes:

(1) 1966 figure includes grapes for Queensland

3.1.5 Mining

The other major industry in rural Australia is mining. While still directly employing fewer people by comparison with agriculture, mining makes a greater contribution to the Australian economy. In 1966, GNP in the agricultural industries was six times the GNP in the mining industries and agriculture directly employed 8 times as many people. By 2006 mining had overtaken agriculture, with GDP in the mining industries 60% greater than that in agricultural industries. However agriculture still directly employed nearly 3 times as many people as mining.

Table 4: Contribution of mining to the Australian economy

Measure	1966	2006	Increase	% increase	Annual % increase
Total employment	56,343	106,896	34,490	61%	1.2%
Proportion of total employment	1.2%	1.2%	0.0%	0%	0%
Contribution to GDP (CPI adjusted)	$4,419 million	$45,000 million	$40,581 million	918%	6.0%
Proportional contribution to GDP	2.1%	4.9%	2.8%	133%	2.1%

Source: Australian Bureau of Statistics (2008), *op cit*, Commonwealth Bureau of Census and Statistics (1968), *op cit*, and ABS (September 2010) 6401.0 *Consumer Price Index, Australia,* JSA calculation.

3.2 The MDB Level

3.2.1 The effect on output of reductions in irrigation water

Introduction

Since 2005-06, ABS has compiled detailed data sets on Gross Value of Irrigated Agricultural Production (GVIAP) and irrigation water usage in the MDB. Some data is also available for 2000-01. That data, adjusted for inflation, is shown below.

Data

Table 5: Murray Darling Basin Gross Value of Irrigated Agricultural Production (GVIAP) (Adjusted for CPI to June 2009)

Commodity groups	2000-01 ($m)	2005-06 ($m)	2006-07 ($m)	2007-08 ($m)	2008-09 ($m)	2009-10 ($m)
Cereals for grain and seed	$185.6	$195.1	$202.3	$273.1	$278.7	$122.3
Total hay production	$99.7	$173.7	$186.3	$140.7	$80.1	$97.1
Cereals for hay	$7.6	$0.0	$0.0	$0.0	$15.8	
Pastures for hay	$92.2	$0.0	$0.0	$0.0	$64.3	
Pastures for seed	$4.3	$0.0	$0.0	$0.0	$19.7	
Cotton	$1,386.2	$863.6	$484.5	$196.3	$561.9	$616.6
Rice	$435.8	$296.1	$58.3	$7.4	$34.5	$89.0
Sugar cane	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Other broadacre crops	$0.0	$0.0	$0.0	$21.6	$0.0	$0.0
Fruit and nuts	$875.2	$1,094.3	$1,279.9	$1,199.3	$1,032.5	$1,080.1
Grapes	$980.0	$780.1	$689.8	$1,119.9	$598.4	$719.3
Vegetables for human consumption and seed	$583.7	$600.2	$589.8	$728.8	$564.2	$538.7
Nurseries, cut flowers and cultivated turf	$112.7	$162.1	$136.5	$228.8	$119.4	$139.0
Dairy production	$1,003.0	$975.6	$808.8	$975.5	$790.7	$623.9
Production from meat cattle	$477.8	$641.3	$592.8	$167.0	$129.3	$171.0
Production from sheep and other livestock	$156.4	$155.0	$173.8	$94.7	$105.1	$169.1
Total GVIAP	**$6,347.2**	**$5,976.5**	**$5,218.8**	**$5,152.9**	**$4,349.1**	**$4,386.0**

Source: ABS Murray-Darling Basin - Gross Value of Irrigated Agricultural Production, 2000-01 to 2009-10, ABS 6401.0 - Consumer Price Index, Australia, Sep 2010, JSA calculation.

Table 6: Murray Darling Basin Volume of Water Applied

	2000-01	2005-06	2006-07	2007-08	2008-09	2009-10
Commodity groups	**ML**	**ML**	**ML**	**ML**	**ML**	**ML**
Cereals for grain and seed		623,678	571,756	805,267	707,221	468,944
Total hay production		648,762	468,839	340,612	244,625	221,301
Cereals for hay		117,645	76,968		42,536	
Pastures for hay		531,117	391,871		202,089	
Pastures for seed		25,215	73,953		40,070	
Cotton		1,574,435	818,780	282,568	793,429	763,924
Rice		1,251,881	239,432	26,664	101,474	
Sugar cane		0	0	0	0	
Other broadacre crops		117,654	61,044	85,329	89,531	46,795
Fruit and nuts		412,653	417,066	356,082	374,310	449,862
Grapes		514,819	533,933	433,862	439,259	427,580
Vegetables for human consumption and seed		152,002	124,863	124,017	121,487	129,403
Nurseries, cut flowers and cultivated turf		12,166	12,680	9,376	8,514	8,242
Livestock grazing						722,288
Dairy production		1,028,430	599,971	365,852	331,948	
Production from meat cattle		554,402	346,730	159,168	133,130	
Production from sheep and other livestock		439,364	186,947	131,751	92,172	
Total volume applied	**10,516,000 (1)**	**7,369,806**	**4,458,279**	**3,141,659**	**3,492,407**	**3,564,481**

(1) This figure is taken from Mallawaarachchi,T, Adamson, D, Chambers, S & Schrobback, P (2010) *Economic analysis of diversion options for the Murray–Darling Basin Plan: returns to irrigation under reduced water availability.* The report references ABS. The authors may have calculated the figure from other data as the ABS does not publish this figure. Similar figures are used by other authors but the provenance is uncertain.

Source: ABS Murray-Darling Basin - Gross Value of Irrigated Agricultural Production, 2000-01 to 2009-10, JSA calculation.

A more detailed analysis by commodity group is shown in the figures below including a linear regression analysis. It should be noted that GVIAP includes variation from output and from commodity price. (The first p value applies to the dependent variable coefficient and the second applies to the constant. A p value greater than 0.05 means the coefficient or constant is not statistically significantly different from zero).

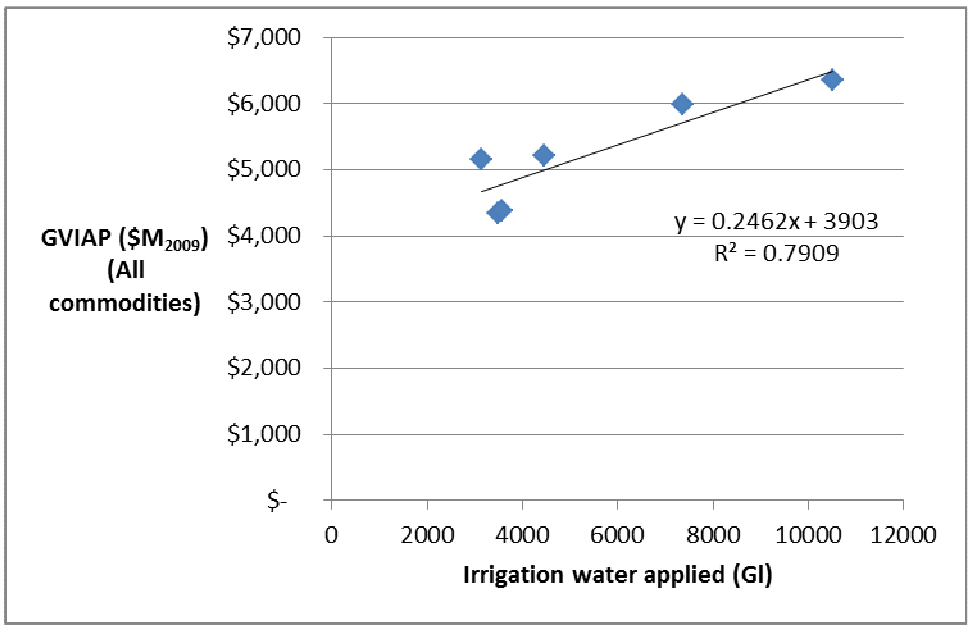


Figure 2: GVIAP (All commodities) versus irrigation water applied (p=0.02, 0.00)

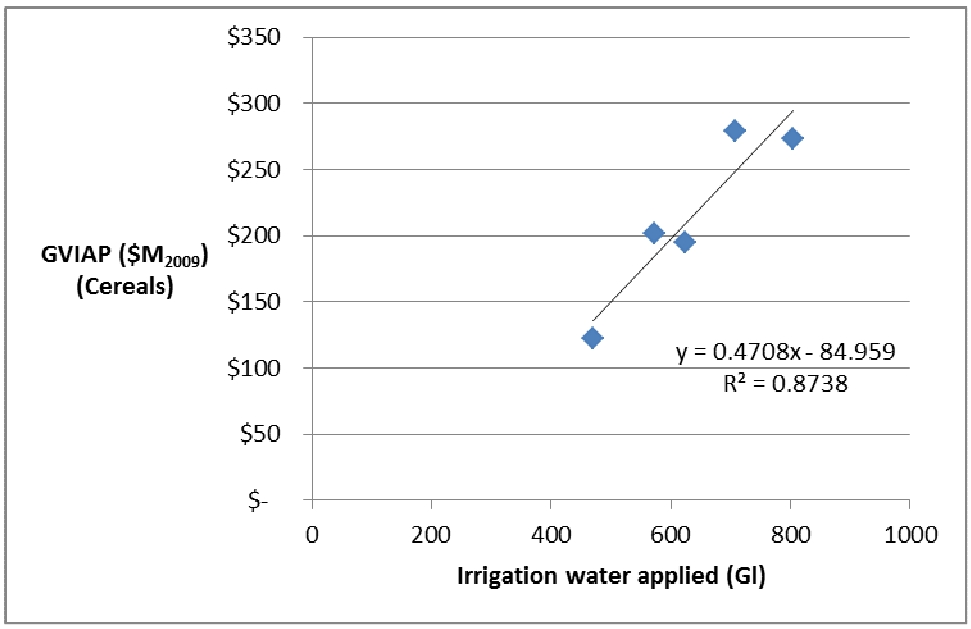


Figure 3: GVIAP (Cereals) versus irrigation water applied (p=0.02, 0.29)

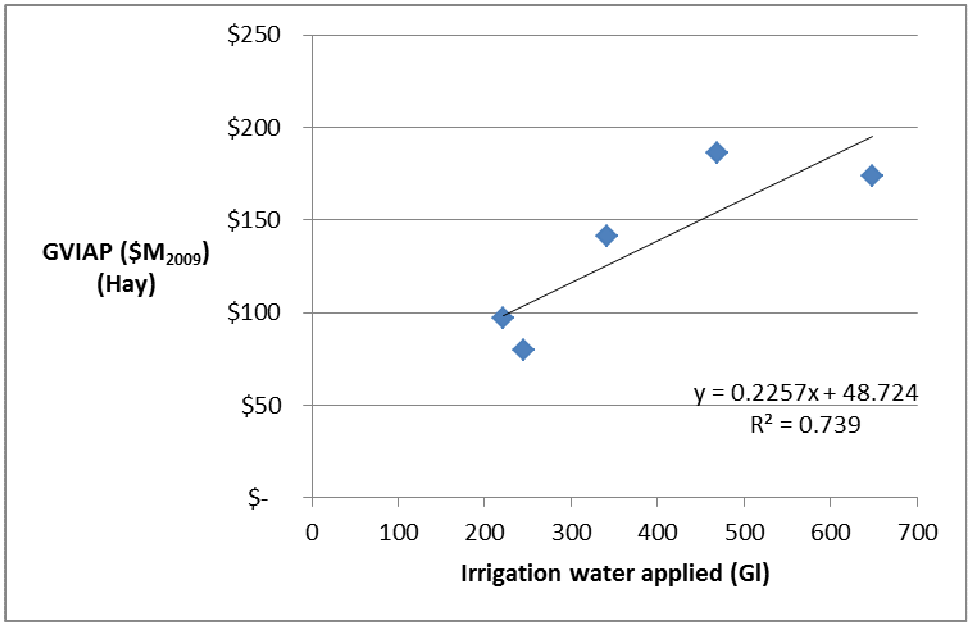


Figure 4: GVIAP (Hay) versus irrigation water applied (p=0.06, 0.23)

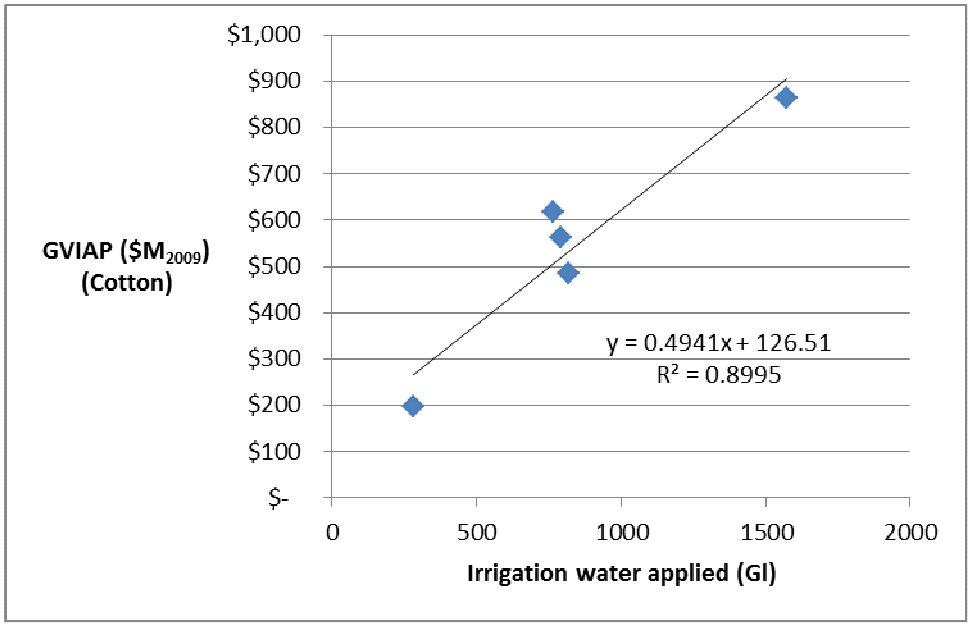


Figure 5: GVIAP (Cotton) versus irrigation water applied (p=0.06, 0.23)

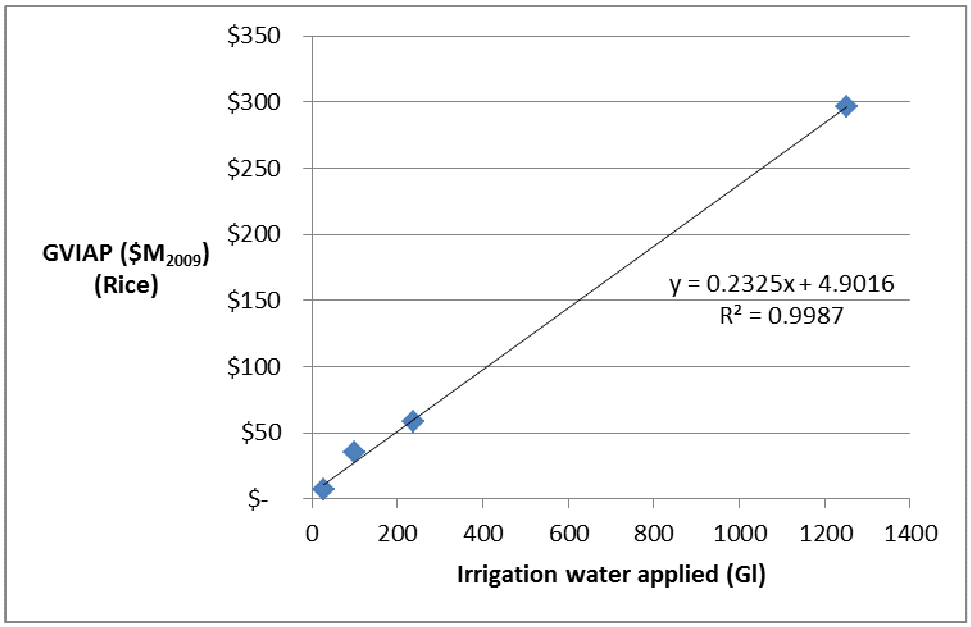


Figure 6: GVIAP (Rice) versus irrigation water applied (p=0.00, 0.32)

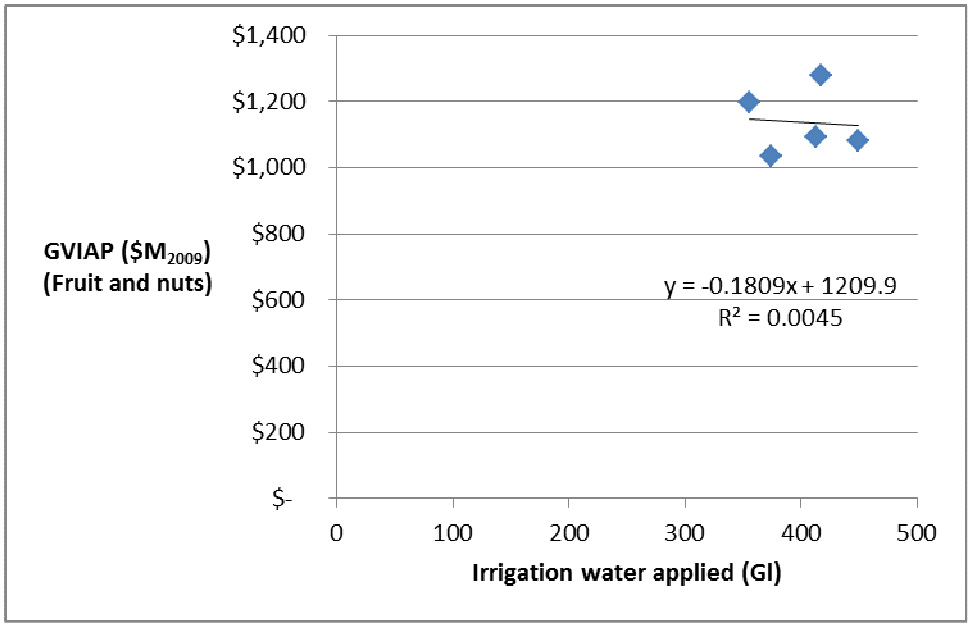


Figure 7: GVIAP (Fruit and nuts) versus irrigation water applied (p=0.90, 0.15)

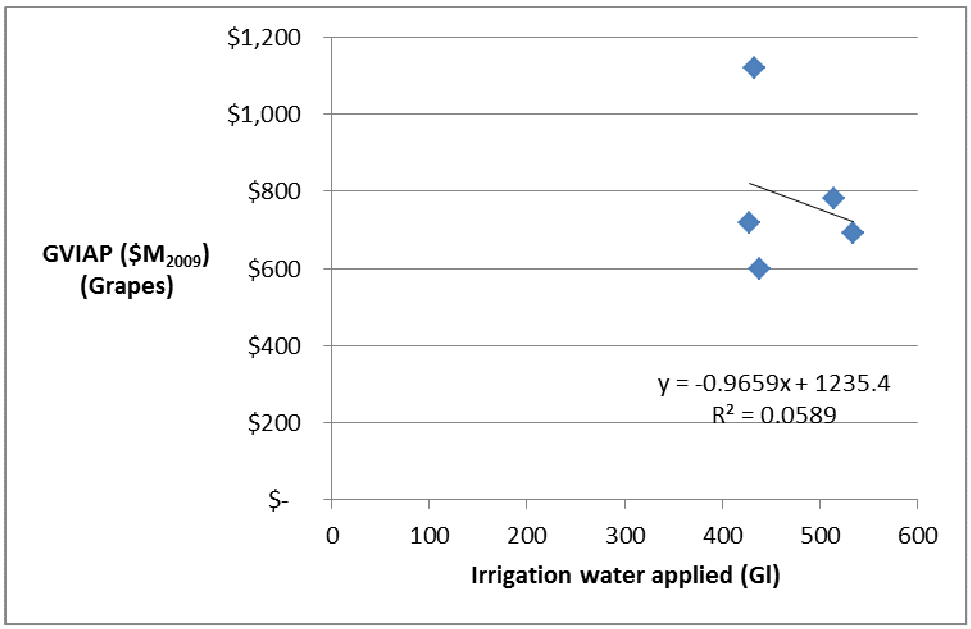


Figure 8: GVIAP (Grapes) versus irrigation water applied (p=0.69, 0.32)

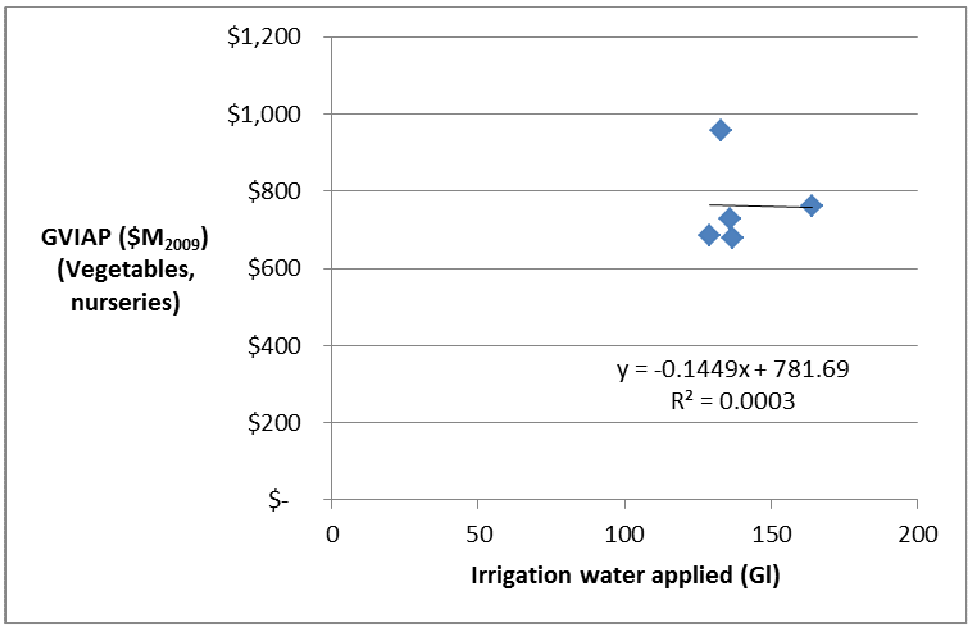


Figure 9: GVIAP (Vegetables, nurseries) versus irrigation water applied (p=0.98, 0.33)

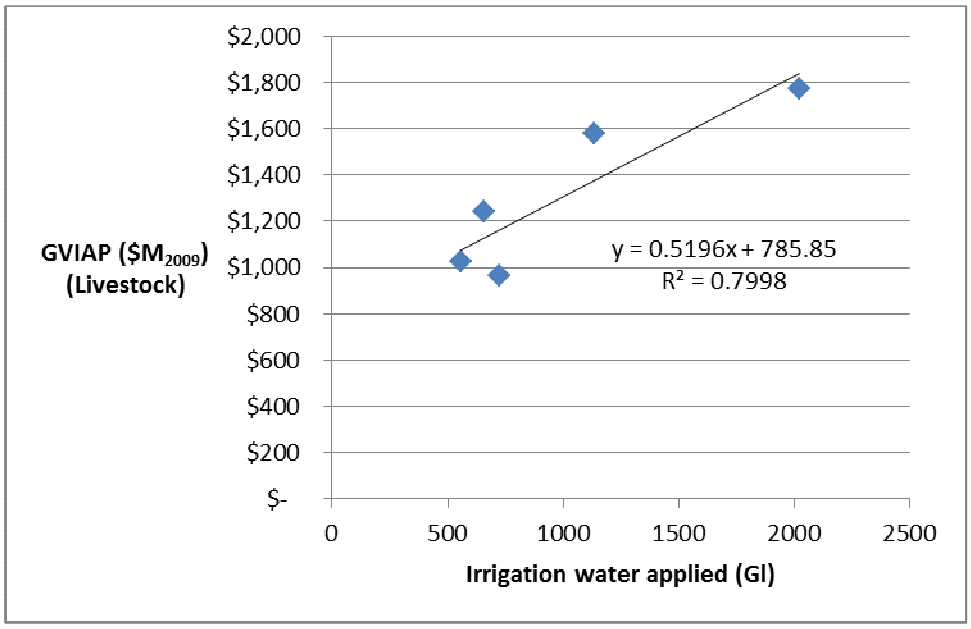


Figure 10: GVIAP (Livestock including dairy) versus irrigation water applied (p=0.04, 0.02)

Discussion

Based on the complete data set, the impact on GVIAP of reductions in irrigation water is about $2.5 million for each 10Gl reduction, with a threshold level of GVIAP of $3.9 billion, however the situation is more complex than this. Detailed examination by commodity group reveals a more complex relationship, with a division between permanent plantings (fruit and nuts, grapes and vegetables) utilising high security water and those commodities utilising low security water.

In terms of GVIAP, the permanent plantings of fruit and nuts, grapes and vegetables and nurseries show no relationship with reductions in irrigation water. It is not possible to conclude that these commodities were immune from the effects of the recent drought (as GVIAP may have been sustained by buying in water thereby reducing profitability) but rather that the variation in GVIAP from the effects of reductions in irrigation water cannot be separated out from the variations from price changes for the data set. What trend there is infers increasing value from reduced irrigation water suggesting that price increases associated with reduced production more than offset lost revenue from reduced production. However if the 2007-08 data is treated as an aberration, a different picture emerges. The two graphs below show combined data for all permanent plantings, with the second graph excluding the 2007-08 data. The second group of data is more plausible, in that zero GVIAP is predicted with zero irrigation water (more correctly the hypothesis that the constant is zero cannot be rejected at the 95% level of confidence), however the data set is small. This combined set (excluding 2007-08 data) suggests the impact on GVIAP of reductions in irrigation water for permanent plantings is $24 million for each 10 Gl. International food prices increased rapidly through the first half of 2008 (by factors of 2 and 3

for selected commodities) but had fallen from peaks by the end of 2008 supporting this assessment of the 2007-08 data as an aberration.[21]

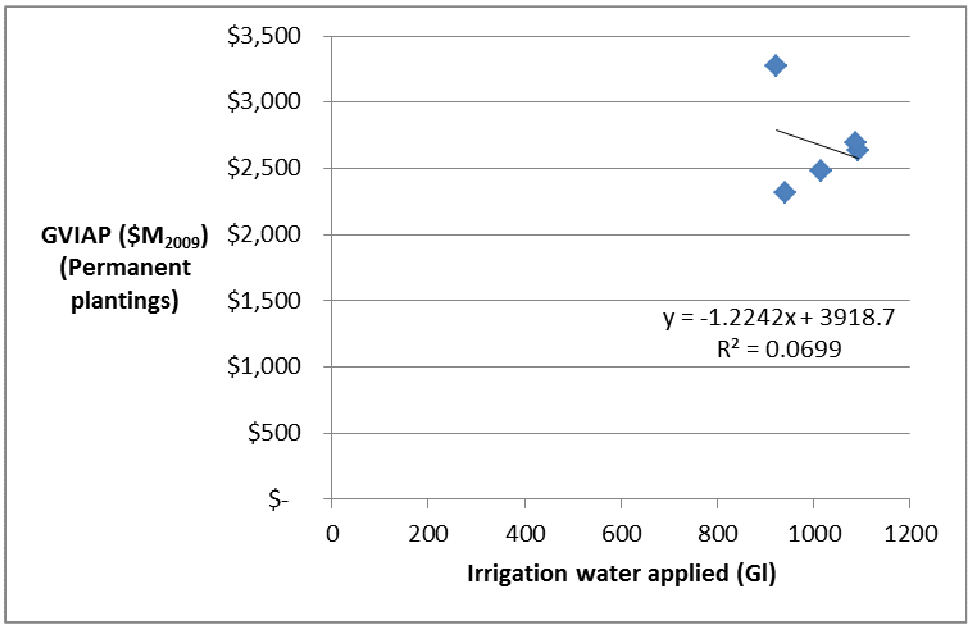


Figure 11: GVIAP (Permanent plantings) versus irrigation water applied (p=0.66, 0.23)

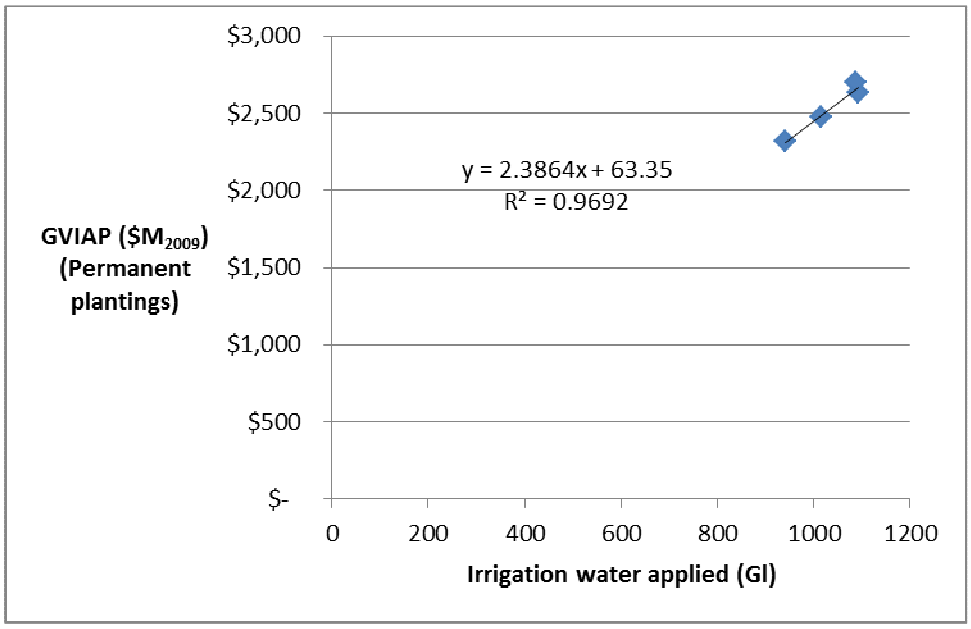


Figure 12: GVIAP (permanent plantings) versus irrigation water applied (p=0.02, 0.86)

[21] Department of Foreign Affairs and Trade (2008) *Rising Prices for agricultural commodities*; Department of Foreign Affairs and Trade (2008) *High food prices, food security and the international trading system.*

The picture is much clearer for the commodities of cereals ($4.7 million of GVIAP for each 10 Gl of irrigation water), cotton ($4.9 million of GVIAP for each 10 Gl of irrigation water) and rice ($2.3 million of GVIAP for each 10 Gl of irrigation water) with all commodities predicting zero GVIAP with zero irrigation water (more correctly the hypothesis that the constant is zero cannot be rejected at the 95% level of confidence).

The data for hay is not statistically significant at the 95% level of confidence, while that for livestock shows $5.2 million for each 10 Gl of irrigation water, and with a threshold level of GVIAP in the absence of irrigation water of $786 million. The latter may be plausible in that irrigation water may be used to supplement rain fed grazing.

Conclusion

The most important finding is the strong evidence for a linear relationship between irrigation water and GVIAP for all commodities except for grazing. The ranking of commodity groups in terms of GVIAP per 10 Ml of irrigation water applied is permanent plantings ($23.8 million) followed by livestock ($5.2 million), cotton ($4.9 million), cereals ($4.7 million) and rice ($2.3 million). These latter results should be treated with caution, as the 95% confidence intervals for livestock, cotton, cereals and rice overlap and the permanent planting data is obtained by treating the 2007-08 data as an aberration.

3.2.2 Comparison of GVIAP data with model predictions

Some conceptual problems

While the question "what will be the impact of reductions in irrigation water?" seems quite straight forward, there is a conceptual problem in answering the question. The concept used by economists, the authors of this report and favoured by government is that of Cost Benefit Analysis informed by opportunity cost, or more correctly social opportunity cost, defined as:

"The social opportunity cost of using resources in one activity is the value foregone by not using them in the best alternative activity".[22]

This method is favoured by the Australian Government. "The Australian Government is committed to the use of cost-benefit analysis (CBA) to assess regulatory proposals to encourage better decision making. A CBA involves a systematic evaluation of the impacts of a regulatory proposal, accounting for all the effects on the community and economy; not just the immediate or direct effects, financial effects or effects on one group. It emphasises, to the extent possible, valuing the gains and losses from a regulatory proposal in monetary terms".[23]

The essential principle is "with and without", rather than "before and after".[24] This is discussed in the Best Practice Regulation Handbook under the heading "Common Cost Benefit Analysis Pitfalls" with "before and after" identified as a common pitfall.

[22] Friedman, L., (2002) *The Microeconomics of Public Policy Analysis*, Princeton, page 336.
[23] Australian Government (2010) *Best Practice Regulation Handbook*, page 61.
[24] Ibid, page 75.

The Murray Darling Basin Authority (MDBA) has commissioned a number of studies into the impacts of reductions in irrigation water. Contrary to best practice, these studies are typified by a "before and after" approach rather than a "with and without" approach.

The two approaches give quite different answers. Taking a "before and after" approach effectively combines mitigations with impacts, that is it adds mitigating effects to adverse impacts to reduce the expressed quantum of such adverse impacts. In the modelling approach favoured by the MDBA, job losses from reductions in irrigation water are offset by wider economic growth elsewhere in the community. The future is compared to the past, that is the perspective is "before and after".

In a "with and without" approach, the answer is quite different. The cost or the impact of reductions in irrigation water is the benefit if that irrigation water was used for the "best alternative activity". In this approach there will always be a cost regardless of mitigations, because if water was diverted from environmental flows to irrigation, there would be economic and jobs growth as a result of increases in irrigation water, whether this takes place now or later. Whatever happens, environmental flows can be converted to jobs, with a resulting economic benefit. At the same time, cost benefit analysis requires this cost to be offset by the environmental costs from reduced environmental flows. In the view of the authors of this report, that environmental cost is determined by willingness to pay, and that assessment is properly carried out by elected representatives. Economic growth may be considered by elected representatives to mitigate the adverse impacts of reductions in irrigation water, but those reductions will always come at an economic cost.

Comparison of Report 4 Predictions

In our report 4 we made a number of predictions regarding the impacts of reductions in irrigation water. We predicted that the impact of reduced irrigation water on jobs would be linear within each commodity group, we predicted that the impacts of job losses would rapidly be offset by GDP growth, we assumed that trade would be affected by connectivity and administrative constraints and we predicted the cost of lost productivity of cuts in irrigation water as $0.6 billion for 10% cuts, $1.4 billion for 25% cuts and $2.7 billion for 50% cuts from a 2006 benchmark.

The assumption of linearity is supported by the analysis of GVIAP data when 2007-08 data is excluded for permanent plantings noting that exclusion of that data is supported by rapid commodity price rises in 2008 and subsequent fall.

Data in Table 7 below shows that around 25,000 agricultural jobs were lost between 2001 and 2006, most likely because of the drought. However in the same period economic growth delivered 118,000 jobs (ACT excluded) more than offsetting the job losses in agriculture, supporting our prediction.

Around 1,089 Gl of water was applied to permanent plantings in 2006-07, however this fell by 166 Gl, 146 Gl and 74 Gl in 2007-08, 2008-09 and 2009-10 respectively. At the same time considerable water was applied to much lower value uses such as hay, livestock and cereal rather than that water being traded to permanent plantings. This is particularly noticeable in

terms of the apparent elevated commodity prices of 2007-08. The data do not support a hypothesis of perfect trade, but neither do they support our assumption of even cuts across commodity groups. The difference could be explained by a reluctance by irrigators to sell water in the short term rather than physical and administrative barriers to trade, however the trend is persistent over the period 2007-10. A more likely explanation, supported by our community consultation in Report 4, is that the higher value uses have access to higher security water, perhaps augmented by some trade, but with trade limited by physical and administrative constraints.

The table below shows the impact on GVIAP of irrigation water reductions from 2005-06. Our report 4 predictions are also shown, with our agricultural multiplier of 0.9 deducted, and predictions adjusted on a pro rata basis.

Table 7: Historical reductions in GVIAP compared to Report 4 predictions

Year	Reduction in irrigation water	Reduction in GVIAP	Report 4 prediction
2006-07	40%	$0.8 billion	$1.1 billion
2007-08	57%	$0.8 billion	$1.6 billion
2008-09	53%	$1.6 billion	$1.5 billion
2009-10	52%	$1.6 billion	$1.5 billion

Source: ABS, JSA, JSA calculations

There are some important points.

The model in Report 4 was based on employment as the primary indicator and an average value for agricultural productivity was used to generate estimates of annual cost in lost production. Agricultural productivity may vary between commodity sectors.

Report 4 used estimates based on lost productivity (or value added) whereas GVIAP is a gross indicator. Accordingly not all of GVIAP is attributable to value added and so the Report 4 estimates should be below the GVIAP value.

The report 4 estimates were based on water reductions evenly distributed across all irrigators. This is a significant simplification, as initial cuts would be more likely to come from lower value uses, and there is likely to be inter-valley trade from lower value to higher value uses. To properly do such an analysis would require a valley by valley assessment assuming trade between commodity groups, with the results summed across valleys and commodity groups to determine the predicted reduction in employment. Hence the estimates should be high.

The report 4 estimates of agriculture jobs include manufacturing and other industries not classified as agriculture but directly associated with agriculture and hence the estimates should be higher than GVIAP as this is based on agriculture only. The overestimate is of the order of 15%.

GVIAP is greater than value added. A comparison of gross value of agricultural production for the two years to September 2011 with gross agricultural value added for the same period[25] suggests that value added is of the order of 48% of gross value.

GVIAP shows the impacts of price changes as well as changes in output.

Despite these caveats, there is reasonable alignment between the report 4 predictions and reductions in GVIAP apart from the 2007-08 data. The large overestimate in 2007-08 is probably attributable to the rapid increase in agricultural commodity prices in early 2008 while the overestimate in 2006-07 is probably because permanent plantings with higher security water did not experience cuts to irrigation water in that year.

Disregarding 2007-08 and taking averages for the other years, the Report 4 prediction on average is 2.5% above GVIAP, compared with an expected value of 55%[26] of GVIAP, suggesting the predictions should be reduced by 46%.

Those predictions also included an agricultural multiplier of 0.9, however further analysis below supports a higher value of 1.2. On this basis the Report 4 estimates for the MDB should be multiplied by 54%, then by 2.2/1.9, or 63%, with the most likely reason for the overestimate being the Report 4 assumption that water reductions are evenly distributed across all irrigators. It is likely that administrative differences between reductions to higher and lower security irrigation water uses, combined with some trade, has ameliorated the impacts of reductions in irrigation water from 2005-06 levels.

The table below shows the impacts from Table 0-1 of Report 4 adjusted by the factor of 63% calculated above. This table shows estimated impacts for levels of reductions distributed geographically in accordance with reductions in the drought. Most of the reductions in irrigation water came from cotton in the northern basin and from rice and dairy in the southern basin, with around a 50:50 split between north and south.

The proposed SDL in the southern basin requires a reduction in irrigation water use of 2,360 Gl compared to 390 Gl in the northern basin, a ratio of 6:1.[27] The reduction in the southern basin is more than the total used for rice and dairy production in 2005-06. Detailed analysis on a valley by valley basis is required to estimate the likely impacts of the introduction of SDLs on employment, however the much greater requirement required from the southern basin suggests that the drought adjusted estimates in Table 8 below would not provide a reasonable reflection of the introduction of SDLs and are likely to be low compared to the likely impact of the introduction of SDLs.

[25] ABS publication *5206.0 Australian National Accounts: National Income, Expenditure and Product*

[26] 0.48*1.15

[27] MDBA (2011) *Plain English summary of the proposed Basin Plan,* Table S2.1.

Table 8: Estimated job losses and cost of lost productivity from permanent reductions in irrigation water adjusted for empirical estimates of the impact of administrative differences and trade and including an agricultural multiplier of 2.2.

Level of Reduction	10%	25%	50%
Loss of Jobs	4,000 jobs	9,000 jobs	18,000 jobs
Annual Cost	$0.4 billion	$0.9 billion	$1.7 billion
Capitalised Cost	$5.3 billion	$12.4 billion	$24.9 billion

Source: JSA

Other modelling approaches

In a review of the MDBA's socio-economic impact modelling,[28] the results of three modelling approaches are summarised. This section briefly compares the results of those modelling approaches with empirical data. While this seems a reasonable approach to the authors of this report. KPMG[29] state:

"There can be a tendency to evaluate model performance by comparison of modelled and actual observed outcomes. This 'ex ante' evaluation is seen to constitute a quality control test designed to provide evidence on a model's performance. However such validation exercises have limited value and must be interpreted with caution.

Despite the intuitive appeal of this approach, considerable care is needed in interpreting socio-economic models. The modelling approaches reviewed in this report do not constitute 'forecasts' of the economy over a time horizon. Rather, the models are structural representations of regional and national economies that underlie simulations designed to measure the deviation resulting from a single policy impact from a baseline state…"

The report continues in this vein for four paragraphs. To the authors of this report, this seems to be a wholesale rejection of the scientific method, that is the concept of falsifiability.[30] Alternatively, in the view of the authors, it requires one to believe that economic modellers can accurately model an economic system such as the Murray Darling Basin. This seems a heroic task, as predicting changes in dynamic and chaotic systems, no matter how simple, is fraught with difficulty (and by definition not possible), with the first needing a detailed understanding of how the system rules change in the presence of information, and the second needing extremely accurate data on base parameters to make predictions over even short time periods.

For these reasons, we think it is in fact imperative and important to adopt Popper's falsification test, that is to test the models against the real world they purport to represent. (While KPMG appear to say that the models don't purport to represent the real world, this seems like a cleft stick. If they don't represent the real world, then what is the meaning of the model results and how can any decision maker be informed by them?)

[28] KPMG (2011), *Review of the MDBA's Socio-Economic Impact Modelling.*
[29] Ibid, page 48.
[30] Popper, K (1934) *The Logic of Scientific Discovery.*

ABARES-BRS[31] predicted a decrease in GVIAP of $676 million per year with interregional trade based on a 2,260 GL reduction in irrigated water use. Results for "without interregional trade" are not provided for this scenario. Based on GVIAP data above, a reduction in GVIAP of $556 million is predicted from a 2,400 Gl reduction, suggesting the model is somewhat conservative in its estimates compared to the impacts of the drought. Job losses from this model are not reported, and the study then offsets job losses with general economic growth, that is "before after" rather than "with without".

If linearity between GVIAP and employment is assumed, a 2,400 GL reduction would mean an 11% reduction in irrigation employment, or approximately 5,100 jobs using our 2001 employment data for vegetables, fruit, grapes, dairy and cotton, and ignoring any multiplier effect.

UQ-RSMG[32] predicted a $1,445 million reduction in GVIAP from a 3,746 Gl reduction in irrigation water use. Based on GVIAP data above, a reduction in GVIAP of $992 million is predicted from a 3,746 Gl reduction, suggesting this model is also conservative in its estimates. Job losses from this model are not reported, and the study then offsets job losses with general economic growth, that is "before after" rather than "with without".

CoPS-Monash is the final study cited, but no data were reported on the impacts on agricultural production.

3.2.3 Employment and agriculture

Introduction

The primary social impact of irrigated agriculture, and agriculture in general, is the provision of employment.

In *Report 2,* we conducted an analysis of the relative contribution of different agricultural sectors to employment in terms of land and water usage. We have carried out a similar analysis using ABS data for 1996 and 2001, noting that water usage data for 1996 and 2001 was not available.

Summary

Three major trends are evident in the data. These are the diversification of the study area economy away from agriculture with time, the increasing importance of irrigated agriculture within the agricultural sector (with irrigation appearing to provide most or all of the growth in agricultural employment) and the impacts of the drought leading to reduced agricultural employment.

Analysis of time trends within commodity categories is confounded by the high percentage of agricultural employment coded to balance of agriculture in 1996, changes in classification of employment between 1996/2001 and 2006 data and lack of data on water use. As a result of

[31] KPMG *op cit.* Table 6-3.

[32] Ibid Table 6-8.

this uncertainty, trends within commodity groups with time are difficult to establish or to relate to changes in employment and areas under cropping.

The categories of vegetables, fruit and grapes had a 39% increase in area between 1996 and 2001, with employment increasing by 71% but then dropping between 2001 and 2006 by 14%. Although not simple, employment per '000 ha generally increased between 1996 and 2001, and then dropped between 2001 and 2006, both by the average of areas and the MDB average. The reason for this is not obvious. The proportion of processing employment compared to direct agricultural employment is relatively constant between 1996 and 2001,[33] but halving with 2006 data however wholesale trade was not included in 2006 data, accounting for the apparent fall in vegetables but not in fruit and grapes. Other possible explanations include higher levels of employment per '000 ha associated with bringing new plantings on line; and a loss of jobs from efficiency gains between 2001 and 2006, with potential mechanisms including consolidation of smaller farms resulting in economies of scale and increasing mechanisation.

Grazing data are inconclusive because there is a wide range of intensity of grazing uses and land use data differs from year to year regarding the inclusion of rangelands. Understanding the contribution of irrigation is important in understanding grazing employment however data were not available for 1996 and 2001. The impact of the drought is marked, with a 24% drop in employment between 2001 and 2006.

The regression results for 2001 are of particular interest, as data were available for land use across three categories, cereals etc., other crops (including oilseeds and legumes) and rice. By considering the average of areas, a hierarchy is apparent for broadacre irrigated crops, with rice having the highest employment at 10.6 people per 1,000 ha, followed by cotton at 6.5 people per 1,000 ha and finally other crops at 5.6 people per 1,000 ha. Dryland cereal crops are much lower employers at 0.8 people per 1,000 ha.

The area cropped to cotton increased by 70% between 1996 and 2006, with the addition of 1,600 jobs in cotton and cotton related industries. Employment per '000 ha fell by 7% between 1996 and 2001, probably as a result of technological change, but employment per '000 ha was constant between 2001 and 2006 even though the area cultivated fell by 43%.

Methodology

Data sets were compiled for employment and land use across small areas for the MDB and for cotton growing areas in Queensland for 1996 and 2001 (typically at SLA level but with some areas combined as discussed in Appendix 6 of Report 2).

There were a number of major areas of concern with respect to the data and with comparisons across years.

Detailed water usage data were not available for 1996 and 2001. This particularly affected the analysis of grazing.

[33] 17% for 1996, 18% for 2001 and 8% for 2006.

The availability of data varies from year to year. Instances where these concerns impact on the analysis include:

- A reduction in the proportion of agricultural employment coded to balance of agriculture from 39% in 1996 to 10% in 2001 and 12% in 2006. As a result, apparent growth in agriculture sector employment between 1996 and 2001 may be a result of reallocation of employment from balance of agriculture to more specific categories. Alternatively, on average the reallocation would be expected to result in a 48% increase in employment in each agricultural sector.
- The data available for grazing area varies across years, with the 1996 data based on pastures, the 2001 data including pasture and rangelands with a wide description and the 2006 data including pastures and some rangelands but on a narrower description compared to 2001.
- Place of work data were used for 2006, but for 1996 and 2001, employment by place of usual residence was used. Due to coding deficiencies, place of work data understates the work force by around 10% on average by comparison with usual residence data.
- The analysis for 1996 and 2001 incorporated knowledge we gained from analysis of the 2006 data, and so differs from that analysis.
- Changes in GVIAP data reflect changes in commodity prices as well as changes in output.

The data were analysed in two ways. Firstly a linear regression analysis was carried out across areas. Secondly, average employment at the MDB level was calculated. Results are presented below.

Table 9: Relationship between land use and employment using linear regression analysis across areas

Landuse (Year)	Employment per '000 ha	R^2	'p' value	Comments
Vegetables				
1996	50.9	0.19	0.000	
2001	73.5	0.35	0.000	
2006	65.4 (72.0)	0.35	0.000	2006 employment data does not include wholesale trade, data based on place of employment. Figure in brackets is increased by 10% to reflect differences in employment numbers between place of employment and place of usual residence.
Fruit				
1996	80.3	0.81	0.000	
2001	129.2	0.79	0.000	
2006	74.2 (81.6)	0.60	0.000	2006 employment data does not include wholesale trade. Figure in brackets is increased by 10% to reflect differences in employment numbers between place of employment and place of usual residence.
Grapes				
1996	114.9	0.96	0.000	
2001	116.1	0.95	0.000	
2006	97.3 (107.0)	0.96	0.000	Figure in brackets is increased by 10% to reflect differences in employment numbers between place of

				employment and place of usual residence.
Grazing				
1996				Employment data were available for dairy and for grazing generally, however land use data did not discriminate between grazing uses. Grazing is highly variable with uses ranging from low density wool and beef production in arid western areas to high density irrigated dairy production. In the absence of water usage data, but including rainfall data, modelling results were quite poor.
Grazing	0.1	0.10	0.032	
Dairy	-0.0	0.10	0.343	The relationship is not statistically significant.
Constant	172.7	0.10	0.000	
2001				Employment data were available for dairy and for grazing generally, however land use data did not discriminate between grazing uses. Grazing is highly variable with uses ranging from low density wool and beef production in arid western areas to high density irrigated dairy production. In the absence of water usage data, but including rainfall data, modelling results were quite poor.
Grazing	0.6	0.10	0.044	
Dairy	-0.5	0.10	0.049	
Constant	1104.6	0.10	0.000	
2006	Employment per '000 ha			

	0.4 (0.4)	0.32	0.001	The model also includes 3.8 (4.2) people employed per Gl of water. Figure in brackets is increased by 10% to reflect differences in employment numbers between place of employment and place of usual residence.
Cereals etc.				For 1996, 2001 and 2006, rice employment data were very poor.
1996				Total employment in cropping was compared with area of rice and of other crops.
Cereals etc.	1.0	0.43	0.000	
Rice	8.4	0.43	0.000	
2001				
Cereals	0.8	0.73	0.000	
Other crops	5.6	0.73	0.000	
Rice	10.6	0.73	0.000	
2006				
Cereals	1.2 (1.3)	0.76	0.000	Figure in brackets is increased by 10% to reflect differences in employment numbers between place of employment and place of usual residence.
Rice	16.0 (17.6)	0.68	0.000	Employment in Rice was estimated for 2006 data
Cotton				
1996	7.0	0.83	0.000	
2001	6.5	0.90	0.000	

2006	5.8 (6.4)	0.84	0.000	Figure in brackets is increased by 10% to reflect differences in employment numbers between place of employment and place of usual residence.

Source: ABS census 1996, 2001 and 2006; Agricultural commodities small area data 1996, 2001 and 2006; JSA calculations

Table 10: Relationship between land use and employment using MDB averages

Landuse (Year)	Employment per '000 ha	Total employment	Total area (ha)	Comment
Vegetables				
1996	122.5	5,263	42,958	
2001	138.0	6,619	47,955	
2006	109.3 (120.2)	4,364 (4,800)	39,922	2006 employment data does not include wholesale trade. Figure in brackets is increased by 10% to reflect differences in employment numbers between place of employment and place of usual residence.
	129.5 (142.5)	5,171 (5,688)	39,922	Adjusted to include wholesale trade at 2001 proportion
Fruit				
1996	77.6	5,191	66,937	
2001	120.2	10,118	84,166	
2006	72.7 (80.0)	6,424 (7,066)	88,356	2006 employment data does not include wholesale trade. Figure in brackets is increased by 10% to reflect differences in employment numbers between place of employment and place of usual residence.
	85.9 (94.5)	7,593 (8,352)	88,356	Adjusted to include wholesale trade at 2001 proportion
Grapes				
1996	132.6	6,621	49,949	

2001	135.3	12,211	90,232	
2006	98.9 (108.8)	9,973 (10,970)	100,854	Figure in brackets is increased by 10% to reflect differences in employment numbers between place of employment and place of usual residence.
Grazing				
1996	3.0	42,908 (excluding dairy)	18,559,003	
		13,136 (dairy)		
2001	0.8	66,581(excluding dairy)	101,279,792	
		12,848 (dairy)		
2006	0.9 (1.0)	54,765 (60,242)	63,426,232	Figure in brackets is increased by 10% to reflect differences in employment numbers between place of employment and place of usual residence.
Cereals etc.				
1996	1.3	12,156	9,189,557 (excluding rice)	
			136,251 (rice)	
			9,325,808 (total)	
2001	2.0	23,087	11,456,552 (excluding rice)	
			175,817 (rice)	

			11,632,369	
2006	1.4 (1.5)	17,485 (19,234)	12,262,135 (excluding rice)	Excluding rice. Figure in brackets is increased by 10% to reflect differences in employment numbers between place of employment and place of usual residence.
	17.1 (18.8)	1,743 (1,917)	102,020 (rice)	Rice employment and area estimated
	1.6 (1.8)	19,228 (21,151)	12,364,155	Total cereals
Cotton				
1996	8.0	2,511	314,654	
2001	7.7	4,105	534,713	
2006	7.0 (7.7)	2,112 (2,323)	303461	Figure in brackets is increased by 10% to reflect differences in employment numbers between place of employment and place of usual residence.

Source: ABS census 1996, 2001 and 2006; Agricultural commodities small area data 1996, 2001 and 2006; JSA calculations

Table 11: MDB and Queensland cotton growing areas - employment trends 1996-2006 (excluding not stated)

Year	Agricultural employment	% change	Other employment	% change	Total employment	% change	
1996	143,785		692,979		807,721		
Less ACT	143,031		520,917		663,948		
2001	151,466	5.3%	747,379	7.8%	898,845	7.4%	
Less ACT	150,617	5.3%	587,034	12.7%	737,651	11.1%	
2006	115,134 (126,647)	-16.4%	814,009 (895,410)	19.8%	929,143 (1,022,057)	13.7%	Figure in brackets is increased by 10% to reflect differences in employment numbers between place of employment and place of usual residence.
Less ACT	114,645 (126,110)	-16.3%	640,921 (705,013)	20.1%	755,566 (831,123)	12.7%	do

Source: ABS census 1996, 2001 and 2006; JSA calculations

Table 12: Rainfall across the study area:

Year	Average across areas (mm)	Median across areas (mm)	BoM data set for Murray Darling Basin (mm)(1)
1996	692	690	543
2001	518	491	403
2006	325	292	282
2007			472
2008			452
2009			416
2010			805
2011			592

(1) Data set no longer available for access, data for 2007-2011 taken from various BoM climate bulletins

Source: Australian Bureau of Meteorology and JSA calculation

Discussion

Vegetables

On average across the basin, the area cropped for vegetables (including nursery and turf) increased by 12% between 1996 and 2001, but fell to 17% below 1996 levels in 2006. The reasons for the fall in area between 2001 and 2006 are not readily apparent. While 2006 was a low rainfall year by contrast with 1996 and 2001, in most irrigation areas a full or near full allocation of irrigation water was given. By comparison, the area cropped for fruit and grapes increased in the period, although at a lesser rate than between 1996 and 2001. If a proportion of vegetable production was rain based, the reduction in rainfall between 2001 and 2006 would explain the reduction in area between 2001 and 2006, however rainfall also decreased between 1996 and 2001, and this period was accompanied by an increase in area. Changing commodity prices also do not seem to be an explanation, as the GVIAP (CPI adjusted) for vegetables and nurseries increased from $696.4 million in 2000-01 by 9.5% to $762.3 million in 2005-06, with a reduction in area of 16.8%, suggesting an increase in real prices. A data error is unlikely, as total employment (adjusted to include wholesale trade) also fell during the period, however to a lower extent (14%). A similar trend is seen in cotton and rice, suggesting that at least some irrigated vegetables may be grown with general, rather than high security irrigation water and so would have been affected by lower allocations of general security water in 2006.

Employment per ha (using the MDB average) appears to be relatively constant, with the estimates for 2001 and 2006 within 3% of each other when adjusted for wholesale trade and differences between place of employment and place of usual residence. While the 1996 value is lower, it is not possible to form a view regarding trends because of the high proportion of agricultural jobs coded to balance of agriculture for 1996 by comparison with other years. A similar conclusion can be reached from inspection of the regression analysis, with the averages across areas for 2001 and 2006 within 2% of each other, although this figure is not adjusted for wholesale trade.

The other major trend is a reduction in variability across areas between 1996 and 2006. This variability can also be seen in the relatively low R^2 value for 1996, suggesting that employment per 1,000 ha was much more variable in 1996 by comparison with later years. At the same time, the R^2 values for 2001 and 2006 are low by comparison with fruit and grapes. This could be interpreted as showing that processing and other value adding for vegetables may be concentrated in a few centres, with vegetables being grown much more widely, and also that processing and value adding decentralised to some degree between 1996 and 2001.

Fruit

On average across the basin, the area cropped for fruit (including nursery and turf) increased by 26% between 1996 and 2001, and by 5% between 2001 and 2006.

At the basin level, average employment fell by 21% between 2001 and 2006 (adjusting for wholesale trade), while the average of areas fell by 37%. Again it is not possible to form a view as to trends between 1996 and 2001, however the 1996 averages are almost certainly understated because of the large degree of coding to balance of agriculture in that year. If an average under coding of 48% was assumed, the MDB average would then be about 115 people per 1,000 ha, suggesting that average employment in fruit production was relatively constant between 1996 and 2001. Variability in the average of areas also increased in 2006, with R^2 dropping from 0.81 and 0.79 in 1996 and 2001 to 0.60 in 2006. This trend could be explained by, for example, centralisation of processing and fruit packing combined with labour saving technology, or perhaps closing or consolidation of smaller enterprises in some areas.

Grapes

The area cropped to grapes across the basin nearly doubled (81% increase) between 1996 and 2001, with a further increase of 12% between 2001 and 2006. That slowing is probably accounted for by a reduction in the terms of trade, with real GVIAP dropping by 20% between 2001 and 2006, even though area in production increased by 12%.

At the MDB level, average employment per ha dropped by 20% between 2001 and 2006. Variability between areas has remained quite low with R^2 around 0.95-0.96. This data suggests a rapid and general increase in efficiency in the industry, perhaps as a result of consolidation of small enterprises and increasing capitalisation, with this also supported by the drop in real GVIAP between 2001 and 2006.

Grazing

Grazing data is quite poor and so it is difficult to form any conclusion around trends. This is because there is a wide range in intensity of grazing uses and land use data differs from year to year regarding the inclusion of rangelands. Between 2001 and 2006 there was a significant drop (24% reduction) in grazing employment, with this almost certainly explained by drought conditions. It is likely that employment in irrigated dairy fell slightly between 2001 and 2006, however we have not analysed dairy employment data for 2006. This is because generally full or near full allocations were received in the southern basin in 2006, and dairy GVIAP fell by 3% in real terms between 2001 and 2006. If 2001 employment levels were assumed for dairy, the drop in employment in grazing across the basin due to the drought can be estimated as 29%.

Use of irrigation water is clearly an important variable, as can be seen in the change in R^2 values from 0.10 using land use, rainfall and employment data, to 0.32 using water use, land use and employment data. The negative coefficient for dairy employment in 2001, when considered with the coefficient) can be interpreted as meaning that dairy employment is highest in areas with small areas devoted to grazing, and this seems reasonable as irrigated dairy is quite intensive by comparison say with wool production in the western areas of the MDB.

Cereals and other broadacre crops excluding cotton

The area cropped to cereals and other broadacre crops increased by 25% between 1996 and 2001, and by a further 7% between 2001 and 2006. The area cropped to rice increased by 29% between 1996 and 2001, similar to other irrigated crops including vegetables, fruit, grapes and cotton, and fell by 42% between 2001 and 2006, again similar to vegetables and cotton. Employment fell between 2001 and 2006 by 8% despite an increase in area, and employment per ha fell by 10% in the period, almost certainly because of the 62% reduction in area used for rice. The employment increase between 1996 and 2001 is almost certainly overstated. If a factor of 0.48 is assumed to account for differences in allocation to balance of agriculture between 1996 and 2001, the estimated increase in employment is 28%, and in line with the 25% increase in area, suggesting that average employment was probably unchanged in the period.

The regression results for 2001 are of particular interest, as data were available for landuse across three categories, cereals etc., other crops (including oilseeds and legumes) and rice. By considering the average of areas, a hierarchy is apparent for broadacre irrigated crops, with rice having the highest employment at 10.6 people per 1,000 ha, followed by cotton at 6.5 people per 1,000 ha and finally other crops at 5.6 people per 1,000 ha. Dryland cereal crops are much lower employers at 0.8 people per 1,000 ha. The 2006 data is less reliable as rice employment was estimated indirectly and the 1996 data is affected by the high proportion of employment coded to balance of agriculture.

Cotton

The area cropped to cotton increased by 70% between 1996 and 2001. This was probably as a result of expansion of the industry generally. The area fell between 2001 and 2006, returning to

1996 levels, probably as a result of lower allocations of general security water. Average employment per ha remained relatively constant through the period, although the 4% drop between 1996 and 2001 can probably be attributed to technological change. The drop in this period may well have been higher because of the high proportion of employment coded to balance of agriculture for 1996. While average employment remained the same between 2001 and 2006, it would be expected that the introduction of 'Roundup Ready' cotton in 2001 would have led to a decrease in seasonal labour, however such labour will not be detected by the census if the season does not align with the time of census. A similar trend is seen in the average of areas.

General trends

Three major trends are evident. These are the diversification of the study area economy away from agriculture with time, the increasing importance of irrigated agriculture within the agricultural sector and the impacts of the drought. Total employment across the study area increased between 1996 and 2001 by around 7.4%. In the same period, agricultural employment increased by 5.3%. Between 2001 and 2006 there was a decrease in agricultural employment of 16.4% as a result of the drought, however overall employment increased by 13.7%, and 12.7% with the exclusion of the ACT. The importance of agriculture in the study area has decreased, with agriculture providing 17.8% of employment in 1996, 16.9% in 2001 and decreasing to 12.4% in 2006. Excluding the ACT, the proportion decreased from 21.5% in 1996, 20.4% in 2001 and decreasing to 15.2% in 2006. The downward trend was exacerbated by drought conditions in 2006 and some recovery from the 2006 values would be expected in 2011 census data. Despite the downward trend, agriculture is a significant part of the study area economy, comprising around one fifth of direct employment in areas outside the ACT. With multipliers, around 40% of the economy of the study area is dependent on agriculture.

Irrigated agriculture (vegetables, fruit, grapes, dairy and cotton) comprised at least 30% of agricultural employment in 2001 and (assuming 2001 values for dairy) at least 32% in 2006. Similarly, these industries comprised around 5% of the total economy of the study area in 2001 and 4% in 2006.

Impacts of the recent drought can be seen in the differences between 2001 and 2006 data. The major impact of the drought appears to have been experienced in the grazing sector, with employment in dryland grazing probably dropping by around 24% during the drought. Of the 25,000 agricultural jobs lost between 2001 and 2006, around 19,000 (76%) were in the grazing sector. High security irrigation sectors were protected from the drought up until 2006, however the drought appears to have had significant impacts on other irrigated crops such as cotton, rice and vegetables with these sectors experiencing reductions of 43%, 42% and 17% in area respectively between 2001 and 2006. The impacts on other broadacre crops were less in quantum, with area increasing by 7%.

Table 13: Agricultural employment by sector and proportion of agricultural and total employment – MDB and Queensland cotton growing areas 1996-2001

Industry	% of agricultural employment 1996	% of total employment 1996	% of agricultural employment 2001	% of total employment 2001	% of agricultural employment 2006	% of total employment 2006
All agricultural employment	100%	17.2%	100%	16.9%	100%	13.6%
All agricultural employment (excluding ACT)	100%	21.5%	100%	20.4%	100%	17.3%
Vegetables	3.7%	0.7%	4.4%	0.7%	4.7%	0.6%
Fruit	3.6%	0.6%	6.7%	1.1%	7.0%	0.9%
Grapes	4.6%	0.8%	8.1%	1.4%	9.2%	1.2%
Grazing (including dairy)	39.0%	6.9%	52.4%	8.8%	50.2%	6.8%
Dairy	9.1%	1.6%	8.5%	1.4%	Not known	Not known
Cereals etc. (including rice)	8.5%	1.5%	15.2%	2.5%	17.6%	2.4%
Cotton	1.7%	0.3%	2.7%	0.5%	1.9%	0.3%

Source: ABS census 1996, 2001 and 2006; JSA calculation

3.2.4 Employment and indicators of well-being and resilience

Introduction

In *Report 3,* we conducted an analysis of relationships between a variety of indicators of community well-being and resilience with key independent variables and with agricultural industries. We have carried out a similar analysis using ABS data for 1996 and 2001.

Time trends may be evident within these relationships, and these have been identified. In addition the agricultural multiplier was estimated for the three years and economic diversity was examined.

In addition there was a secondary outcome. Because of generally low levels of variance in data and evident multi-collinearity between independent employment variables, it is possible for identified relationships to be data artefacts rather than reflecting any underlying causal relationship. Accordingly, those relationships evident across the three years or showing an appropriate trend have been taken as robust and indicative of an underlying causality, while those not found in all years are treated as data artefacts and disregarded.

Summary

Generally across the data set and the three years, much of the variation in the dependent variables was accounted for by the four key variables of remoteness, population, indigenous population and age as found previously.

For most indicators, the relationship with employment variables was slight, and in many cases the relationship is more likely to be with the type of community (e.g. regional centre) associated with employment patterns, rather than with the employment variable itself. For other indicators there was a significant and plausible causal relationship with employment variables.

A number of time trends were evident. Economic diversity and the multiplier were estimated, and finally some indicators are not as straight forward as they may appear on first view.

Key variables

The table below shows the relationship between key variables and indicators of well-being and resilience. A positive relationship means that an increase in the independent variable is associated with an increase in the dependent variable.

The main predictor of indicators of community wellbeing was indigenous population, followed by age. For indicators of community resilience (economic growth) the main predictor was population followed by remoteness. For indicators of community resilience (resource distribution) the main predictor was age followed by remoteness. Finally age was the main predictor of indicators of community resilience (social capital).

Table 14: Relationship between key variables and indicators of well-being and resilience

	Remoteness	Population	Indigenous population	Age
Indicators of Community Wellbeing				
SEIFA (disadvantage)	Negative relationship		Positive relationship	Positive relationship
SEIFA (economic resources)			Negative relationship	Negative relationship
Premature death			Positive relationship	
Assault (Non domestic violence)			Positive relationship (*with remote indigenous*)	
Assault (domestic violence)			Positive relationship (*with remote indigenous*)	
Property crime		Positive relationship	Positive relationship	
Labour force participation 15+	Positive relationship		Negative relationship	Negative relationship
Median household income			Negative relationship	Negative relationship
Disability support pension			Positive relationship	Positive relationship
Profound or severe disability	*Data not available*	*Data not available*	*Data not available*	*Data not available*
Chronic ill health		Positive relationship	Positive relationship	Positive relationship
Indicators of Community Resilience – Economic growth				
Employment change		Positive relationship (*with population change*)		
Labour force participation 65+	Positive relationship	Negative relationship		
Median age		Negative	Negative	

		relationship	relationship	
Skills base	Negative relationship			Negative relationship
Secondary school participation 12-17	Negative relationship		Negative relationship	Positive relationship
SEIFA (education and occupation)		Positive relationship		
Economic diversity	Negative relationship	Positive relationship	Negative relationship	Positive relationship
Indicators of Community Resilience – Resource distribution				
GINI coefficient (increasing polarisation)	Positive relationship			Positive relationship
Youth unemployment	Negative relationship		Positive relationship	Positive relationship
General unemployment	Negative relationship		Positive relationship	Positive relationship
Indicators of Community Resilience – Social Capital				
Change of address			Negative relationship	Negative relationship
Population change	Negative relationship			Negative relationship
Indicators of Community Resilience – Citizen participation				
Voluntary work	*Data not available*	*Data not available*	*Data not available*	*Data not available*

Source: JSA

Employment variables

The table below shows the relationship between employment variables and indicators of well-being and resilience. The indicators are ranked by the degree to which employment variables account for variation in the dependent variable on average across the three years. In no case did employment account for more than 50% of the variation in the dependent variable.

For many of the variables considered, industry had no discernible impact. Agriculture and different agricultural sectors were typically associated with indicators of economic growth. Much of the association might be considered negative and suggestive of a residualised less

skilled population; with agriculture, grazing and cereal associated with an older workforce; agriculture and grazing associated with an older population; fruit and grapes associated with lower status education and occupation; agriculture, vegetables, fruit and cereal associated with a lower skills base; fruit associated with lower levels of secondary school participation. However this is not always the case, with fruit and vegetables associated with a younger workforce; and cereal associated with higher levels of secondary school participation.

However the picture is somewhat different with regard to indicators of wellbeing and resource distribution. Grazing and total agriculture is associated with higher levels of labour force participation and lower levels of unemployment however this may be a mixed finding as the effect could reflect an older workforce or tendency for people to leave smaller rural centres in search of work.

There are two trends of particular interest. First there is a diminishing trend over time for agriculture to be associated with lower household incomes. This reflects a trend of diminishing rural poverty and is in line with the larger trend towards amalgamation of smaller farms.

Secondly, the expansion of agriculture and particularly the cotton industry between 1996 and 2001 had a number of positive effects. These included increased household incomes in smaller remote areas, population growth in cotton growing areas, and increased levels of employment. Conversely the contraction of agriculture and the cotton industry between 2001 and 2006 was associated with loss of employment and population. This is in line with the predictions of modelling carried out in report 4 which found that one of the effects of reductions in irrigation water would be loss of employment and population.

Table 15: Relationship between employment variables and indicators of well-being and resilience

Variable	Industry	Comments
Employment accounting for more than 35% of variation		
Labour force participation 65+	Agriculture, grazing and cereal	Consistently associated with an older work force.
	Fruit and vegetables	Consistently associated with a younger work force.
Median age	Agriculture and grazing	Consistently associated with an older population.
SEIFA (education and occupation)	Fruit, grapes, mining	Consistently associated with lower levels of skills
Employment accounting for more than 20% of variation		
Median household income	Agriculture	Appears to show a trend of diminishing rural poverty associated with farming over time
	Cotton	The expansion of the cotton industry between 1996 and 2001 appears to have had a positive

		impact on household incomes in smaller remote centres.
Skills base	Agriculture, vegetables, fruit and cereal	These industries are consistently associated with a lower skills base.
GINI coefficient	No trend	
Change of address	Construction	Consistently associated with higher levels but probably acting as a proxy for an area with increasing population or where new industries are being developed.
	Utilities, retail	Consistently associated with lower levels but probably acting as a proxy for regional centres.
Population change	Construction and rental	Associated with increase but probably acting as a proxy for an area with increasing population or where new industries are being developed.
	Cotton	Growth in the cotton industry between 1996 and 2001 is associated with increasing population, while decline from drought between 2001 and 2006 is associated with decreasing population.
Employment accounting for more than 5% of variation		
SEIFA (disadvantage)	No trend	Industry probably acts as a proxy for types of communities where disadvantaged people congregate or are found.
SEIFA (economic resources)	Construction	The industry variable probably indicates an area with increasing population or where new industries are being developed.
Premature death	No trend	
Labour force participation 15+	Grazing	Associated with higher levels but may suggest an older workforce
	Total agriculture	Associated with higher levels but may suggest an older workforce
	Retail, wholesale, communications, education and health	Associated with lower levels but probably acting as a proxy for regional centres with concentrations of retired people
Disability support	No trend	

pension		
Chronic ill health	No trend	
Secondary school participation	Fruit	Associated with lower levels
	Cereal	Associated with higher levels
Youth unemployment	Retail	Consistently associated with higher levels
General unemployment	Agriculture	Associated with lower levels
	Retail and finance	Associated with higher levels but the relationship is probably to do with unemployed people congregating in regional centres
Balance		
Assault (non-domestic violence)	No trend	
Assault (domestic violence)	No trend	
Aggregate property crime	No trend	
Employment change	Cotton and agriculture	Expansion of the industry between 1996 and 2001 is associated with employment growth, while contraction from drought between 2001 and 2006 is associated with loss of employment.

Source: JSA

Economic diversity

Increasing economic diversity appears to be associated with less remote areas, larger populations and older populations while decreasing economic diversity appears to be associated with grazing, remoter areas, smaller populations and indigenous populations, however the effects are slight and are typically seen in one or two industries. Meaningful trends include lower levels of manufacturing in remote areas, and higher levels of finance, professional and public administration in more populous areas. Increasing urbanisation is associated with more diverse economies.

The multiplier

On review the multiplier estimated in Report 3 appeared to be an artefact of the population partitions used, however using population partitions of less than 5,000, 5,000 to 10,000 and

greater than 10,000, a consistent multiplier of 1.1-1.2 was estimated using 1996 and 2001 data. The 2006 data appears to have been confounded by the marked loss of agricultural employment resulting in a multiplier of 2.5, but the higher value is likely to be attributable to the drought and to lag effects of other industries in responding to downturns. An examination of 2011 census data is required to determine whether the 2006 analysis reflects an anomaly due to drought conditions or whether it reflects a trend.

Using the 1996 and 2001 data, smaller communities (population less than 5,000) are highly reliant on agriculture and are becoming more so with time, medium communities (population between 5,000 and 10,000) are quite reliant on agriculture and are becoming more so with time, while larger communities are less reliant on agriculture and are becoming less reliant with time.

Methodology

Data sets were compiled for employment and land use across small areas for the MDB and for cotton growing areas in Queensland for 1996 and 2001 (typically at SLA level but with some areas combined as discussed in Appendix 6 of Report 2).

A linear regression analysis was carried out for the various dependent variables listed below. Analysis was confounded by collinearity within the data set (that is many of the variables vary together as well as with the dependent variable), evidenced by modelling generally have a high overall level of fit, but with no industry variables, and often other key variables not being individually significant.

Detailed results of the regression analysis (coefficient values and parameter tests) have not been reported. Sensitivity of the dependent variable to variations in independent variables (significant at the 90% and 95% level) has been calculated and is tabulated below. The adjusted R^2 value is reported for the model incorporating all independent variables. The variation explained by industry is the difference in the adjusted R^2 value between the model with all variables and a model excluding industry variables.

To address matters of collinearity, individual models were analysed for each industry variable considered separately and with the non-industry variables included. For the non-industry variables, the sensitivity is reported based on results of a parsimonious model (a model with non-significant variables deleted) and excluding industry variables.

Results

Table 16: Indicators of Community Wellbeing

Absolute and proportional change in mean value of the dependent variable arising from a 5% change in the mean value of the independent variable. (Variables significant at the 95% level are shown in bold, and those at the 90% level are shown in normal type). Data not shown for non-significant variables)

INDEPENDENT VARIABLES	DEPENDENT VARIABLES								
	SEIFA Disadvantage (2006)	SEIFA Disadvantage (2001)	SEIFA Disadvantage (1996)	SEIFA Economic Resources (2006)	SEIFA Economic Resources (2001)	SEIFA Economic Resources (1996)	Premature Death (2006)	Premature Death (2001)	Premature Death (1996)
Adjusted R^2 value	0.52	0.69	0.64	0.70	0.75	0.73	0.51	Data not available	0.58
Relative variation of dependent variable (SD/Mean)	5%	4%	4%	4%	5%	4%	26%		31%
Variation explained by industry (difference in Adjusted R^2 values)	7%	21%	18%	21%	21%	10%	9%		3%
Mean value	953	984	975	974	935	953	303/ 100,000		190/ 100,000
INDUSTRY SECTORS									
Vegetables				**2.5 (0.3%)**	-0.1 (-0.0%)				
Fruit		**-0.1 (-0.0%)**	**-0.1 (-0.0%)**						
Grapes		-0.1 (-0.0%)							
Grazing				**0.7 (0.1%)**		**-0.4 (-0.0%)**			**0.8 (0.4%)**
Dairy	NA	0.1 (0.0%)		NA					**-0.2 (-0.1%)**
Cereal		**0.3 (0.0%)**	**0.3 (0.0%)**		-0.2 (-0.0%)				
Rice		NA	NA		NA	NA	**0.1 (0.0%)**		
Cotton							**0.0**		

INDEPENDENT VARIABLES	DEPENDENT VARIABLES								
	SEIFA Disadvantage (2006)	SEIFA Disadvantage (2001)	SEIFA Disadvantage (1996)	SEIFA Economic Resources (2006)	SEIFA Economic Resources (2001)	SEIFA Economic Resources (1996)	Premature Death (2006)	Premature Death (2001)	Premature Death (1996)
							(-0.0%)		
Balance Agriculture		-0.4 (-0.0%)		**0.4 (0.0%)**	**-0.6 (-0.1%)**	**-0.5 (-0.1%)**			
Total agriculture		0.5 (0.0%)		**1.1 (0.1%)**	**-1.1 (-0.1%)**	**-0.5 (-0.1%)**			
Mining					**0.2 (0.0%)**	0.1 (0.0%)			
Manufacturing		**-0.4 (-0.0%)**				0.2 (0.0%)			
Utilities									
Construction	**0.6 (0.06%)**			**0.9 (0.1%)**	**0.8 (0.1%)**	**0.8 (0.1%)**	**-1.3 (-0.4%)**		
Wholesale							**-0.9 (-0.3%)**		
Retail		**-2.0 (-0.2%)**	**-1.1 (-0.1%)**	**-1.4 (-0.1%)**	**-1.3 (-0.1%)**				
Accommodation				-0.2 (-0.0%)	**0.5 (0.1%)**				
Transport		**-0.7 (-0.1%)**		**-0.1 (-0.0%)**					
Communications				**-0.6 (-0.1%)**					
Finance				**-0.7 (-0.1%)**					
Rental			**0.7 (0.1%)**		**1.4 (0.1%)**	**0.8 (0.1%)**			

INDEPENDENT VARIABLES	DEPENDENT VARIABLES								
	SEIFA Disadvantage (2006)	SEIFA Disadvantage (2001)	SEIFA Disadvantage (1996)	SEIFA Economic Resources (2006)	SEIFA Economic Resources (2001)	SEIFA Economic Resources (1996)	Premature Death (2006)	Premature Death (2001)	Premature Death (1996)
Professional	**1.3 (0.1%)**	NA	NA		NA	NA			NA
Administration		NA	NA	**-0.6 (-0.1%)**	NA	NA			NA
Public Administration	0.5 (0.1%)	**0.4 (0.0%)**		**0.5 (0.1%)**	**0.5 (0.1%)**				
Education									
Health	**-1.1 (-0.1%)**			**-1.7 (-0.2%)**					
Recreation					**0.6 (0.7%)**	0.2 (0.0%)			
Other				**-0.8 (-0.1%)**					
OTHER VARIABLES									
Remoteness	**-1.8 (-0.2%)**		**-1.0 (-0.1%)**			**-1.9 (-0.2%)**			
Population		**0.1 (0.0%)**	**0.1 (0.0%)**		**0.2 (0.0%)**	**0.1 (0.0%)**			
Indigenous Population	**-0.6 (-0.1%)**	**-0.8 (0.1%)**	**-0.6 (-0.1%)**	**-0.9 (0.1%)**	**-0.5 (-0.1%)**	**-0.5 (-0.1%)**	**1.7 (0.6%)**		**1.6 (0.8%)**
Age	**-7.9 (-0.8%)**		**-4.4 (-0.5%)**	**-7.1 (-0.7%)**	**-17.2 (-1.8%)**	**-9.5 (-1.0%)**			**13.2 (6.9%)**
Remote indigenous population									

INDEPENDENT VARIABLES	DEPENDENT VARIABLES											
	Assault (non domestic violence) (2006)	Assault (non domestic violence) (2001)	Assault (non domestic violence) (1996)	Assault (domestic violence) (2006)	Assault (domestic violence) (2001)	Assault (domestic violence) (1996)	Aggregate property crime (2006)	Aggregate property crime (2001)	Aggregate property crime (1996)	Labour force participation 15+ (2006)	Labour force participation 15+ (2001)	Labour force participation 15+ (1996)
Adjusted R^2 value	0.91	0.80	0.79	0.87	0.94	0.64	0.82	0.78	0.59	0.71	0.67	0.69
Relative variation of dependent variable (SD/Mean)	72%	81%	89%	103%	124%	197%	61%	57%	63%	9.9%	9.3%	9.2%
Variation explained by industry (Difference in adjusted R^2 values)	2%	1%	8%	0%	4%	2%	3%	0%	11%	9%	13%	11%
Mean value	826/ 100,000	960/ 100,000	756/ 100,000	644/ 100,000	738/ 100,000	551/ 100,000	4,996/ 100,000	6,015/ 100,000	4,999/ 100,000	59.7%	60.0%	59.6%
INDUSTRY SECTORS												
Vegetables					**3.8(0.5%)**					**0.02% (0.0%)**		
Fruit					**2.4(0.3%)**							
Grapes					**3.8(0.5%)**	2.8(0.5%)						
Grazing										**0.1% (0.11%)**	**0.1% (0.12%)**	**0.1% (0.10%)**
Dairy	N/A			N/A			N/A			N/A		
Cereal										**0.04% (0.1%)**		

INDEPENDENT VARIABLES	DEPENDENT VARIABLES											
	Assault (non domestic violence) (2006)	Assault (non domestic violence) (2001)	Assault (non domestic violence) (1996)	Assault (domestic violence) (2006)	Assault (domestic violence) (2001)	Assault (domestic violence) (1996)	Aggregate property crime (2006)	Aggregate property crime (2001)	Aggregate property crime (1996)	Labour force participation 15+ (2006)	Labour force participation 15+ (2001)	Labour force participation 15+ (1996)
Rice												
Cotton	**1.2 (0.1%)**		**3.2(0.4%)**						**20.6 (0.4%)**		**0.02% (0.0%)**	
Balance Agriculture	**4.5 (0.5%)**								-69.5 (-1.4%)	**0.05% (0.1%)**	**0.06% (0.1%)**	**0.08% (0.1%)**
Total agriculture								**-71.6 (-1.2%)**		**0.09% (0.2%)**	**0.18% (0.3%)**	**0.14% (0.2%)**
Mining	**-1.0 (-0.1%)**			**-1.3 (-0.2%)**			-6.3 (-0.1)			**-0.01% (-0.0%)**		
Manufacturing											-0.05% (0.1%)	
Utilities												
Construction												-0.09% (-0.2%)
Wholesale										**-0.08% (-0.1%)**	**-0.11% (-0.2%)**	**-0.08% (-0.1%)**
Retail	8.8 (1.1%)							108.6 (1.8%)		**-0.19% (-0.3%)**	**-0.40% (-0.7%)**	**-0.30% (-0.5%)**
Accommodation								63.8 (1.1%)				
Transport						**21.1(3.8%)**				0.01% (0.0%)	**-0.10% (-0.2%)**	**-0.10% (-0.2%)**
Communications	5.0 (0.6%)				-11.0 (-1.5%)		**50.0 (1.0%)**			**-0.07% (-0.1%)**	**-0.08% (-0.1%)**	**-0.07% (-0.1%)**

INDEPENDENT VARIABLES	DEPENDENT VARIABLES											
	Assault (non domestic violence) (2006)	Assault (non domestic violence) (2001)	Assault (non domestic violence) (1996)	Assault (domestic violence) (2006)	Assault (domestic violence) (2001)	Assault (domestic violence) (1996)	Aggregate property crime (2006)	Aggregate property crime (2001)	Aggregate property crime (1996)	Labour force participation 15+ (2006)	Labour force participation 15+ (2001)	Labour force participation 15+ (1996)
Finance	**12.0 (1.5%)**						**65.9 (1.3%)**		**132.8 (2.7%)**	**-0.12% (-0.2%)**	-0.09% (-0.2%)	**-0.14% (-0.2%)**
Rental					**-14.0 (-1.9%)**							
Professional											NA	NA
Administration	7.0 (0.8%)									**-0.05% (-0.1%)**	NA	NA
Public Administration											**0.06% (0.1%)**	**0.08% (0.1%)**
Education					19.4(2.6%)					**-0.16% (-0.3%)**	**-0.19% (-0.3%)**	**-0.08% (0.1%)**
Health							60.9 (1.2%)			**-0.15% (-0.3%)**	**-0.18% (-0.3%)**	**-0.17% (-0.3%)**
Recreation			**8.4(1.1%)**						**55.0 (1.1%)**	**0.04% (0.1%)**		
Other		**14.7(1.5%)**						**74.9 (1.2%)**		**-0.12% (-0.2%)**	**-0.20% (-0.3%)**	**-0.17 (-0.3%)**
OTHER VARIABLES												
Remoteness	-13.9 (-1.7%)			**-21.6 (-3.4%)**						**0.23% (0.4%)**	**0.24% (0.40%)**	**0.21% (0.4%)**
Population	**4.7 (0.6%)**	4.3 (0.5%)			3.6(0.5%)		**32.4 (0.7%)**	**55.1 (0.9%)**	**40.8 (0.8%)**			

INDEPENDENT VARIABLES	DEPENDENT VARIABLES											
	Assault (non domestic violence) (2006)	Assault (non domestic violence) (2001)	Assault (non domestic violence) (1996)	Assault (domestic violence) (2006)	Assault (domestic violence) (2001)	Assault (domestic violence) (1996)	Aggregate property crime (2006)	Aggregate property crime (2001)	Aggregate property crime (1996)	Labour force participation 15+ (2006)	Labour force participation 15+ (2001)	Labour force participation 15+ (1996)
Indigenous Population	**-11.9 (-1.4%)**			**-16.6 (-2.6%)**				**116.7 (1.9%)**	**78.0 (1.6%)**	**-2.08% (-3.5%)**	**-0.08% (-0.1%)**	**-0.08% (-0.1%)**
Age							-290 (-5.8%)			**-2.40% (-4.0%)**	**-2.24% (-3.7%)**	**-2.49% (-4.2%)**
Remote indigenous population	**29.5 (3.6%)**	**19.4 (2.0%)**	**14.2(1.9%)**	**21.4 (3.3%)**	**37.4(5.1%)**	**21.2(3.8%)**	**85.8 (1.7%)**			Not assessed		

Source: JSA

INDEPENDENT VARIABLES	DEPENDENT VARIABLES											
	Median Household Income (2006)	Median Household Income (2001)	Median Household Income (1996)	Disability support pension (2006)	Disability support pension (2001)	Disability support pension (1996)	Profound or severe disability (2006)	Profound or severe disability (2001)	Profound or severe disability (1996)	Chronic Ill health (2006)	Chronic Ill health (2001)	Chronic Ill health (1996)
Adjusted R^2 value	0.78	0.80	0.81	0.30	Data not available	0.33	0.60	Data not available	Data not available	0.51	Data not available	0.72
Relative variation of dependent variable (SD/Mean)	21%	21%	21%	33%		33%	22%			8%		13%
Variation explained by industry (Difference in Adjusted R^2 values)	10%	32%	26%	9%		7%	20%			12%		12%
Mean value	$783	$651	$625	6.9%		3.2%	4.7%			215/ 1,000		11.6%
INDUSTRY SECTORS												
Vegetables	$0.33 (0.0%)			-0.1% (-0.1%)			**-0.00% (-0.1%)**					
Fruit												**0.00%(0.0%)**
Grapes												0.00%(0.0%)
Grazing			**-$2.41 (-0.4%)**				**-0.01% (-0.3%)**					
Dairy	N/A			N/A			N/A			N/A		
Cereal	-$0.52 (-0.1%)						0.00% (0.1%)					

INDEPENDENT VARIABLES	DEPENDENT VARIABLES											
	Median Household Income (2006)	Median Household Income (2001)	Median Household Income (1996)	Disability support pension (2006)	Disability support pension (2001)	Disability support pension (1996)	Profound or severe disability (2006)	Profound or severe disability (2001)	Profound or severe disability (1996)	Chronic Ill health (2006)	Chronic Ill health (2001)	Chronic Ill health (1996)
Rice		NA	NA									
Cotton										**0.06 (0.0%)**		
Balance Agriculture		**-$1.42 (-0.2%)**	**-$3.54 (-0.6%)**				**-0.01% (0.2%)**					
Total agriculture		**-$2.52 (-0.4%)**	**-$4.42 (-0.7%)**				**-0.02% (-0.4%)**					
Mining		**$1.03 (0.2%)**	**$1.11 (0.2%)**			-0.00% (-0.1%)				**0.04 (0.0%)**		
Manufacturing												
Utilities										**0.16 (0.1%)**		
Construction	**$2.86 (0.3%)**			**-0.06% (-0.9%)**			**-0.02% (-0.4%)**					
Wholesale	**-$1.94 (-0.3%)**		**-$2.01 (-0.3%)**				**0.02% (0.4%)**					**0.02%(0.2%)**
Retail	**-$3.06 (-0.4%)**	**-$6.86 (-1.0%)**		**0.07% (0.9%)**		**0.03% (1.0%)**	**0.04% (0.9%)**					**0.07%(0.6%)**
Accommodation	**$0.83 (0.1%)**			**0.03% (0.4%)**		-0.02% (-0.5%)	**-0.01% (-0.2%)**			**-0.21 (-0.1%)**		
Transport												
Communications	**-$1.50 (-0.2%)**						**0.01% (0.2%)**					

INDEPENDENT VARIABLES	DEPENDENT VARIABLES											
	Median Household Income (2006)	Median Household Income (2001)	Median Household Income (1996)	Disability support pension (2006)	Disability support pension (2001)	Disability support pension (1996)	Profound or severe disability (2006)	Profound or severe disability (2001)	Profound or severe disability (1996)	Chronic Ill health (2006)	Chronic Ill health (2001)	Chronic Ill health (1996)
Finance	**-$2.77 (-0.4%)**	-$2.00 (-0.3%)		0.03% (0.4%)			**0.03% (0.6%)**					**0.03%(0.2%)**
Rental	**$1.31 (0.2%)**	**$2.61 (0.4%)**	$1.57 (0.3%)							**-0.18 (-0.1%)**		
Professional	$1.69 (0.2%)	NA	NA									
Administration		NA	NA	**0.03% (0.5%)**			0.01% (0.2%)					
Public Administration		$1.18 (0.2%)					-0.01% (-0.3%)					**-0.03% (-0.3%)**
Education							**0.03% (0.6%)**					
Health	**-$3.46 (-0.4%)**	**-$4.01 (-0.6%)**		0.04% (0.6%)		**0.03%(0.9%)**	**0.06% (0.0%)**					**0.05%(0.4%)**
Recreation	**$1.59 (0.2%)**						**-0.01% (-0.2%)**			**-0.13 (-0.1%)**		
Other							**0.04% (0.8%)**					**0.02%(0.2%)**
OTHER VARIABLES												
Remoteness	**-$4.31 (-0.6%)**		**-$2.50 (0.4%)**							**0.96 (0.5%)**		
Population	**$0.55 (0.1%)** (10)		**$0.37 (0.1%)**							**0.02 (0.0%)**		**0.00%(0.0%)**

INDEPENDENT VARIABLES	DEPENDENT VARIABLES											
	Median Household Income (2006)	Median Household Income (2001)	Median Household Income (1996)	Disability support pension (2006)	Disability support pension (2001)	Disability support pension (1996)	Profound or severe disability (2006)	Profound or severe disability (2001)	Profound or severe disability (1996)	Chronic Ill health (2006)	Chronic Ill health (2001)	Chronic Ill health (1996)
Indigenous Population	**-$1.30 (-0.2%)**	**-$1.41 (0.2%)**	**-$1.41 (0.2%)**	**0.0% (0.4%)**		**0.02%(0.5%)**				**0.24 (0.1%)**		**0.02%(0.2%)**
Age	**-$63.67 (-8.1%)**	**-$59.92 (-9.2%)**	**-$57.27 (-9.2%)**	**0.54% (7.9%)**		**0.26%(8.2%)**	**0.36% (7.7%)**			**3.10 (1.4%)**		**0.77%(6.6%)**

Table 17: Indicators of Community Resilience

Absolute and proportional change in mean value of the dependent variable arising from a 5% change in the mean value of the independent variable. (Variables significant at the 95% level are shown in bold, and those at the 90% level are shown in normal type). Data not shown for non-significant variables)

	Dependent Variables - Economic Growth								
Independent variable	Employment change 2001-2006	Employment change 1996-2001	Employment change 1991-1996	Labour force participation 65+ (2006)	Labour force participation 65+ (2001)	Labour force participation 65+ (1996)	Median Age (2006)	Median Age (2001)	Median Age (1996)
Adjusted R^2 value	0.91	0.78	0.85	0.78	0.66	0.70	0.54	0.59	0.55
Mean Value	1.2%	5.1%	-0.5%	15.3%	14.7%	14.2%	39.9	37.3	35.1
Relative variation of dependent variable (SD/Mean)	750%	176%	1,920%	50%	41%	49%	10%	9%	9%
Variation explained by industry (Difference in Adjusted R^2 values)	4%	6%	3%	53%	45%	43%	36%	38%	31%
INDUSTRY VARIABLES									
Vegetables		**0.03% (0.0%)**				**-0.03 %(0.2%)**			
Fruit				**-0.03% (-0.2%)**	**-0.03% (0.2%)**	**-0.02% (0.1%)**			
Grapes				**-0.03% (-0.2%)**	**-0.02% (0.1%)**	**-0.02% (0.1%)**			
Grazing			**-0.07%(14.0%)**	**0.18% (1.2%)**	**0.24%(1.6%)**	**0.29%(2.0%)**	**0.06 (0.2%)**	**0.07 (0.2%)**	**0.05 (0.1%)**
Dairy	N/A			N/A			N/A		
Cereal				**0.04% (0.2%)**	**0.05% (0.3%)**	**0.04% (0.3%)**	**0.03 (0.1%)**		
Rice									
Cotton	**-0.02% (-1.8%)**	**0.02%(0.4%)**			0.01%(0.1%)		**-0.01 (-0.0%)**	-0.20 (-0.5%)	-0.01 (-0.0%)
Balance Agriculture	**-0.04% (-3.4%)**		**-0.08%(16.0%)**	0.06% (0.4%)	**0.08% (0.5%)**	**0.33% (2.3%)**			**0.08 (-0.0%)**

	Dependent Variables - Economic Growth								
Independent variable	Employment change 2001-2006	Employment change 1996-2001	Employment change 1991-1996	Labour force participation 65+ (2006)	Labour force participation 65+ (2001)	Labour force participation 65+ (1996)	Median Age (2006)	Median Age (2001)	Median Age (1996)
Total agriculture	**-0.08% (-6.9%)**	**0.10%(2.0%)**	**-0.11%(22.0%)**	**0.25% (1.7%)**	**0.41% (2.8%)**	**0.47% (3.3%)**	**0.13 (0.3%)**	**0.13 (0.3%)**	**0.11 (0.3%)**
Mining			**0.01%(-0.0%)**	-0.02% (-0.1%)				**-0.02 (-0.1%)**	**-0.02 (-0.1%)**
Manufacturing		**-0.08%(-1.6%)**	**0.06%(-12.0%)**	-0.07% (-0.5%)	**-0.14% (-1.0%)**	**-0.12% (-0.9%)**			
Utilities				**-0.06% (-0.1%)**		**-0.06% (-0.0%)**		-0.02 (-0.1%)	
Construction		**0.23%(4.5%)**		**-0.18% (-1.2%)**		**-0.45% (-3.2%)**		**-0.17 (-0.5%)**	**-0.14 (-0.4%)**
Wholesale	**-0.08% (-7.0%)**			**-0.29% (-1.9%)**	**-0.23% (-1.6%)**	**-0.31% (-2.2%)**		**-0.19 (-0.5%)**	**-0.09 (-0.3%)**
Retail			0.10%(-20.0%)	**-0.51% (-3.3%)**	**-0.78% (-5.3%)**	**-0.81% (-5.7%)**		**-0.10 (-0.3%)**	
Accommodation					**-0.18% (-1.2%)**	**-0.19% (-1.3%)**	**-0.06 (-0.2%)**		**0.05 (0.1%)**
Transport	**0.03% (2.4%)**			**0.10% (0.7%)**		-0.11% (-0.8%)	**-0.03(-0.1%)**	**-0.08 (-0.2%)**	**-0.06 (-0.2%)**
Communications	**0.00% (0.4%)**			**-0.01% (-0.1%)**	-0.11% (-0.8%)	**-0.22% (-1.5%)**	**-0.04 (-0.1%)**		
Finance				**-0.26% (-1.7%)**	**-0.28% (-1.9%)**	**-0.48% (-3.4%)**		**-0.12 (-0.3%)**	-0.06 (-0.2%)
Rental		0.11%(2.2%)			**-0.18% (-1.2%)**	**-0.31% (-2.2%)**	**-0.09 (-0.2%)**	**-0.13 (-0.4%)**	**-0.08 (-0.2%)**
Professional		N/A	N/A	**-0.16% (-1.1%)**	N/A	N/A		N/A	N/A
Administration		N/A	N/A	**-0.18% (-1.2%)**	N/A	N/A		N/A	N/A

	Dependent Variables - Economic Growth								
Independent variable	Employment change 2001-2006	Employment change 1996-2001	Employment change 1991-1996	Labour force participation 65+ (2006)	Labour force participation 65+ (2001)	Labour force participation 65+ (1996)	Median Age (2006)	Median Age (2001)	Median Age (1996)
Public Administration			**-0.08%(16.0%)**		0.07% (0.0%)				
Education	0.12% (9.6%)								
Health			**0.14%(-0.3%)**	**-0.36% (-2.4%)**	**-0.37% (-2.5%)**	**-0.46% (-3.2%)**	**0.13 (0.3%)**	**0.15 (0.4%)**	**0.11 (0.3%)**
Recreation	**0.06% (4.7%)**	-0.07%(-1.4%)		**0.15% (1.0%)**	**-0.15% (-0.0%)**	**-0.06% (-0.0%)**			
Other		**-0.14%(-3.5%)**		**-0.44% (-2.9%)**	**-0.32% (-2.2%)**	**-0.33% (-2.3%)**		**-0.06 (-0.2%)**	**-0.05 (-0.1%)**
OTHER VARIABLES									
Remoteness			**-0.10%(20.0%)**	**0.39% (2.5%)**	**0.28% (1.9%)**	**0.41% (-2.9%)**			
Population				**-0.03% (-0.2%)**	**-0.03% (-0.0%)**	**-0.03% (-0.0%)**	**-0.02 (-0.1%)**	**-0.02 (-0.1%)**	**-0.02 (-0.1%)**
Indigenous Population	**-0.03% (-2.9%)**		**-0.02%(4.0%)**	**-0.05% (-0.3%)**		**-0.04% (-0.0%)**	**-0.05 (-0.1%)**	**-0.04 (-0.1%)**	**-0.04 (-0.1%)**
Age		**0.56%(11.0%)**	**-1.02%(204.0%)**	**-1.23% (-8.1%)**		**-0.70% (-4.9%)**	N/A	N/A	N/A
Remote indigenous population									
Population change 2001-06	**5.6% (5.6%) (1)**	**0.03%(0.6%)(2)**	**0.02%(4.0%)(3)**						

Source: JSA

	Dependent variables – Economic Growth								
Independent variable	Skills base (2006)	Skills base (2001)	Skills base (1996)	Secondary School participation ages 12-17 (2006)	Secondary School participation ages 12-17 (2001)	Secondary School participation ages 12-17 (1996)	SEIFA index of Education and Occupation (2006)	SEIFA index of Education and Occupation (2001)	SEIFA index of Education and Occupation (1996)
Adjusted R^2 value	0.74	0.72	0.71	0.47	0.63	0.49	0.49	0.73	0.65
Mean Value	31.6%	27.0%	22.8%	75.9%	77.5%	76.8%	953	943	948
Australia Mean Value	39.4%			77.1%	79.4%	79.3%	1000	1000	1000
Relative variation of dependent variable (SD/Mean)	19%	18%	19%	11%	12%	14%	5%	3%	3%
Variation explained by industry. (Difference in Adjusted R^2 values)	32%	34%	29%	7%	12%	6%	33%	44%	30%
INDUSTRY VARIABLES									
Vegetables	**-0.01%**	**-0.03%**	**-0.02%**			**-0.05% (-0.1%)**			**-0.17**
	(-0.0%)	**(-0.1%)**	**(-0.1%)**						**(-0.0%)**
Fruit	-0.02%	**-0.02%**	**-0.01%**	**-0.02% (-0.0%)**	-0.02% (-0.0%)	-0.02% (-0.0%)	**-0.15 (-0.0%)**	**-0.14**	**-0.11**
	(-0.1%)	**(-0.1%)**	**(-0.0%)**					**(-0.0%)**	**(-0.0%)**
Grapes	**-0.02%**	**-0.01%**			**-0.02% (-0.0%)**		**-0.13 (-0.0%)**	**-0.12**	**-0.10**
	(-0.1%)	**(-0.0%)**						**(-0.0%)**	**(-0.0%)**
Grazing					**-0.09% (-0.1%)**		**0.41 (0.0%)**		
Cereal	**-0.05%**	**-0.03%**	**-0.02%**	**0.06% (0.1%)**	**0.07% (0.1%)**	**0.04% (0.1%)**			
	(-0.2%)	**(-0.1%)**	**(-0.1%)**						
Dairy	N/A						N/A		
Rice		N/A	N/A					N/A	N/A
Cotton									

	Dependent variables – Economic Growth								
Independent variable	Skills base (2006)	Skills base (2001)	Skills base (1996)	Secondary School participation ages 12-17 (2006)	Secondary School participation ages 12-17 (2001)	Secondary School participation ages 12-17 (1996)	SEIFA index of Education and Occupation (2006)	SEIFA index of Education and Occupation (2001)	SEIFA index of Education and Occupation (1996)
Balance Agriculture	**-0.08%**	**-0.12%**	**-0.16%**	**-0.08% (-0.1%)**	**-0.19% (-0.2%)**			**-0.92**	**-0.81**
	(-0.3%)	**(-0.0%)**	**(-0.1%)**					**(-0.1%)**	**(-0.1%)**
Total agriculture	**-0.18%**	**-0.22%**	**-0.21%**		-0.11% (-0.1%)			**-0.83**	**-1.02**
	(-0.6%)	**(-0.8%)**	**(-0.9%)**					**(-0.1%)**	**(-0.1%)**
Mining		**0.01%**	**0.02%**				**-0.11 (-0.0%)**	**-0.07**	-0.06
		(0.0%)	**(0.1%)**					**(-0.0%)**	(-0.0%)
Manufacturing							**-0.54 (-0.1%)**		
Utilities			0.03%				**-0.26 (-0.0%)**		**0.26**
			(0.1%)						**(0.0%)**
Construction		**0.24%**	**0.17%**		**-0.33% (-0.4%)**				**0.94**
		(0.9%)	**(0.7%)**						**(0.1%)**
Wholesale	**-0.19%**						**-1.29 (-0.1%)**		
	(-0.6%)								
Retail							**-1.59 (-0.2%)**		
Accommodation	**0.13%**	**0.15%**	**0.10%**				**0.41 (0.0%)**	**0.77**	**0.51**
	(0.4%)	**(0.6%)**	**(0.4%)**					**(0.1%)**	**(0.1%)**
Transport	**0.04%**	**-0.11%**					**0.25 (0.0%)**	**-0.86**	
	(0.1%)	**(0.4%)**						**(-0.1%)**	
Communications		**0.11%**	**0.08%**				**-0.37 (-0.0%)**	**1.02**	**1.00**
		(0.4%)	**(0.3%)**					**(0.1%)**	**(0.1%)**
Finance	**-0.07%**	**0.08%**	**0.08%**		**0.19% (0.2%)**	**0.19% (0.2%)**	**-1.00 (-0.1%)**	**0.97**	**1.30**
	(-0.2%)	**(0.3%)**	**(0.3%)**					**(0.1%)**	**(0.1%)**

	Dependent variables – Economic Growth								
Independent variable	Skills base (2006)	Skills base (2001)	Skills base (1996)	Secondary School participation ages 12-17 (2006)	Secondary School participation ages 12-17 (2001)	Secondary School participation ages 12-17 (1996)	SEIFA index of Education and Occupation (2006)	SEIFA index of Education and Occupation (2001)	SEIFA index of Education and Occupation (1996)
Rental	**0.16% (0.5%)**	**0.30% (1.1%)**	**0.23% (1.0%)**	**-0.09% (-0.1%)**		0.13% (0.2%)	**0.39 (0.0%)**	**1.35 (0.1%)**	**1.71 (0.2%)**
Professional	**0.15% (0.5%)**	N/A	N/A					N/A	N/A
Administration		N/A	N/A	**-0.09% (-0.1%)**			**-0.63 (-0.1%)**	N/A	N/A
Public Administration		**0.08% (0.3%)**	0.05% (0.2%)					**0.74 (0.1%)**	**0.55 (0.1%)**
Education	**0.15% (0.5%)**	**0.20% (0.7%)**	**0.18% (0.8%)**	**0.27% (0.4%)**	**0.23% (0.3%)**		**1.32 (0.1%)**	**2.64 (0.3%)**	**2.27 (0.2%)**
Health		**0.17% (0.6%)**	0.09% (0.4%)		**0.29% (0.4%)**		**-0.88 (-0.1%)**	**2.01 (0.2%)**	**1.42 (0.1%)**
Recreation	**0.09% (0.3%)**	**0.17% (0.6%)**	0.06% (0.3%)				**0.34 (0.0%)**	**1.15 (0.1%)**	**0.42 (0.0%)**
Other		**0.14% (0.5%)**	**0.12% (0.5%)**				**-1.25 (-0.1%)**	**0.95 (0.1%)**	**1.01 (0.1%)**
OTHER VARIABLES									
Remoteness	**-0.33% (-1.0%)**	**-0.24% (-0.9%)**	**-0.31% (-1.3%)**	**-0.32% (-0.4%)**	**-0.62% (-0.8%)**	**-0.60% (-0.8%)**		**-1.14 (0.1%)**	**1.64 (0.2%)**
Population		**0.02% (0.1%)**	**0.02% (0.1%)**	0.02% (0.0%)			**0.24 (0.0%)**	**0.29 (0.0%)**	**0.29 (0.0%)**
Indigenous Population	**-2.70% (-8.6%)**	**-0.03% (-0.1%)**		-0.04% (-0.1%)	**-0.05% (-0.1%)**	**-0.06% (-0.1%)**	**-0.25 (-0.0%)**		

	Dependent variables – Economic Growth								
Independent variable	Skills base (2006)	Skills base (2001)	Skills base (1996)	Secondary School participation ages 12-17 (2006)	Secondary School participation ages 12-17 (2001)	Secondary School participation ages 12-17 (1996)	SEIFA index of Education and Occupation (2006)	SEIFA index of Education and Occupation (2001)	SEIFA index of Education and Occupation (1996)
Age	**-1.16%**	**-0.75%**	**-0.46%**	**1.61% (2.1%)**	**1.10% (1.5%)**	**1.17% (1.5%)**			
	(-3.7%)	**(-2.8%)**	**(-2.0%)**						

	DEPENDENT VARIABLES – Resource Distribution								
Independent variable	**GINI coefficient (2006)**	**GINI coefficient (2001)**	**GINI coefficient (1996)**	**Youth unemployment (2006)**	**Youth unemployment (2001)**	**Youth unemployment (1996)**	**General unemployment (2006)**	**General unemployment (2001)**	**General unemployment (1996)**
Adjusted R^2 value	0.60	0.65	0.49	0.40	0.20	0.45	0.53	0.44	0.46
Mean Value	0.40	0.37	0.37	10.4%	13.3%	17.0%	5.1%	6.3%	4.8%
Relative variation of dependent variable (SD/Mean)	6%	6%	4%	41%	38%	31%	37%	37%	27%
Variation explained by industry (Difference in Adjusted R^2 values)	21%	25%	14%	15%	6%	16%	10%	19%	23%
INDUSTRY VARIABLES									
Vegetables	**-0.00 (-0.0%)**			**-0.02% (-0.2%)**			-0.1% (-0.1%)		
Fruit									
Grapes						**-0.02% (-0.1%)**			
Grazing			**0.00(0.1%)**	**-0.47% (-4.5%)**			-0.29% (-5.6%)	**-0.03% (-0.5%)**	
Cereal	**0.00(0.0%)**					**-0.05% (-0.3%)**		**-0.02% (-0.3%)**	**-0.02% (-0.4%)**
Dairy				N/A	**-0.02% (-0.2%)**	**-0.02% (-0.1%)**	N/A	**-0.01% (-0.2%)**	-0.00% (-0.0%)
Rice					N/A	N/A		N/A	N/A
Cotton									
Balance Agriculture	**-0.00(0.0%)**		**0.00(0.1%)**	**-0.07% (-0.7%)**			**-0.02% (-0.4%)**	**-0.03% (-0.5%)**	**-0.03% (-0.6%)**

	DEPENDENT VARIABLES – Resource Distribution								
Independent variable	**GINI coefficient (2006)**	**GINI coefficient (2001)**	**GINI coefficient (1996)**	**Youth unemployment (2006)**	**Youth unemployment (2001)**	**Youth unemployment (1996)**	**General unemployment (2006)**	**General unemployment (2001)**	**General unemployment (1996)**
Total agriculture			**0.00(0.1%)**	0.06 (0.6%)	**-0.11% (-0.8%)**	**-0.17% (-1.0%)**	**-0.04% (-0.8%)**	**-0.11% (-1.7%)**	**-0.06% (-1.3%)**
Mining	**0.00 (0.0%)**	**-0.00 (-0.0%)**	**-0.00 (-0.0%)**				**0.00% (0.08%)**		
Manufacturing			**-0.00 (-0.0%)**					**0.03% (0.5%)**	
Utilities									
Construction				**-0.06% (-0.6%)**					**0.05% (1.0%)**
Wholesale								**0.06% (1.0%)**	
Retail		**0.00 (0.2%)**		**0.10 (1.0%)**	**0.19% (1.4%)**	**0.20% (1.2%)**	**0.07% (1.3%)**	**0.20% (3.2%)**	**0.09% (1.9%)**
Accommodation	**-0.00 (-0.9%)**								0.02% (0.4%)
Transport				**-0.02% (-0.2%)**	0.10% (0.8%)	**0.09% (0.1%)**	**-0.01% (-0.1%)**		
Communications	**0.00 (0.1%)**			**0.07% (0.7%)**	0.17% (1.3%)	**0.12% (0.7%)**	**0.03% (0.6%)**	**0.09% (1.4%)**	**0.03% (0.6%)**
Finance	0.00 (0.1%)	0.00 (0.1%)		**0.04% (0.4%)**			**0.04% (0.7%)**	**0.06% (1.0%)**	**0.04% (0.8%)**
Rental	**-0.00 (-0.1%)**							**0.06% (1.0%)**	**0.03% (0.6%)**
Professional					N/A	N/A		N/A	N/A
Administration				**0.05% (0.4%)**	N/A	N/A	**0.02% (0.4%)**	N/A	N/A
Public Administration								-0.03% (-0.5%)	
Education		0.00			**0.22% (1.7%)**	0.14% (0.8%)		**0.09% (1.4%)**	0.04% (0.8%)

	DEPENDENT VARIABLES – Resource Distribution								
Independent variable	**GINI coefficient (2006)**	**GINI coefficient (2001)**	**GINI coefficient (1996)**	**Youth unemployment (2006)**	**Youth unemployment (2001)**	**Youth unemployment (1996)**	**General unemployment (2006)**	**General unemployment (2001)**	**General unemployment (1996)**
		(0.2%)							
Health		**0.00 (0.2%)**		**0.10% (0.9%)**		**0.14% (0.8%)**	**0.05% (0.9%)**	**0.09% (1.4%)**	**0.04% (0.8%)**
Recreation	**-0.00 (-0.1%)**								**0.01% (0.2%)**
Other		**0.00 (0.1%)**				**0.19% (1.1%)**	**0.05% (1.0%)**	**0.09% (1.4%)**	**0.06% (1.3%)**
OTHER VARIABLES									
Remoteness	**0.00 (0.2%)**	**0.00 (0.1%)**	**0.00 (0.3%)**	**-0.14% (-1.4%)**	**-0.17% (-1.3%)**	**-0.13% (-0.8%)**	**-0.08% (-1.6%)**	**-0.11% (-1.7%)**	**-0.05% (-1.0%)**
Population									
Indigenous Population	**0.00 (0.1%)**	**0.00 (0.1%)**		**0.09% (0.9%)**	**0.08% (0.6%)**	**0.09% (0.5%)**	**0.05% (1.0%)**	**0.05% (0.8%)**	**0.02% (0.4%)**
Age	**0.01 (1.7%)**	**0.01 (2.1%)**	**0.00 (1.3%)**	**0.54% (5.2%)**	**0.78% (5.9%)**	**1.47% (8.6%)**	**0.32% (6.2%)**	**0.35% (5.6%)**	**0.19% (4.0%)**
Remote indigenous population									
Population change 2001-06									

DEPENDENT VARIABLES – Social Capital **DEPENDENT VARIABLES – Citizen participation**

Independent variable	Change of address 2001-06	Change of address 1996-01	Change of address 1991-96	Population change 2001-2006	Population change 1996-2001	Population change 1991-1996	Voluntary work (2006)	Voluntary work (2001)	Voluntary work (1996)
Adjusted R^2 value	0.52	0.49	0.35	0.70	0.54	0.45	0.70	Not available	Not available
Mean Value	22.7%	20.4%	21.5%	-0.00%	0.50%	-0.49%	29.0%		
Relative variation of dependent variable (SD/Mean)	29%	27%	27%	6,300%	13,160%	15,920%	21%		
Variation explained by industry (Difference in Adjusted R^2 values)	27%	28%	14%	38%	40%	13%	17%		
INDUSTRY VARIABLES									
Vegetables									
Fruit	**-0.03%**	**-0.02%**				**0.05%**	**-0.01% (-0.1%)**		
	(-0.1%)	**(-0.1%)**				**(-10.2%)**			
Grapes							**-0.02% (-0.1%)**		
Grazing	**0.10% (0.5%)**	**0.07%**				**-0.09%**			
		(0.3%)				**(18.4%)**			
Cereal	**-0.04%**	**-0.05%**	-0.02%	**-0.06% (47.0%)**	**-0.06%**		**0.08% (0.3%)**		
	(-0.2%)	**(-0.2%)**	(-0.1%)		**(-12.0%)**				
Dairy	N/A			N/A			N/A		
Rice		N/A	N/A		N/A	N/A		N/A	N/A
Cotton				**-0.04% (27.5%)**	**0.02%**				
					(4.0%)				
Balance Agriculture				-0.06% (49.4%)	**0.10%**	-0.10%			
					(20.0%)	(-20.0%)			
Total agriculture					**-0.06%**	-0.12%	**0.13% (0.4%)**		

	DEPENDENT VARIABLES – Social Capital						DEPENDENT VARIABLES – Citizen participation		
Independent variable	**Change of address 2001-06**	**Change of address 1996-01**	**Change of address 1991-96**	**Population change 2001-2006**	**Population change 1996-2001**	**Population change 1991-1996**	**Voluntary work (2006)**	**Voluntary work (2001)**	**Voluntary work (1996)**
					(-12.0%)	(24.5%)			
Mining		**0.01%**			**-0.03%**	**-0.02%**	**-0.02%**		
		(-0.0%)			**(6.0%)**	**(4.1%)**	**(-0.1%)**		
Manufacturing					**0.09%**		-0.04% (-0.1%)		
					(18.0%)				
Utilities	**-0.07%**	**-0.07%**	**-0.06%**	**-0.09% (68.8%)**			**-0.05%**		
	(-0.3%)	**(-0.3%)**	**(-0.3%)**				**(-0.2%)**		
Construction	**0.13% (0.6%)**	**0.36%**	**0.16%**	**0.40% (-303.8%)**	**0.72%**	**0.41%**			
		(1.8%)	**(0.7%)**		**(144.0%)**	**(-84.0%)**			
Wholesale	**-0.20%**				0.13%	**0.17%**			
	(-0.9%)				(26.0%)	**(-34.7%)**			
Retail	**-0.21%**	**-0.23%**	**-0.21%**			**0.20%**	**-0.16%**		
	(-0.9%)	**(-1.1%)**	**(-1.0%)**			**(-40.8%)**	**(-0.5%)**		
Accommodation	**0.08% (0.4%)**			**0.08% (-57.1%)**					
Transport	**0.04% (0.2%)**								
Communications							**-0.05%**		
							(-0.2%)		
Finance	**-0.13%**		**-0.22%**						
	(-0.6%)		**(-1.0%)**						
Rental	**0.11% (0.5%)**			**0.15%**	**0.30%**	**0.25% (-51.0%)**	**-0.05% (-0.2%)**		
				(-114.5%)	**(60.0%)**				
Professional	**-0.17%** (-	N/A	N/A				**-0.11% (-0.4%)**		

Independent variable	DEPENDENT VARIABLES – Social Capital						DEPENDENT VARIABLES – Citizen participation		
	Change of address 2001-06	Change of address 1996-01	Change of address 1991-96	Population change 2001-2006	Population change 1996-2001	Population change 1991-1996	Voluntary work (2006)	Voluntary work (2001)	Voluntary work (1996)
	0.7%)								
Administration	**-0.07% (-0.3%)**	N/A	N/A				**-0.09% (-0.3%)**		
Public Administration		**0.10% (0.5%)**	**0.12% (0.6%)**		**0.01% (2.0%)**				
Education		**0.22% (1.1%)**					**0.22% (0.7%)**		
Health	**-0.23% (-1.0%)**								
Recreation	**0.09% (0.4%)**	0.07% (0.3%)			**0.11% (22.0%)**	0.05% (-10.2%)			
Other	**-0.24% (-1.0%)**								
OTHER VARIABLES									
Remoteness			**-0.15% (0.7%)**	**-0.39% (297.8%)**	**-0.26% (-52.0%)**	**-0.55% (112.2.0%)**	**0.43% (1.5%)**		
Population	**-0.03% (-0.1%)**	0.02% (0.1%)							
Indigenous Population	**-0.08% (-0.4%)**	**-0.05% (-0.2%)**	**-0.04% (-0.2%)**	**-0.05% (41.4%)**			**-0.11% (-0.4%)**		
Age	**-1.78% (-7.8%)**	**-1.31% (-6.4%)**	**-1.58% (-7.3%)**	**-1.32% (1,012.8%)**	**-1.00% (-200.0%)**	**-1.40% (286.0%)**	**1.46% (5.0%)**		

Source: JSA

Discussion

General comments

For most of the dependent variables considered, much of the variation could be accounted for by the dependent variables of remoteness, population, indigenous population and age. While in many cases industry variables were found to be significant, there was often no consistency across years and the quantum of the impact was slight, suggesting that the relationship was most likely a data artefact, with the apparent relationship disappearing with small changes in data sets between years. Similar effects were found in some cases with the key independent variables, showing a strong relationship in some years and not in others. While the effect may be real, that is reflecting causality and/or changing circumstances, it could also reflect changes in coding by ABS, data artefacts or the impacts of collinearity. Consequently this report does not draw conclusions from such instances.

SEIFA (Disadvantage)

There is some variation in the mean value of SEIFA (Disadvantage) for the areas over the time period however this may reflect changes in the weighting and variables used by ABS to calculate the indicator, rather than any trend. There is no consistent relationship with regard to SEIFA (Disadvantage) with the independent variables, apart from the association with indigenous population, however if ACT data is excluded, then age becomes a significant variable for 2001 data.

Less robust trends appear to be an association between increasing disadvantage and less remote and larger centres, although whether this means that people on welfare are more likely to gravitate to these areas or whether disadvantage is an outcome of characteristics of such areas cannot be determined. The variation in significant industry variables across years suggests that those variables are not determining higher or lower levels of disadvantage, but rather are acting as proxies for the type of communities where disadvantaged people may congregate.

The main conclusion appears to be that disadvantage is associated with aboriginality (noting that aboriginality is one of the variables considered in SEIFA (Disadvantage)), older populations and less remote larger centres.

SEIFA (Economic Resources)

Again, there is some variation in the mean value of SEIFA (Economic Resources) for the areas over the time period however this may reflect changes in the weighting and variables used by ABS to calculate the indicator, rather than any trend.

There is no consistent relationship with regard to SEIFA (Economic Resources) with the independent variables, apart from the association with construction, indigenous population and age. The latter two are to be expected. The association with construction may be more to do with the characteristics of the area rather than the variable itself (the proposition that a vigorous construction industry leads to higher levels of SEIFA (Economic Resources)), that is higher levels of employment in construction are likely to be associated with areas increasing in population or where new industries are being developed.

Premature Death

Variation in the rates of premature death are more likely to reflect changes in the way the variable is calculated than a 50% increase in premature death rates across years. There is a consistent relationship between premature death and indigenous populations, and this is consistent with other data, for example the low numbers of older people in indigenous populations.

Assault (Non domestic violence)

Increasing levels of Assault (Non domestic violence) is primarily associated with remote indigenous populations. The effect of industry is negligible.

Assault (Domestic violence)

Increasing levels of Assault (domestic violence) is primarily associated with remote indigenous populations. The effect of industry is negligible.

Property crime

Increasing levels of Property Crime is primarily associated with increasing indigenous population and with more populous areas. The effect of industry is negligible.

Labour force participation 15+

Labour force participation 15+ is primarily associated with remoteness, indigenous population and age. Lower levels of labour force participation are associated with increasing indigenous population and increasing age, and higher levels are associated with more remote communities. Higher levels are found with increasing grazing and with agriculture generally, and lower levels are found in communities with industries characteristic of regional centres including increasing levels of retail, wholesale, communications, education and health.

The relationship with increasing age can be explained by the presence of retired people in the community and the relationship with increasing indigenous population reflects general disadvantage and low levels of education among indigenous people. Higher levels of labour force participation in agricultural communities may reflect older people continuing to operate farms past more normal retirement ages (consistent with personal experience and anecdotal evidence), while higher levels in more remote areas may reflect the relative undesirability of these areas, that is people are less likely to live there if it is not required for their livelihood.

Median weekly household income

Variation in median household income is primarily associated with age, and to a lesser extent, indigenous population. Again, this would be expected. While the effect of industry is small, there are some interesting findings with respect to agriculture and irrigated agriculture.

Firstly there is a trend for the negative association between agriculture and household income to reduce over time and to disappear by 2006. This is consistent with other trends including increasing productivity in agriculture and the increased size of establishments discussed above, and suggests declining rural poverty associated with farming over time.

Secondly, the trend for decreased household income with increasing remoteness and for increasing household income in areas with larger populations is not evident for 2001. This is consistent with the near doubling in size in cotton production between 1996 and 2001, and the subsequent reduction in 2006 to 1996 levels, as much or most cotton production takes place in smaller remote areas, suggesting a positive effect of the expansion of the cotton industry.

Disability support pension

Disability support pension is primarily associated with indigenous population and age, noting that the data excludes those in the aged pension age brackets and those under 16. There is no consistent relationship with industry.

Profound or severe disability

Time series data were not available for this variable.

Chronic ill health

The measure of chronic ill health is different between the two data years of 1996 and 2006. Increasing age, and to a lesser extent increasing indigenous population and larger populations, are associated with increasing chronic ill health.

Employment change

Variation in employment change is primarily associated with population increase. The effect of industry is slight, accounting for about 4% of variation. There are some interesting findings with respect to agriculture and in particular irrigated agriculture. Cotton was positively correlated with employment growth 1996-2001 and negatively correlated with employment growth 2001-2006, reflecting the expansion and contraction of the cotton industry over the period. A similar trend is seen with total agriculture.

Labour force participation 65+

Variation in labour force participation 65+ is primarily associated with industry, remoteness and population. The effect of industry is significant, accounting for 40-50% of variation. Agriculture overall is positively associated with increased labour force participation 65+, however there is some nuance, with fruit and vegetables consistently associated with a younger workforce, and grazing and cereal consistently associated with an older workforce. Similarly, more remote areas are associated with an older workforce, and more populous areas are associated with younger workforces. Industries other than agriculture are typically associated with younger workforces. This suggests that regional centres typically have younger workforces. Age and indigenous population were associated with younger workforces for 2006 and 1996, but not for 2001. This may be associated in some way with the growth in the area of cereals and cotton between 1996 and 2001, although there is no obvious mechanism.

Median age

Variation in median age is primarily associated with industry, population and indigenous population. The effect of industry is significant, accounting for about 30-40% of variation.

Agriculture, and grazing in particular, is consistently associated with older populations. More populous areas tend to be younger, as do areas with larger indigenous populations, with the latter reflecting the difference in age structure between indigenous populations and the population generally.

Skills base

Variation in skills base is primarily associated with industry, remoteness and age. The effect of industry is significant, accounting for around 30% of variation, perhaps indicating that some industries require higher levels of skills compared to others or perhaps that they attract more skilled people. Agriculture generally is associated with a lower skills base, with the sectors of vegetables, fruit and cereal consistently showing the same effect. Older areas and more remote areas are negatively associated with skills base.

Secondary School participation ages 12-17

Variation in secondary school participation ages 12-17 is primarily associated with remoteness, indigenous population and age. The effect of industry is small. Fruit growing is associated with lower levels, and cereal growing is associated with higher levels.

SEIFA Education and Occupation

Variation in SEIFA (Education and Occupation) is primarily associated with industry and population. The effect of industry is significant, accounting for around 30-40% of variation. Fruit and Grape growing and mining are consistently associated with lower levels of skills, while education, recreation and rental are consistently associated with higher levels, with the latter industries probably associated with regional centres. This is supported by the positive relationship between SEIFA (Education and Occupation) and more populous areas.

Economic Diversity

Economic diversity is difficult to measure and is far from a simple indicator. While simple indexes can be constructed for measurement, these can generate artefacts, for example a GINI type index of economic diversity contains an assumption that industry type is a continuous variable, where this is clearly not the case. Correlation with indicators of wellbeing is itself fraught. A higher level of economic diversity may be acting as a proxy for a larger regional centre, with a wider range of industry, and other indicators of wellbeing may be associated with that, rather than diversity.

It is not clear that higher levels of diversity are in fact a positive attribute. A more diverse economy could be achieved by reducing levels of agriculture in an area in the MDB, but this may result in lower levels of income and population decline. While diversity may lead to greater resilience in the face of decline, this would only be the case where an underlying resource exists to utilise the labour displaced by downturn of another industry. There is also an assumption that the underlying resource has not been fully exploited, and so can absorb displaced labour. To the degree to which the underlying diversity is an outcome of service industries, it seems likely that these industries will exist because of an underlying primary industry, and removal of that industry may result in loss of the service industry as well. Probably the multiplier concept,

explored below is a better indicator of resilience, with evidence of a critical population size for an area at which the economy is less dependent on an underlying industry such as agriculture.

To understand economic diversity, we have compared the distribution of employment by industry for the study area (as an average across areas) with the distribution of employment by industry for Australia to attempt to understand those factors that lead to a more diverse economy. Having said that, economies in the study area are skewed towards agricultural, with around 14% of employment in agriculture compared to around 3% for Australia.

Obvious trends are few. Time trends are complicated by the change in the employment classification system used for 1996 and 2001, compared to that used for 2006. As discussed elsewhere, multi-collinearity between variables can result in findings which are significant but not robust. Accordingly only relationships which are found across the three years are considered in the discussion below.

Generally, differences in agricultural industries have little impact on the diversity of the economy. Vegetables are associated with decreased mining and public administration, and balance of agriculture with mining and health, but a causal link is difficult to determine. Grazing is associated with lower levels of manufacturing.

For the key variables:

Remoteness is consistently associated with lower levels of manufacturing;

Higher populations are associated with higher levels of finance, professional (rental for earlier years) and public administration, with these functions likely to be located in larger regional centres;

Indigenous populations are associated with higher levels of education employment perhaps reflecting the younger age structure of indigenous communities, however the trend is not apparent for the age variable; and

Higher age is associated with lower levels of mining and public administration although a causal link whereby mining has a younger workforce seems more plausible than one whereby aged people generate extra mining. The relationship between public administration could reflect either a younger workforce in public administration or may reflect a propensity for older populations to use more public services, however a consistent trend is not seen with variables such as health.

Increasing economic diversity appears to be associated with less remote areas, larger populations and older populations while decreasing economic diversity appears to be associated with grazing, remoter areas, smaller populations and indigenous populations, however the effects are slight and are typically seen in one or two industries. Meaningful trends include lower levels of manufacturing in remote areas, and higher levels of finance, professional and public administration in more populous areas. Increasing urbanisation is associated with more diverse economies.

Table 18: Economic Diversity Detailed Analysis 2006 (Only variables significant at the 95% level are reported)

	% of employment		delta	Coefficient (p value)											
	Australia	MDB		Vegetables	Fruit	Grapes	Grazing	Cereal	Rice	cotton	Balance agriculture	Remoteness	Population (10,000)	Indigenous population	Median age
R^2				0.26	0.51	0.27	0.64	0.36	0.15	0.12	0.47	0.51	0.62	0.41	0.48
Mining	1.2%	1.1%	+0.1%	**-0.1%** **(0.021)**							**-0.1%** **(0.003)**	**+3.4** **(0.019)**			**-17.7** **(0.027)**
Manufacturing	10.7%	6.5%	+4.2%	**-0.1%** **(0.012)**	**-0.1%** **(0.048)**		**-0.5%** **(0.000)**	**-0.3%** **(0.009)**				**-4.6** **(0.000)**			
Utilities	1.0%	1.1%	+0.1%				**-1.3%** **(0.035)**		**+0.5%** **(0.019)**	**+0.3%** **(0.030)**					
Construction	8.0%	5.0%	+3.0%					**-0.8%** **(0.007)**							
Wholesale	4.5%	2.9%	+1.6%	**+0.3%** **(0.031)**	**+0.3%** **(0.025)**		**-2.1%** **(0.003)**								
Retail	11.7%	10.4%	+1.3%										**-19.1** **(0.023)**		
Accommodation	6.5%	7.5%	-1.0%		**-0.1%** **(0.014)**		**-0.5%** **(0.003)**	**-0.3%** **(0.047)**			**-0.1%** **(0.012)**				**-18.2** **(0.003)**
Transport	4.8%	1.3%	+3.5%												**-49.4** **(0.000)**
Communications	2.0%	0.7%	+1.3%										**+160** **(0.000)**		
Finance	3.9%	1.3%	+2.6%	**-0.7%** **(0.029)**									**+73.3** **(0.042)**		**-155.5** **(0.007)**

	% of employment		delta	Coefficient (p value)											
	Australia	MDB		Vegetables	Fruit	Grapes	Grazing	Cereal	Rice	cotton	Balance agriculture	Remoteness	Population (10,000)	Indigenous population	Median age
Rental	1.7%	0.1%	+1.6%												
Professional	6.8%	2.6%	+4.2%									-20.6 (0.000)	+106.5 (0.000)		
Administration	3.2%	1.7%	+1.5%		+1.2% (0.000)	+1.2% (0.000)	-2.5% (0.000)								
Public Administration	6.9%	6.7%	+0.2%	-0.1% (0.015)				-0.5% (0.002)		-0.1% (0.015)	-0.1% (0.000)		+21.8 (0.000)	+0.5% (0.001)	-33.0 (0.000)
Education	7.9%	8.3%	-0.4%											+1.3% (0.000)	-48.8 (0.001)
Health	10.8%	9.6%	+1.2%				-0.7% (0.015)		-0.3% (0.009)		-0.2% (0.000)			+0.4% (0.042)	34.9 (0.002)
Recreation	1.4%	1.0%	+0.4%												+81.1 (0.021)
Other	3.8%	3.2%	+0.6%												
Constant				2.7% (0.010)			5.9% (0.000)	19.7% (0.000)			0.1% (0.000)	2.5 (0.000)			49.0 (0.000)

Source: JSA calculation

Table 19: Economic Diversity Detailed Analysis 2001 (Only variables significant at the 95% level are reported)

	% of employment		delta	Coefficient (p value)											
	Australia	MDB		Vegetables	Fruit	Grapes	Grazing	Cereal	Dairy	cotton	Balance agriculture	Remoteness	Population (10,000)	Indigenous population	Median age
R^2				0.14	0.20	0.17	0.58	0.34	0.12	0.30	0.48	0.61	0.51	0.49	0.53
Mining	0.9%	1.2%	-0.3%	**-0.0%** **(0.019)**			**-0.3%** **(0.008)**	**-0.2%** **(0.015)**			**-0.1%** **(0.000)**	**+1.6** **(0.026)**			**-15.2** **(0.000)**
Manufacturing	12.5%	7.5%	+5.0%				**-0.5%** **(0.001)**			**-0.1%** **(0.016)**		**-5.9** **(0.000)**		**-0.2%** **(0.021)**	
Utilities	0.7%	0.9%	-0.2%												
Construction	6.9%	5.8%	+1.1%				**1.4%** **(0.011)**	**-1.9%** **(0.000)**					**-3.2** **(0.014)**		
Wholesale	5.4%	3.5%	+1.9%		**-0.7%** **(0.013)**					**0.6%** **(0.002)**					**-68.3** **(0.003)**
Retail	14.9%	14.4%	+0.5%		**0.2%** **(0.027)**		**-0.8%** **(0.008)**	**-0.6%** **(0.022)**							
Accommodation	5.1%	4.9%	+0.2%												
Transport	4.4%	3.6%	+0.8%					**1.0%** **(0.014)**		**-0.3%** **(0.030)**		**-10.6** **(0.000)**		**-0.7%** **(0.017)**	
Communications	1.8%	1.3%	+0.5%		**-1.7%** **(0.018)**	**-2.4%** **(0.019)**	**+5.0%** **(0.022)**						**+10.5** **(0.047)**		**139.7** **(0.030)**
Finance	3.9%	1.9%	+2.0%								**-0.5%** **(0.040)**	**-26.8** **(0.009)**	**+10.3** **(0.014)**	**-3.1%** **(0.003)**	**-145.2** **(0.004)**
Rental	11.4%	7.7%	+3.7%				**-1.9%** **(0.000)**			**0.3%** **(0.007)**		**-10.25** **(0.001)**	**4.8** (0.000)		

	% of employment		delta	Coefficient (p value)											
	Australia	MDB		Vegetables	Fruit	Grapes	Grazing	Cereal	Dairy	cotton	Balance agriculture	Remoteness	Population (10,000)	Indigenous population	Median age
Public Administration	4.6%	8.0%	-3.4%	**-0.1%** **(0.011)**	**-0.3%** **(0.002)**	**-0.3%** **(0.012)**							+2.8 (0.000)	**+0.5%** **(0.005)**	**-31.9** **(0.000)**
Education	7.3%	7.7%	-0.4%											**+0.9%** **(0.001)**	**-37.0** **(0.005)**
Health	9.9%	9.6%	+0.3%		**-0.3%** **(0.026)**						**-0.2%** **(0.000)**				**53.6** **(0.000)**
Recreation	2.5%	1.9%	+0.6%	**+0.6%** **(0.010)**						-0.9% (0.015)		**-22.7** **(0.009)**	+10.8 (0.002)	**-2.5%** (0.005)	
Other	3.7%	3.4%	+0.3%					**-1.7%** **(0.008)**		+0.5% (0.008)		**+12.4** **(0.011)**	-4.3 (0.030)	3.1% (0.000)	**-94.8** **(0.000)**
Constant				**0.0%** (0.000)	**0.1%** **(0.000)**	**0.1%** **(0.000)**	**43.8%** (0.000)	**21.5%** (0.000)	**0.0%** (0.024)		**0.1%** (0.000)	**2.7** (0.000)			

Source: JSA calculation

Table 20: Economic Diversity Detailed Analysis 1996 (Only variables significant at the 95% level are reported)

	% of employment		delta	Coefficient (p value)											
	Australia	MDB		Vegetables	Fruit	Grapes	Grazing	Cereal	Dairy	cotton	Balance agriculture	Remoteness	Population (10,000)	Indigenous population	Median age
R^2				0.17	0.22	0.15	0.59	0.32	0.12	0.12	0.85	0.49	0.43	0.35	0.40
Mining	1.2%	1.1%	+0.1%	**-0.0%** (0.006)			**-0.3%** (0.000)				**-0.4%** (0.000)				**-18.2** (0.000)
Manufacturing	10.7%	6.5%	+4.2%				**-0.4%** (0.000)			**-0.6%** (0.033)	**-0.4%** (0.000)	**-6.4** (0.000)		**-0.4%** (0.001)	
Utilities	1.0%	1.1%	+0.1%								**-0.7%** (0.010)				
Construction	8.0%	5.0%	+3.0%								**-0.5%** (0.036)			**-0.9%** (0.040)	
Wholesale	4.5%	2.9%	+1.6%		**+0.4%** (0.007)	**+0.4%** (0.040)	**-1.9%** (0.000)			**0.3%** (0.017)					**-53.2** (0.011)
Retail	11.7%	10.4%	+1.3%								**-0.6%** (0.000)				
Accommodation	6.5%	7.5%	-1.0%								**-0.4%** (0.002)				**22.2** (0.028)
Transport	4.8%	1.3%	+3.5%	**-0.2%** (0.009)											
Communications	2.0%	0.7%	+1.3%		**-1.2%** (0.001)										**112.8** (0.032)
Finance	3.9%	1.3%	+2.6%										**+8.4** (0.036)		

	% of employment		delta	Coefficient (p value)											
	Australia	MDB		Vegetables	Fruit	Grapes	Grazing	Cereal	Dairy	cotton	Balance agriculture	Remoteness	Population (10,000)	Indigenous population	Median age
Rental	1.7%	0.1%	+1.6%								**-0.6%** (0.005)		**3.2** (0.012)		
Public Administration	6.9%	6.7%	+0.2%	**-0.1%** (0.014)							**-0.5%** (0.000)		**+3.3** (0.000)		**-15.3** (0.039)
Education	7.9%	8.3%	-0.4%											**+0.6%** (0.039)	
Health	10.8%	9.6%	+1.2%								**-0.7%** (0.000)			**+0.9%** (0.000)	
Recreation	1.4%	1.0%	+0.4%												
Other	3.8%	3.2%	+0.6%					**-0.9%** (0.030)		**+0.4%** (0.021)	**-1.1%** (0.002)				**-55.4** (0.045)
Constant				0.0% (0.000)	**3.0%** (0.003)	**3.3%** (0.009)	**30.0%** (0.000)	**11.9%** (0.000)	**4.0%** (0.032)		**44.4%** (0.000)	**2.7** (0.000)			**38.3** (0.000)

Source: JSA calculation

Polarisation (GINI coefficient)

Note that the GINI coefficient was incorrectly calculated in our report 3. GINI coefficients have been recalculated for 2006 in this report. In the study area, there is little variation in GINI coefficient for household income, suggesting that one area is much like another. What variation exists is primarily associated with industry, indigenous population and age. The effect of industry is small, accounting for typically 15-25% of variation. No particular industry variable showed any consistent relationship, and the quantum of any relationships were slight. Older areas and more remote areas were more likely to be more polarised, and indigenous populations are associated with increasing polarisation for 2001 and 2006.

The indicator itself is not straightforward. While less polarised communities might be seen as a positive indicator, this may represent a community where poor people are excluded in some way, or it may represent a community with a residualised and welfare dependent population. Hence a more polarised community may in fact be more diverse, with this diversity contributing in a positive way to resilience.

Youth unemployment

Variation in youth unemployment is primarily associated with remoteness, indigenous population and age. The effect of industry is small, accounting for 5-15% of variation. There is no particular trend amongst industry, although retail is consistently associated with higher levels of youth unemployment. Increasing remoteness is negatively associated with youth unemployment, while indigenous population and older communities are positively associated. These trends for key variables are the same as those found for general unemployment.

Unemployment

Variation in unemployment is primarily associated with remoteness, indigenous population and age. The effect of industry is small, accounting for 10-25% of variation, however with a trend over time for industry to become a less important predictor. There is a trend for agriculture to be negatively associated with unemployment, while a range of industries associated with regional centres, such as retail and finance, are positively associated. Increasing remoteness is negatively associated with youth unemployment, while indigenous population and older communities are positively associated.

Change of address

Variation in change of address is primarily associated with industry, indigenous population and age. The effect of industry is significant, accounting for about 30% of variation for 2006 and 2001. Of industries, construction is positively associated with change of address, commensurate with people moving into expanding areas. Industries associated with regional centres, including utilities and retail, are negatively associated, as are indigenous population and age.

Change of address is not necessarily a straightforward indicator. We have assumed that lower levels indicate higher levels of social capital showing increased attachment to place. At the same time lower levels of change of address may reflect decline with this outcome expected with

residual populations. High levels within an area may also reflect a dynamic economy, with a transient professional population associated with relocation for career advancement.

Population change

Variation in population change is primarily associated with industry, remoteness and age. The effect of industry is significant, accounting for about 40% of variation for 2006 and 2001. Again construction is positively associated, as is rental. Cotton is positively associated in 2001, and negatively associated in 2006, and this is consistent with growth in the industry between 1996 and 2001, and contraction from drought in 2006. Remoter areas are negatively associated, as are older areas. The first is commensurate with trends of urbanisation, while the second is more likely to represent an older residual population in areas undergoing population decline.

Voluntary work

Data were not available for this variable in 1996 and 2001.

The multiplier

In report 3, the data set used for this indicator did not include the Queensland cotton growing areas, however in this report those SLAs have been included.

One important question of relevance to this study is the degree to which jobs in the agricultural sector flow on to the wider community. The table below shows the results of analysis for the three years. A number of partitions for population were tested. Using partitions for areas below 5,000 population, 5-10,000 population and greater than 10,000 population gave the best estimates of the agricultural jobs multiplier based on the 'p' value. While higher R2 values could be obtained by including a partition for 10,000 – 50,000 population, the remaining partition, 50,000 plus had only five data points, and the use of this partition led to quite high 'p' values for the agricultural multiplier for 1996 and 2001, and to a 'p' value around 0.07 for 2006 data.

Table 21: Relationship between primary industry employment (independent variables) and balance of employment (dependent variable).

	1996 (p value)	2001 (p value)	2006 (p value)
R^2	0.47	0.44	0.41
Multiplier for Agricultural jobs	1.1 (0.011)	1.2 (0.010)	2.5 (0.001)
Multiplier for Mining jobs	-1.2 (0.189) [Not significant]	-0.2 (0.898) [Not significant]	0.1 (0.898) [Not significant]
Baseline jobs population < 5,000	+250 (0.000)	+188 (0.000)	-341 (0.000)
Baseline jobs population 5,000 – 10,000	+1,250 (0.000)	+1,194 (0.000)	+222 (0.000)

Baseline jobs population > 10,000	+6,025 (0.000)	+6,871 (0.000)	+5,299 (0.000)

Source: ABS data, JSA calculation

The table below shows changes in average values across areas.

Table 22: Average values for jobs across areas

	1996	2001	2006
Balance of jobs (less agriculture and mining)	3,017	3,368	3,325
Agricultural jobs	851	875	717
Ratio Agricultural jobs to balance of jobs	28%	26%	22%
Mining jobs	83	61	91

Source: ABS data, JSA calculation

It is evident from the results that the 2006 results differ markedly from those for 1996 and 2001. The difference cannot be explained by sampling error, as each analysis is essentially based on the same sample, with some minor differences arising from boundary changes between SLAs and some changes in employment classifications. Collinearity or multi-collinearity could also lead to results being non-robust, but there is no evidence of these effects. Similarly, there is quite a wide range in the data, with the relative standard deviation for the ratio of agricultural jobs to balance of jobs being +/-86%. Similarly, the results were found to be robust with the removal of outliers (data points with very high and very low ratios of agricultural jobs to balance of jobs). For all years, removal of outliers led to an increase in the agricultural multiplier of about 1.0. Hence we conclude that the results are explained by changing circumstances within the MDB, rather than being a data artefact.

The most likely explanation is drought conditions across the basin in 2006 combined with ongoing trends of increasing urbanisation. During the period 2001-2006, total employment (excluding the ACT) grew from 738,000 to 831,000, however agricultural employment fell from 151,000 to 126,000, most likely as a result of drought. The ratio fell from 20% to 15%, a fall of about 25%. The same trend can be seen in Table 22 above, where the ratio of agricultural jobs to the balance of jobs fell from 26% to 22%, a fall of about 15%.

The effects of urbanisation are evident in two ways. Firstly, for 1996 and 2001, base line jobs increase by factors of about 5 and 6 respectively for the two population steps and the level of base line jobs has decreased for populations below 10,000. That is, smaller communities are more dependent on agricultural jobs than large communities, and that dependence has increased with time.

Secondly, base line jobs in larger communities increased between 1996 and 2001. That is, there appears to be a trend of non-agricultural related jobs to flow from smaller to larger communities.

The multiplier for agricultural jobs is relatively constant for 1996 and for 2001, however it increases markedly in 2006. One explanation, and in line with trends observed by key informants, is a lag effect whereby industries dependent on agriculture hang on as the agricultural sector undergoes a down turn. That is, if 2006 is considered to be the early stages of the drought, the impact of the drought was for the same or similar number of agriculture related jobs to be supported by fewer agricultural jobs.

It is also noted that the introduction of an additional partition for those areas with populations over 50,000 gives a multiplier of 0.8, more in line with that for previous years, however the 'p' value for the multiplier is 0.07, that is the variable is not significant at the 95% level. This may indicate a trend for larger areas to be free from the vagaries of climate with respect to agriculture, and may also be influenced by irrigation based on high security water, which did not feel the effects of the drought in 2006, although the latter trend is not immediately obvious.

It is not clear whether the fall in baseline jobs between 2001 and 2006 is a trend. It is likely to be a data artefact to some extent, as the increase in the multiplier from 2001 to 2006 is greater than would be expected from the change in the ratio of agricultural jobs to the balance of jobs.

Census data will soon be available for 2011, and analysis of this data will assist in disentangling drought effects from longer term trends both for the multiplier and for the number of baseline jobs.

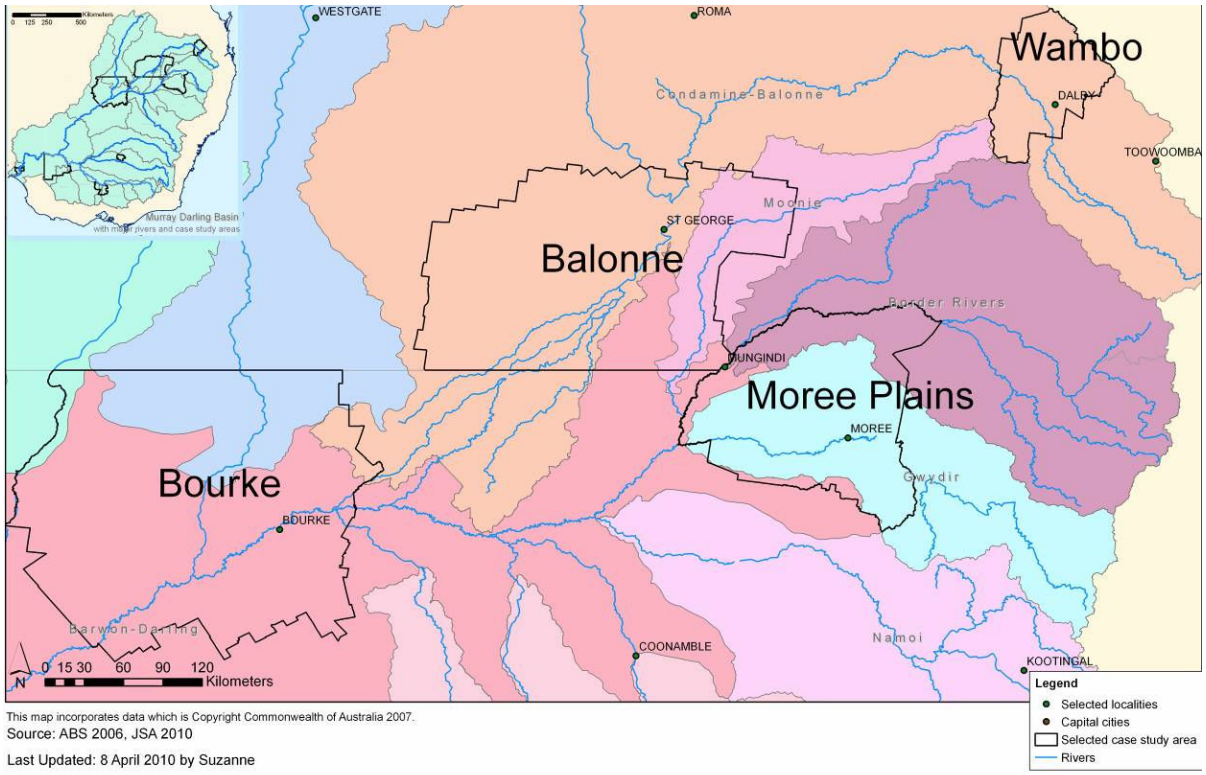
3.3 The Local Level

3.3.1 Overview

To explore the likely social and economic impacts and degree of resilience to more permanent changes in water at different geographic scales, JSA developed a 'resilience report card' in Report 4, and applied this to eight case studies across the Murray Darling Basin in different types of irrigated agricultural communities. The eight case study areas were selected in order to represent different states, different CSIRO Sustainable Yields Regions, cotton and non-cotton producing areas, a diversity of irrigated agricultural uses and diversity across three key attributes including population size, remoteness and indigenous population.

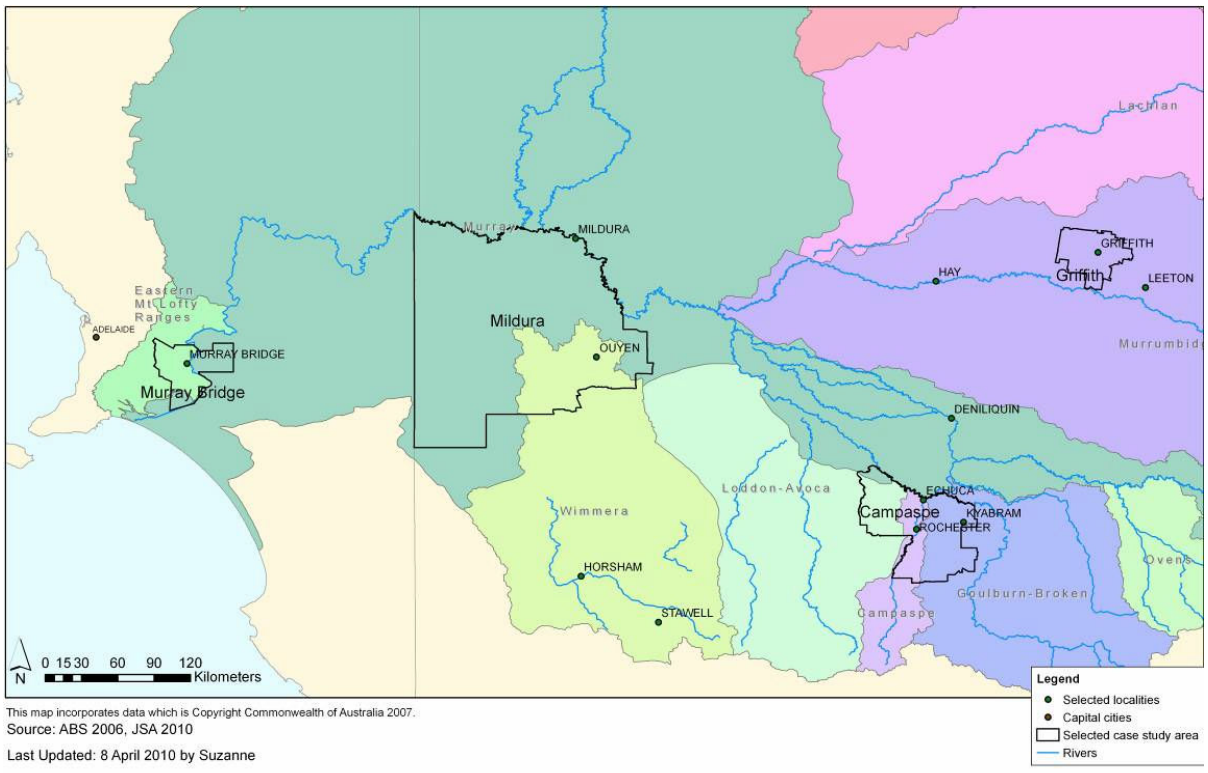
Selected case study areas in the Northern Basin are Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; and Bourke, NSW. The following map shows these case study communities in the context of the Northern Basin.

Map 3.1: Northern Basin Case Study Areas



Selected case study areas in the Southern Basin are Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia. The following map shows these areas in the context of the Southern Basin.

Map 3.2: Southern Basin Case Study Areas



3.3.2 Summary of results

Generally, the impacts of drought and reductions in irrigation water across the case study areas were seen in changes in employment with any impacts on other indicators masked by larger trends. The resilience report card developed in Report 4 was supported, with some communities very sensitive to changes in irrigation water, and others showing little or no impact, and those sensitivities in line with predictions.

Smaller, remote communities most reliant on agriculture were found to be most sensitive to changes in irrigated agriculture, while those communities with a wider economic base and close to major centres were found to be least sensitive to changes in irrigated agriculture. There were two broad groups of communities.

The first group included communities very sensitive to changes in irrigated agriculture. These included Balonne Shire, Bourke Shire, Moree Plains, Griffith and Mildura. Impacts on employment in Balonne Shire, Bourke Shire and Moree Plains were found to be much greater than expected from Report 4 modelling. For Bourke and Moree Plains, the impacts of change in irrigated agriculture were overlaid on longer term trends of decline. In Griffith, impacts of reductions in water were mitigated by differences in water security and trade in water between commodity sectors. Conclusions for Mildura are based on the impacts of growth in irrigation water use, with no significant reductions over the period, and with an apparent underlying trend of employment growth. Population change was generally found to be 'sticky' across the case study areas, lagging change in employment.

The second group included southern areas in which there was little variation in irrigation water use over the time period (Campaspe) or where the data showed little or no impact from changes in irrigated agriculture (Dalby-Wambo and Murray Bridge). These three centres were predicted in Report 4 to be quite resilient to changes in irrigation water due to a wider economic base and proximity to other larger centres.

4 Balonne Shire

4.1 How Resilient is Balonne Shire likely to be to permanent reductions in water?

4.1.1 Summary

Report 4 modelling with respect to employment and population in the light of changes to irrigated agriculture was generally supported by time series data for Balonne, however impacts, both positive and negative, were relatively larger than expected.

Generally Balonne Shire scores poorly on indicators of community resilience, hence greater than average impacts could be expected. This is reflected in time series data, with employment changes arising from changes to the extent of irrigated agriculture larger than would be expected from our modelling.

Population change was less than predicted, lagging employment change and suggesting "sticky" rather than "frictionless" structural adjustment. This is supported by unemployment data, suggesting that expansion was fuelled by the existing stock of labour, rather than labour migrating into the area.

Changes in other socio-economic indicators of well-being and resilience in response to changes in irrigated agriculture and the predicted effects from our modelling were difficult to discern. This is likely to be because the major drivers of indicators of well-being and resilience are factors such as remoteness, population, indigenous population and age and temporal changes in the latter three variables confound any impacts of changes to agriculture and irrigated agriculture. Where trends were evident, the predicted impacts of changes in agriculture and irrigated agriculture were generally supported, with some exceptions. While decreases in Labour Force Participation Rate 65+ were found with decreasing agricultural employment, the converse was not true, suggesting that growth in agricultural employment is likely to be fuelled by inward migration of younger workers.

The major finding of Report 4, that Balonne Shire is likely to be very vulnerable to a permanent reduction in irrigation water is supported. Conversely, the wellbeing of Balonne Shire is very sensitive to increasing access to irrigation water, with rapid improvement in community wellbeing associated with growth in agricultural industries.

4.1.2 Overview of Findings from Report 4

Balonne Shire is predicted to be very vulnerable to a permanent reduction in irrigation water, with significant job and population loss, and considerable adverse impacts on a range of socio-economic indicators of community resilience and wellbeing projected in the long-term. This is expected to entrench higher levels of disadvantage, particularly among disadvantaged older people and Aboriginal residents. This is because irrigated agriculture forms a large proportion of both agricultural industries and the total economy of the Shire, with irrigated agriculture accounting for around 50% of direct and indirect employment through related multipliers. Other

relevant factors include Balonne Shire's locational disadvantage including its remoteness and isolation from major service centres; its large and growing Aboriginal population, which experiences higher levels of disadvantage; and the lack of alternative economic opportunities such as extractive industries. Its small size means that it is not independent of the fortunes of its agricultural base, and smaller communities in its hinterland are likely to be even more exposed to adverse impacts from loss of water.

4.1.3 Changes to irrigated agriculture 1996-2006

The table below shows changes to agriculture, including irrigated agriculture, in Balonne Shire between 1996 and 2006.

Table 23: Agricultural Land Use Balonne Shire 1996-2006 (Ha)

	Horticulture	Cotton	Grazing (1)	Other
1996	313	16,133	329,814	79,680
2001	451	44,975	3,518,104	129,036
2006	586	21,864	2,293,580	169,413

Source: ABS and JSA calculations

Table Notes:

(1) Data unreliable as definitions of range lands are not consistent over time.

4.1.4 Population and Employment Impact Forecast

Predicted changes to employment and population

The primary impact of a reduction in irrigated agriculture was predicted to be a loss of employment, followed by a loss of population. Impacts were expected to be exacerbated by remoteness, degree of urbanisation, indigenous population, age and reliance on agriculture.

As expected, employment increased by 25% with the increase in irrigated agriculture between 1996 and 2001, and fell by 18% between 2001 and 2006, probably buoyed by diversification into horticulture and expansion within cropping. Using land as a proxy for water use, the increase in irrigation was around 2.8 times between 1996 and 2001.[34] Based on modelling in our Report 4, a 50% decrease in irrigation water use predicted a 10% decrease in employment, however this was based on changes in cotton production only. On this basis, a doubling of irrigation water use predicts a 20% increase in employment, and a 2.8 increase predicts a 28% increase. Between 1996 and 2001, employment increased by 25%, somewhat less than predicted. Between 1991 and 2006, there was an approximate 50% decrease in irrigated agriculture, offset by some diversification into horticulture, with an 18% decrease in employment compared to our predicted 10%.

[34] Referring to Table 3.4 in Report 2, water use per ha is relatively constant for all uses at around 4-6 Ml per ha, with the exception of rice at 12.3 Ml/ha.

The data suggest that Balonne is more sensitive to changes in irrigated agriculture than predicted by our model, with employment growth slower and employment loss greater, and supports our "resilience report card" finding that Balonne Shire performs poorly against the key factors that indicate how resilient a community is likely to be in the face of change. Consequently, impacts would be expected to be more severe than the averages used in our modelling.

These employment changes were accompanied by population change, although, contrary to our modelling, the population change was somewhat less than the employment change, probably reflecting people's unwillingness or inability to relocate as circumstances change. This finding has implications for assumptions of "structural change" as a response to stress, suggesting that if structural change occurs, time lags can be expected, that is structural change is "sticky" rather than "frictionless".

Predicted Changes in Indicators of Wellbeing and Resilience

Modelling of impacts on indicators of community wellbeing and resilience for Balonne from reduced water availability predicted that there will be significant adverse impacts on such indicators as a result of employment and population loss. Such adverse socio-economic impacts are generally a result of a more residualised population, which is likely to be both older and have a greater proportion of disadvantaged people including those from an indigenous background. Notable changes[35] as a result of decreasing irrigated agriculture were predicted as:

- a decrease in median household income,
- an increase in disability support pension rates, and in levels of profound or severe disability,
- a decrease in labour force participation 65+,
- an increase in median age,
- an increase in youth and general unemployment,
- less population replacement /in-migration,
- and
- an increase in assaultive violence, both domestic and non-domestic.

The primary impact on socio-economic indicators was expected to be an increase in age and in proportion of indigenous population with these variables strong predictors of other variables. In time series data it is difficult to disentangle trends arising from the impacts of changing employment from larger trends such as a general aging of the population, and rapid population growth in indigenous populations.

Median household income was found to increase independent of changes in irrigated agriculture. However impacts are masked by the general increasing wealth of Australians over the time period and by the trend for a decreasing association between agriculture and reduced household

[35] More than 5% change

income. Between 1996 and 2001, household incomes in Balonne increased more rapidly than for Australia (14.3% and 10.9% respectively), while between 2001 and 2006 the increase was less rapid (11.6% and 13.4% respectively). This supports our Report 4 findings.

Data on disability is poor, and trends are hard to identify.

Labour Force Participation Rate 65+ decreased relative to Australia across the three census years, whereas an increase followed by a decrease was expected. While an aging and residualised population as a result of a reduction in agriculture may lead to a reduction in those working over 65, it seems unlikely that growth in employment, accompanied by inward migration, would attract older rather than younger workers, and this is the likely explanation. This is seen in the regression analysis results above, where in 2001, age was not a predictor of Labour Force Participation 65+ but was negatively correlated in 1996 and 2006.

Changes in median age relative to Australia are not apparent within the accuracy (+/- 1 year or +/-3%) of the measurement. A decrease would be expected in 2001, and an increase in 2006 using our model. The explanation is likely to be similar to that above, that is inward migration is more likely to be amongst younger workers.

In line with predictions, youth unemployment relative to Australia fell in 2001 and increased in 2006. A similar trend is seen for general unemployment, however in both cases the quantum of change was much greater than predicted by our modelling.

As discussed above, the trends of population change were as expected, however the quantum was less than expected by comparison with employment data, indicative of "sticky" structural change.

Time series data is not available on assaultive violence for Balonne.

Factors Affecting Wellbeing and Resilience

A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study,[36] including changes in employment and population. These included degree of remoteness, degree of urbanisation (population size), proportion of indigenous people particularly remote populations,[37] and age of the population.[38] Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,[39] though our findings indicate that these factors are largely a function of other more endogenous factors like

[36] JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

[37] It is noted that, although 'indigenous people' is a proxy indicator, it is not being Aboriginal *per se* that signifies disadvantage but a range of attributes that are more likely to found among Aboriginal people, such as low income, educational and employment status, being sole parent, lower likelihood of home ownership, etc

[38] JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

[39] JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

remoteness, proximity to a large urban centre or to other economic resources like extractive industries, and to a large extent not within the control of a local community like Balonne Shire.

The following table provides an overview of these key factors, showing changes with time.

In summary, Balonne Shire performs poorly against the key factors that indicate how resilient a community is likely to be in the face of change. It is a 'remote area', with a very high proportion of Aboriginal people who are likely to be far more disadvantaged than average. It has not achieved the critical mass that makes it in any way independent of the fortunes of its predominantly agricultural economy, lacks economic diversity and has few alternative economic options to replace a significant loss of jobs predicted with permanent reductions in irrigation water. It has a younger than average age profile, but this is likely to be strongly influenced by its youthful Aboriginal population though anecdotally this may also relate to the younger profile of those working in irrigated agriculture.

Table 24: Key Factors in Community Resilience

Statistically Significant Factors	Likely to be Resilient	Comment	Changes Over Time
Remoteness	X	'Remote area' and much more remote than the MDB average of areas, with some part of the Shire 'very remote'.	
Degree of Urbanisation: • Population Size	X	Below the 5,000 population threshold so very vulnerable to further population loss, or any constraints to regaining population.	In 1996 the population of Balonne was higher than in 2006, though still fewer than 5,000 persons. Between 1996 and 2001 the population rose to over 5,000 persons, before returning to under 5,000 persons in 2006.
• Proximity to a large regional centre	X	Around 5 hours from the coast and remote from major service centres and capital cities.	
Indigenous Population	X?	3 time the MDB and 6 times the national average. Associated with significantly worse socio-economic outcomes. However, Aboriginal people are not as disadvantaged as the average of the MDB, and more engaged in the labour market.	Increased substantially between 1996 and 2006, from 12.2% of the population to 14.9% over ten years, a 22% increase. Comparatively, the MDB indigenous population increased by 26% over the same period (from 3.9% to 4.9%), and the national increased by 15% (from 2.0% to 2.3%).
Age	√?	Younger than the MDB and Australian median age. Likely a polarised population, with younger indigenous age profile and older farmers and smaller communities. Also younger people in entry level jobs and retained in more high value/irrigated agriculture.	Increased by four years between 1996 and 2006, from 30 to 34. Comparatively the MDB average median age increased by five years, from 35 to 40, and the national median increased by three years, from 34 to 37.

Statistically Significant Factors	Likely to be Resilient	Comment	Changes Over Time
% of employment by industry compared with Australian benchmark	X	Highly reliant on agriculture and directly related activities (42% compared with 29% in MDB). With an average multiplier of 1.1, around 85% of jobs are related to agriculture. Irrigated agriculture forms a relatively high component of the total local economy and employment in Balonne Shire, and at least 50% of jobs are likely to be directly or indirectly associated with irrigated agriculture in Balonne Shire given the anecdotally higher than average multipliers associated with this type of agriculture.	Balonne's reliance on agriculture decreased somewhat between 1996 and 2006, with the proportion of persons directly employed in agriculture decreasing by about 10% between 1996 and 2006. Comparatively, in areas in the MDB on average there was a 17% decrease, and nationally there was a 27% decrease.

Source: JSA

Status on Community Resilience Indicators

The table below shows the status of Balonne Shire on the Community Resilience Score Card at 2006 and notes changes over time. Many of the indicators appear to be driven by increasing employment between 1996 and 2001, and decreasing employment between 2001 and 2006. These include SEIFA Disadvantage and Economic Resources, Change in total employment, labour force participation 15+ years, GINI coefficient, youth unemployment, general unemployment and population growth.

Health variables are probably driven by a generally aging population and an increasing indigenous population, including self-reported health.

There appears to have been an increase in skills level with time.

Table 25: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Changes Over Time
Community Wellbeing:			
SEIFA Disadvantage	X	Lower than the MDB average and much lower than Australia, likely related to high Aboriginal population.	Has varied slightly between 1996 and 2006, but always lower than the MDB average and Australia. Peaked in 2001, in which year the score was only slightly lower than the MDB average score.
SEIFA Economic Resources	X	Lower than the MDB average and much lower than Australia, likely related to high Aboriginal population, the lower value of residential property, etc.	In 1996, Balonne had the second lowest score of the case study areas, substantially lower than the MDB average and national scores. By 2001, however, it had third highest score, higher than the MDB average score, but still substantially lower than the national score.
Median Household Income	√	Much higher than the MDB average and slightly lower than Australia likely due to higher incomes and wages associated with irrigated agriculture, and low unemployment.	Increased significantly (by about $100 per five-year period once inflation has been taken into account) between 1996 and 2006, which means that the area is keeping up with Australia, while in areas in the MDB on average the median household income has dropped by $25 per week between 1996 and 2006.
Social Capital /Volunteering rate	√	Higher level of engagement in voluntary activity than the MDB average and around 2.5 times the Australian rate. Highest of the case study areas.	Not reported in the 1996 and 2001 censes.
Disability Support Pension	√	Lowest of the case study areas, and much lower than MDB and Australian averages. May be due to younger median age, but also indicates higher labour market engagement of Indigenous and other residents.	Similar rate between 1996 and 2008, while MDB average rose by 30% and Australia by 26%. Was slightly higher than Australia in 1996, but still lower than the MDB average.
Premature Death	√	Lower than the MDB average despite the high % of Aboriginal people which is generally associated with this indicator.	Remained similar between the mid-nineties and 2008, as it did for areas in the MDB on average, while in Australia the rate rose slightly (by about 30 persons per 100,000).

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Changes Over Time
Profound or severe disability	√	Much lower than both the MDB and Australian average, and again the lowest of the case study areas. Likely in part due to a lower median age, but also an indicators of more positive community outcomes.	
Chronic Ill Health	?	Higher than the MDB and Australian averages, and possibly related to high Aboriginal population (e.g. diabetes, heart disease). Noted that this conflicts with above indicators and appears likely to be due to sampling error (small sample size).	
Self-reported health 'fair' or 'poor'		In 2007/08, 16.2% of residents aged 15 years and over reported their health as 'fair' or 'poor', somewhat higher than the MDB average rate of 15.2% and the national rate of 14.7%.	In 1995, the rate in Balonne was about 15% lower than the MDB average and national rates. Between 1995 and 2007/08, the rate in Balonne increase by 25% (from 13.0% to 16.2%), with a large peak of 19.3% in 2004/05. The MDB average and national rates in 1995 were similar to their respective 2007/08 rates, though they did both peak in 2004/05 at 16.7% and 15.6% respectively.
Economic growth/ Human Capital :			
Change in Total Employment 2001-06	X	Significant employment loss during drought (-18.3%). Previous long-term employment quantum was relatively stable. Reports that irrigated ag keeping people on wherever possible in drought.	Large increase in number of persons employed (25%) between 1996 and 2001, about five times the average increase for areas in the MDB and almost three times the increase nationally. Prior to this, between 1996 and 2001, decrease of 8%, compared with half a percent decrease on average for the MDB and an 8% increase for Australia.
Labour force participation 15+ years	√	Much higher than the MDB and national average, and the highest of any case study.	Rose by 4% between 1996 and 2006, while the average rate for the MDB did not rise substantially, and the rate for Australia rose by less than 1%. Was still substantially higher than the MDB average and Australia in 1996 and 2001.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Changes Over Time
Labour force participation 65+ years	X?	Very high older work force, including among farmers. Also likely out-migration of retirees, which increases %. Advantages of skills and experience of older work force also noted in consultations, as well as choices to relocate to St George by older people due to increased employment opportunities.	Rose by about 11% between 1996 and 2006, while areas in the MDB rose by 8% on average and by 42% nationally.
Post-school qualification (skills base)	X	Relatively low rate of those with post-secondary qualifications, likely related to larger Aboriginal population and nature of local job opportunities.	Increased by 40% between 1996 and 2006, compared with 39% increase for MDB average and 32% increase for Australia.
School participation at 16 years	?	Low relative rate of high school attendance, though may also be due to low youth unemployment rate and local entry-level job opportunities as well as more disadvantaged Aboriginal people.	
Rate of participation in secondary education		Quite low (62% in 2006) compared with the MDB average and national rates (75% and 77% respectively). Second lowest rate of the eight case study areas.	Rose by 2.3% between 1996 and 2006 (from 60.8% to 62.2%), compared with a fall of 2.1% on average for areas in the MDB (from 76.7% to 75.1%) and 2.8% nationally (from 79.3% to 77.1%). Consistently about 20% lower than the MDB average rate and 20-25% lower than the national rate between 1996 and 2006.
SEIFA Index of Education and Occupation (brings together relevant Census variables on the general level of education and occupation-related skills of people within an area)	√	Interestingly, performs quite well on this broad indicator of human capital, indicating the presence of sufficient people with higher educational and occupational status to balance out other individual indicators. Anecdotally, higher skill levels associated with irrigated agriculture were noted.	Was actually quite low in 1996 (second-lowest of the case study areas) and 2001 (fourth-lowest). In both 1996 and 2001 was lower than both the MDB average and Australian scores. Increased substantially between 2001 and 2006.
% of employment by industry compared with Australian benchmark	X	Highly reliant on agriculture and directly related activities (42% compared with 29% in MDB). With an average multiplier of 1.1, around 85% of jobs are related to agriculture. Irrigated agriculture forms a relatively high component of the total local economy and employment in Balonne Shire.	

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Changes Over Time
GINI co-efficient of household income distribution/polarisation	?	Like other areas of the MBD, Balonne Shire shows quite a high level of polarisation between the 'haves' and 'have nots' based on household income, though it is somewhat less polarised than all other case study areas.	Gini coefficient in 1996 was similar to 2006 value, though the 2001 value was quite low suggesting growth in employment led to reduced polarisation (lower than the other case study areas, as well as the MDB average and Australia).
Youth unemployment rate	√	Lowest case study area, and much lower than MDB and national average, likely due to entry-level jobs and unemployed leaving the area. Reports of recent labour and skill shortages, and sourcing outside labour (e.g. into grapes). Also reported by Aboriginal community leaders to be difficult to recruit and retain some Aboriginal people in existing jobs, with the need to 'import seasonal and other workers' noted, despite the fact that there are reported to be Aboriginal young and older people unemployed.	Was much higher in 1996 (though still not as high as the rates for the MDB average and Australia). Halved between 1996 and 2001, and remained steady thereafter. By comparison, average rate for MDB declined by 39% between 1996 and 2006, and national rate declined by 35%.
General unemployment rate	√	Lowest case study area, and also much lower than average. Again, reports of labour and skill shortage in horticulture and other irrigated agriculture during field visits is noted. Noted several times that *'if you want a job here, you should be able to find one'* (for example, in seasonal work associated with horticulture).	Declined by 23% between 1996 and 2006. In 1996 was the fourth lowest case study area, and in 2001 was the lowest. Lower than national and MDB average rates in both 1996 and 2001.
Amenity:			

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Changes Over Time
Population Growth /Retention 2001-06	?	Significant loss of population (-14.6%) compared with MDB average (no change). However, Balonne Shire generally experienced reasonable population growth over the past 30 years, which is generally against the trend for more remote communities reliant predominantly on dryland agriculture. Population increase was particularly marked between 1996 and 2001, with a significant expansion in irrigated agriculture including cotton and some higher value horticultural uses. This preceded the most recent prolonged drought, with its significant employment and population loss from 2001-06, and was against the general trend in this regard. The smaller loss in population between 1991-96 also accompanied some 'dry years', and the recovery from 1996-2001 is interesting to note in this regard.	Experienced a substantial decrease in population between 1991 and 1996 of 5.2%, compared with a slight decrease in areas is the MDB on average (0.2%), and an increase of 6.2% nationally. This was followed by a large increase between 1996 and 2001 of 11.8%, compared with a slight increase for the MDB (0.5%) and 6.0% nationally.
In-migration	√	Equivalent to Australia and higher than MDB average. Indicates reasonable turnover of jobs and regular inflow of residents and employees.	Between 1991 and 1996, the rate of migration into Balonne was about 7% lower than the rate between 2001 and 2006, lower than the rate for Australia but still higher than the MDB average rate. By comparison the MDB average rate was about 5% lower and the national rate was 5% higher.

Source: JSA

5 Bourke Shire

5.1 How Resilient is Bourke Shire Likely to be to Permanent Reductions in Water?

5.1.1 Summary

Findings for Bourke were not, on the face of it, supportive of our modelling, however the answer is likely to lie in changes in irrigation water overlaying long term structural decline rather than in the modelling. Changes in irrigation water appeared to ameliorate underlying structural decline in employment and population between 1996 and 2001, and exacerbate underlying structural decline between 2001 and 2006.

An important prediction of our modelling, that population decline would result in a residualised older and indigenous population, is supported by the data. Similar to Balonne, population was related to employment change, however population change was "sticky", with the change in population from changes in employment less than expected.

5.1.2 Overview of Findings from Report 4

Bourke has been relatively resilient to past challenges, despite its size and remoteness, in part due to the robustness of the agricultural sector and the more recent growth in irrigated agriculture, the level of public and community sector jobs due to its role as a service centre to more remote communities, and its 'iconic status' in the public imagination that supports outback and river-based tourism.

A permanent reduction in water is predicted to permanently constrain economic and social recovery of Bourke, and entrench and significantly worsen existing high levels of social disadvantage, particularly among its large indigenous population. Imposition of further permanent water reduction is likely to accelerate population and employment loss, and have serious associated impacts, as Bourke loses the critical mass to support higher order retail and services that are currently in place. Further permanent loss of water will undoubtedly be a major contributor to such a social 'tipping point' in a highly vulnerable area like Bourke. That said, Bourke's iconic status and its remoteness also continue to work in its favour.

5.1.3 Changes to irrigated agriculture 1996-2006

The table below shows changes to agriculture, including irrigated agriculture, in Bourke Shire between 1996 and 2006.

Table 26: Agricultural Land Use Bourke Shire 1996-2006 (Ha)

	Horticulture	Cotton	Grazing (1)	Other
1996	133	8,522	398,299	3,585
2001	325	13,367	4,016,069	5,821
2006	949	6,490	3,789,632	7,078

Source: ABS and JSA calculations

Table Notes:

(1) Data unreliable as definitions of range lands are not consistent over time.

5.1.4 Population and Employment Impacts Forecast

Predicted changes to employment and population

The primary impact of a reduction in irrigated agriculture was predicted to be a loss of employment, followed by a loss of population. Impacts were expected to be exacerbated by remoteness, degree of urbanisation and indigenous population; and, to a lesser extent, age and reliance on agriculture.

Employment increased by 2% with the increase in irrigated agriculture between 1996 and 2001, and fell by 16% between 2001 and 2006. Using land as a proxy for water use, the increase in irrigation was around 1.6 times between 1996 and 2001. Based on modelling in our Report 4, a 50% reduction in irrigation water use predicted an 8% decrease in employment, however this was based on changes in cotton production only. On this basis, a 1.6 increase predicts about a 10% increase in employment. Between 1996 and 2001, employment increased by 2%, much less than predicted. The reason for this is not obvious but may reflect the failure of increases in irrigation to offset ongoing structural declines in employment elsewhere in Bourke. Between 2001 and 2006, there was an approximate 50% decrease in irrigated agriculture, offset by some diversification into horticulture, with a 16% decrease in employment compared to our predicted 9%. The large than expected decrease is (at least partially) explained by the impact of the drought on grazing. Alternatively the difference between the two estimates and actual data is 7-8%, and the latter figure may represent long term underlying decline in employment.

This supports a view, as discussed in our Report 4, that Bourke is undergoing decline in employment generally, probably across retail, service and government sectors, and the impact of irrigated agriculture has been only to arrest that decline, rather than to produce significant growth in employment. This is further supported by an increase in the proportion of agricultural employment between 1996 and 2001, at odds with MDB and Australian trends, and by population data, with population decline experienced between 1996 and 2001, despite an increase in irrigated agriculture. Population decline for 1991-96 and 2001-06 is in line with

declines in employment as predicted by our modelling, although again there is evidence of 'stickiness', with change in population, both up and down, less than predicted by our model.

Predicted Changes in Indicators of Wellbeing and Resilience

Modelling of impacts on indicators of Community Wellbeing and Resilience for Bourke Shire also indicate serious adverse impacts on such indicators will accompany employment and population loss, in particular an increasingly residualised population among those who remain including more disadvantaged families, older and Aboriginal people. A further erosion of virtually all of the indicators measured is predicted. Notable changes [40] are projected to be:

- a decrease in median household income,
- an increase in the rate of those on disability support pension,
- an increase in profound or severe disability,
- an increase in unemployment, and
- less in-migration or population replacement in the case study area.

The primary impact of employment loss was expected to be an increase in age and in the proportion of indigenous population from a residualised population, with these variables strong predictors of other variables.

Growth in median household income was less than one quarter the growth in Australia in both periods. While not tracking changes in irrigation industries, the changes reflected population change, and supported the hypothesis of a residualised population with population decline.

There was an increase in disability support pension between 1996 and 2008, aligning with population change and again supporting the hypothesis of residualisation.

Unemployment grew much more rapidly than Australia. Analysis shows both characteristics are associated with increasing age and indigenous population again supporting the hypothesis of residualisation.

Change of address increased over the period, contrary to expectations. The reason is not clear.

Factors Affecting Wellbeing and Resilience

A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study,[41] including changes in employment and population. Our findings for the MDB were generally in line with other research on rural and regional communities, and included degree of remoteness, degree of urbanisation (population size), proportion of Aboriginal people particularly remote populations, [42] and median age of the population.[43] Degree

[40] More than 5% change

[41] JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri

[42] JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010)

of economic diversity and opportunities to diversify were also relevant factors identified in the literature,[44] though our findings indicate that these are largely a function of other things like remoteness, proximity to a large urban centre or to other economic resources like extractive industries.

The following table provides an overview of these key factors. In summary, Bourke Shire is likely to be very vulnerable to population and employment loss due to its remoteness, small size and distance from major service centres, large indigenous population and very high reliance on agriculture including irrigated agriculture. In its favour, it is an important service centre for even more remote communities and so has a much higher than average public and community sector employment. On the down side, a substantial component of such employment is likely to be related to the provision of services required to support a large population of very disadvantaged people particularly among the Aboriginal community, with high levels of reliance on Centrelink payments and social problems requiring significant resources (e.g. a very high per capita police force).

Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

[43] JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri

[44] JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri

Table 27: Key Factors in Community Resilience

Statistically Significant Factors	Likely to be Resilient?	Comment	Changes Over Time
Remoteness	X	Bourke is a 'Remote area' under the ABS Remoteness Classification and much more remote than the MDB average of areas, with some part of the Shire classified 'Very Remote'.	
Degree of Urbanisation: • Population Size • Proximity to a large regional centre	X X	Bourke Shire is below the 5,000 population threshold found to be critical for resilience in terms of having a localised economy heavily reliant upon agriculture. As such, it is very vulnerable to further population loss, or any constraints to recovery of population and employment following the prolonged drought. It is around 5 hours to its nearest regional centre of Dubbo and remote from major cities and the coast.	The population of Bourke has consistently been less than 5,000 persons since 1996, falling by about 700 persons (18%) between 1996 and 2006.
Indigenous Population	X	More than 6 times the MDB and 12 times the national average. Associated with significantly worse socio-economic outcomes.	Increased by 15% between 1996 and 2006 (from 25.6% to 29.4%), similar to the national increase of 15% (from 3.9% to 4.9%), but lower than the MDB average increase of 26% (from 3.9% to 4.9%). However, in actual numbers the indigenous population in Bourke actually decreased by about 50 (5%). The increase in proportion indigenous was due to a loss of about 650 non-indigenous persons over the ten year period.
Age	√?	Younger than the MDB and Australian median age. Likely due to the much younger age profile of its indigenous people, though also likely to be related to the regular turnover of younger professionals. Also younger people found in entry-level jobs, with higher retention of young people reported in irrigated agriculture.	The median age of Bourke increase by four years between 1996 and 2006, from 29 to 33. Comparatively, the MDB average median age increased by five years, from 35 to 40, and national median increased by three years, from 34 to 37.

Statistically Significant Factors	Likely to be Resilient?	Comment	Changes Over Time
% of employment by industry compared with Australian benchmark	**X?**	Very reliant on agriculture and directly related activities (25%) though slightly lower than the MDB average (29%) largely due to the relatively high level of public and community sector employment related to the large welfare sector and important role as a remote service centre. The local economy is highly reliant upon agriculture and government employment (directly or government-funded agencies), with these sectors accounting for at least 65% of employment in Bourke Shire compared with 29% for Australia and 53% for the MDB. A positive aspect of it remoteness is the likely retention of key services for an even more remote region. It is also noted that the vast majority of land is devoted to dryland grazing, and more than half of all direct agriculture is in this sector. As such, dryland grazing remains the major land use and an important employer, and the diversity provided by this alternative landuse is an important factor in resilience. However, employment per ha in dryland grazing is much lower than for irrigated agriculture, and substitution of irrigated agriculture with dryland agriculture as the next best use would lead to significant job losses as discussed below.	In Bourke between 1996 and 2006, there was a substantial decrease in the proportion of persons directly employed in agriculture of about 15%, similar to the MDB average decrease of 17%, but smaller than the national decrease of 27%.

Source: JSA

Current Status on Community Resilience Indicators

The current status of the community is also important in understanding its resilience or vulnerability to changes in employment related to a permanent reduction in irrigation water. The following provides a 'report card' and compares the current status of Bourke Shire with MDB and national benchmarks on key indicators of community resilience.

In summary, the following signifies an extremely disadvantaged community, mainly related to the very high indigenous population exacerbated by remoteness, much of this relates to its highly disadvantaged indigenous population, and there are likely to be more mixed or positive indicators for other residents including the high proportion of those in government and community sector jobs (both indigenous and non-indigenous workers).

The community experiences very poor health outcomes, has an extraordinarily high rate of violence and property crime, and very high levels of disadvantage against key indexes. It experienced significant population and employment loss from 2001-06, a sharp downturn after previous census periods that have shown smaller downturns or increases in employment, and likely related to the depth and severity of the drought. Bourke Shire has much lower than average school participation rates, low levels of post-secondary qualifications, very high unemployment rates, though general labour force participation rates are quite high and very high for those aged 65+ years. These types of human capital indicators may mean a less adaptive labour force to cope with changes in its agricultural base, though it is also likely that more employable people have left the area during the recent severe recent downturn.

Overall levels of educational and occupational resources are relatively high, however, most likely due to the high rate of public and community sector employment, and anecdotally of those engaged in irrigated agriculture and related sectors, and indicates a good resource for community leadership in this respect.

Table 28: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Changes Over Time
Community Wellbeing:			
SEIFA Disadvantage (includes indicators related to people's access to material and social resources, and their ability to participate in society)	X	Much lower than the MDB average and much lower than Australia, likely largely related to the high Aboriginal population and their severe levels of disadvantage	Also much lower than MDB average and Australia in 1996 and 2001. Consistently the second to third lowest score of the case study areas.
SEIFA Economic Resources (including income, housing expenditure and assets of households)	X	Much lower than the MDB average and much lower than Australia, likely related to high Aboriginal population, the lower value of residential property, capital assets, etc.	In 1996, Bourke had the lowest score of any of the case study areas, much lower than the MDB average and national scores. However, in 2001 its score was the fourth highest, higher than the MDB average score, but still substantially lower than the national score.
Median Household Income	√	Lower than Australia but much higher than the MDB average likely due to higher incomes and wages associated with public sector employment. Incomes are likely to be polarised between very low and quite high (see GINI Co-Efficient below)	Increased by $43 per week (5.5%) between 1996 and 2006 (once inflation is taken into account), while nationally there was an increase of $211 per week (29%) and on average in the MDB there was a drop of $25 per week (3.1%).
Social Capital /Volunteering rate	X	Lower engagement in voluntary activity than the MDB average, but much higher than Australia. Local civic leaders noted that they are actively engaging in activities to increase volunteering at the present time	Not included in the 1996 and 2001 censes.
Disability Support Pension (DSP)	X	Much higher than average reliance on DSP, likely due to the very high indigenous population, severe levels of disadvantage and related higher levels of disability despite the younger age profile	Increased by 23% between 1996 and 2008, while the rates for the MDB average and Australia increased by 30% and 26% respectively. Rate for Bourke in 1996 was also higher than MDB average and national rates.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Changes Over Time
Premature Death	X	Double the national average and much higher than the MDB, most likely related to the very high Aboriginal population (e.g. much higher rates of diabetes, heart disease, etc.) and their severe levels of disadvantage, and possibly due to higher rates of accidents and suicide	Increased by 48 persons per 100,000 (9.4%) between mid-nineties and 2008, MDB average remained similar and national rate increased by 31 persons per 100,000 (13.7%). Rate for Bourke in mid-nineties was also much higher than MDB average and national rates.
Profound or severe disability	?	Much lower than both the MDB and Australian average, which may be due to the younger age profile, but also may be unreliable due to sampling error and the above two indicators.	
Chronic Ill Health	X?	Not reported due to sampling error, but likely to be high given the premature death rate high level of reliance on Disability Support Pension.	
Self-reported health 'fair' or 'poor'		Quite high at 18.6%, the second highest rate of the case study areas in 2007/08, 22% higher than the MDB average rate of 15.2% and 27% higher than the national rate of 14.7%.	In 1995, the rate in Bourke was similar to the MDB average and national rates, but increased by 24% (from 15.0% to 18.6%) between 1995 and 2007/08. The MDB average and national rates in 1995 were similar to their respective 2007/08 rates, though they did both peak in 2004/05 at 16.7% and 15.6% respectively.
Domestic Violence- Related Assaults	X	More than 10 times the NSW rate, and over 6 times the MDB average of areas	Increased by 891 incidents per 100,000 persons (29%) between 1996 and 2006, compared with an increase of 91 incidents per 100,000 persons (16%) for the MDB average of areas in NSW and 164 incidents per 100,000 persons (72%) for NSW. Still much higher in 1996 and 2001 than the MDB average and state.
Non-Domestic Violence-Related Assaults	X	More than 6 times the NSW rate, and over 4 times the MDB average of areas	Also very high in 1996 and 2001, about four times the MDB average of areas in NSW and six times the rate for the state. Rate fell by 148 incidents per 100,000 persons (3.6%) between 1996 and 2006, while for the NSW MDB average rose by 72 (9.5%) and in the state rose by 87 (16%).

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Changes Over Time
Aggregate Property Crime	X	Around 4 to 5 times the NSW and MDB average of areas	Also very high in 1996 and 2001, over three times the NSW MDB average and almost three times the rate for NSW. Rose by about 1,800 incidents per 100,000 persons (8.8%) between 1996 and 2006, while the NSW rate fell by about 1,300 (22%) and the NSW MDB average rate in 1996 was similar to its 2006 rate.
Economic growth/Human Capital:			
Change in Total Employment 2001-06	X	Significant employment loss during drought period 2001-2006 (-16.1%), and a sharp downturn after previous census periods that have shown smaller downturns or even increases in employment.	Bourke also had quite a large period of employment loss between 1991 and 1996, during which time the number of persons employed fell by 9.0%, compared with an average decrease of 0.5% in areas in the MDB and an increase of 7.8% nationally. This was followed by an increase of 1.5% between 1996 and 2001, compared with 5.1% for the MDB average and 8.7% for the nation.
Labour force participation 15+ years	√	Slightly higher than the MDB and national average, which will also include the high proportion of those unemployed who are assumed to be actively seeking work. Also relates to the reportedly high level of entry-level jobs, and very high rate of labour force participation among older people.	Has increased by 3.3% between 1996 and 2006, while MDB average and national rates have remained very similar (0.2% and 0.8% change respectively). Rates in 1996 and 2001 also slightly higher than MDB average and national rates.
Labour force participation 65+ years	X?	Very high older work force. Also likely out-migration of retirees, which increases % of older workers of those remaining. The advantages of skills and experience of older workers was also noted in consultations, and the opportunities for continued participation of older people who want to continue working compared with metropolitan areas. A younger age among those in irrigated agriculture was also reported anecdotally.	Increase of 24% between 1996 and 2006, compared with 8.5% increase in areas in the MDB on average and 42% nationally. Labour force participation rate of persons aged 65 years and over was also substantially higher in Bourke in 1996 and 2001 than in the MDB on average and over three times the national rate.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Changes Over Time
Post-school qualification (skills base)	X	Rate of those with trade, degree or better qualification was lower than MDB and much lower than the national average, likely related to the Aboriginal population and nature of local jobs.	Between 1996 and 2006 the proportion of persons with tertiary qualifications increased by almost 50%, while in the MDB on average the proportion increased by 39% and nationally by 32%, meaning that Bourke did catch up somewhat in that ten-year period.
School participation at 16 years	X	Much lower than the MDB and national average of school retention, likely among the large indigenous youth population.	
Rate of participation in secondary school		In 2006, Bourke had a low secondary school participation rate of 63%, compared with 75% on average for areas in the MDB and 77% nationally. Fourth lowest of the case study areas.	Increased by 5.9% between 1996 and 2006 (from 59.6% to 63.1%), compared with an average decrease of 2.1% for areas in the MDB (from 76.7% to 75.1%) and a 2.8% decrease nationally (from 79.3% to 77.1%). Substantially lower than MDB average and national rates between over the ten year period.
SEIFA Index of Education and Occupation (includes relevant Census variables on the general level of education and occupation-related skills and status of a community)	√	Interestingly, performs quite well on this broad indicator of human capital, indicating the presence of sufficient people with higher educational and occupational status to balance out other individual indicators. The presence of a large public and community service sector is noted in this regard, and the presence of a good resource for community leadership, also noted in consultations	Did rise somewhat between 1996 and 2006. Had a higher score than the MDB average score in 1996 and 2001, though substantially lower than the national score.
GINI co-efficient of household income distribution	X	Like the MDB average, this indicates that incomes tend to be polarised at the high and lower ends of the spectrum	Increased substantially (from 0.38 to 0.42) between 1996 and 2006, meaning that the area has become more polarised in terms of household incomes. Comparatively, on average areas in the MDB have increased from 0.37 to 0.39 and Australia had a score of 0.39 in both 1996 and 2006, though it did fall to 0.36 in 2001.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Changes Over Time
Youth unemployment rate	X	Very high relative youth unemployment (around 17% compared with 10% in MDB and nationally), most likely concentrated among Aboriginal young people. Nonetheless, difficulties sourcing workers and the need to source external labour for some jobs was noted during consultations, especially as the local economy begins to recover after recent floods/ high rainfall	Was also about 17% in 1996, though fell to about 10% in 2001 before increasing again. Comparatively, the MDB average rate fell by 39% between 1996 and 2006, and the national rate fell by 35%. The youth unemployment rate in Bourke in 1996 was similar to the MDB average, though still higher than the national rate, and in 2001 was lower than both the MDB average and national rates.
General unemployment rate	X	Higher than the MDB and national average, though again demand for workers was noted with the breaking of the drought.	Increased by about 60% between 1996 and 2006. Rates in 1996 and 2001 were similar to MDB average rates and substantially lower than national rates.
Amenity:			
Population Growth /Retention 2001-06	X	Significant loss of population (-14.6%) compared with MDB average (no change). Though there has been a gradual long-term loss of population, this has fluctuated probably with climatic and market variations and technological change, and government regional development and servicing policies. The sharp decline between 2001-06 was not characteristic of previous fluctuations and is likely due to length and severity of the drought.	Bourke experienced a loss of population both between 1991 and 1996, of 9.3%, and between 1996 and 2001, of 3.5%, compared with only slight changes on average in areas in the MDB and a 6% increase per five-year period nationally.
In-migration	?	Slightly lower than the MDB average, though there is a regular in-flow of professionals into public and community sector jobs.	The rate of migration into Bourke increased slightly (by 5.2%) between 1996 and 2006, compared with a 5.6% increase in the MDB on average and a 4.7% decrease nationally. Lower than MDB average and national rates in 1996 and 2001.

Source: JSA

6 Campaspe LGA

6.1 How Resilient is Campaspe LGA Likely to be to Permanent Reductions in Water?

6.1.1 Summary

There has been little variation in irrigation water use in Campaspe LGA over the period 1996 to 2006. Generally employment and population growth independent of increases in irrigation support our conclusion of a relatively resilient community, due to the presence of other factors. There is insufficient data to form a view as to the historical sensitivity of Campaspe LGA to permanent reductions in water, although expansion of irrigation between 1996 and 2001 was accompanied by employment growth above that for Australia generally.

6.1.2 Overview of findings from Report 4

The Campaspe case study area has a number of positive attributes and indicators of community wellbeing and resilience such as its proximity to large regional and urban centres, location on the river and associated amenity values which make it attractive as a 'tree change' location, and positive outcomes for some health, education and employment indicators.

Despite these positive attributes that are likely to assist some individuals and the community to be more resilient in the face of change, there are other attributes about the area that indicate vulnerabilities. These potential vulnerabilities include its moderate population size, its reliance on agriculture and related industries, its location outside a major transport route unlike other nearby large centres (such as Shepparton) that are more likely to be able to diversify into other industries, the older age profile of the population and its future requirements, and that population growth in Echuca is due to decline in the hinterland. As a result of these potential vulnerabilities, impacts of reduced water availability for irrigation are likely to be more significantly felt in the smaller and more agriculturally dependent towns within the LGA. These areas are more likely to have experienced adverse impacts, including employment and population loss, due to the drought and downturn of the dairy industry in recent years. The extent to which the opportunities available in Echuca are able to offset the declines and losses in the smaller towns throughout the LGA, not to mention replace opportunities for those who cease farming, is uncertain. However, the high degree of dependence on agriculture and related activities, as well as the relatively limited opportunities for industry diversification apparent from the current employment profile, indicate that this is area that would be vulnerable to such changes.

6.1.3 Changes to irrigated agriculture 1996-2006

The table below shows changes to agriculture, including irrigated agriculture, in Campaspe LGA between 1996 and 2006.

Table 29: Agricultural Land Use Campaspe LGA 1996-2006 (Ha)

	Horticulture	Cotton	Grazing (1)	Rice	Other
1996	2,140	0	165,221	0	76,030
2001	3,509	0	271,973	55	105,617
2006	3,934	0	218,724	83	111,505

Source: ABS and JSA calculations

Table Notes:

(1) Data unreliable as definitions of range lands are not consistent over time.

6.1.4 Population and Employment Impacts Forecast

Predicted changes in employment and population

There is no evidence of a reduction in irrigation in Campaspe over the time period considered. This is in line with our field research and other data showing that the impacts of drought were not experienced in high security water until 2007-08, after the census; however reductions may have been experienced in irrigation water for dairy and other uses during 2006-07 depending on trade and security. In 2006, horticultural uses applied around 16.3 Gl of water (including 1 Gl for rice at 12.3 Ml per ha), suggesting usage in 2001 was 14.5 Gl and usage in 1996 was 8.7 Gl. Based on 2006 data, horticulture was about 4% of irrigation water use, suggesting an increase in irrigation water of about 2% between 1996 and 2001, and 0.5% between 2001 and 2006.

Based on Report 4 modelling, employment growth of about 1% would be expected between 1996 and 2001, with only slight employment growth between 2001 and 2006. Similar impacts would be expected for population change. It is not clear whether the growth was additional water used, or whether it reflected changes in use of water in the area, consequently any conclusions should be treated with caution.

Employment growth in 1996-01 was 102% of the Australian value, while in 2001-06 it was 40%. Population growth was 65% and 42% respectively of the Australian value. This suggests some employment growth associated with expansion of irrigation between 1996 and 2001, but it is difficult to form a conclusion as to the quantum and degree.

There is insufficient detectable variation in water use in Campaspe to test the predictions of Report 4 with respect to the impacts of reductions in irrigation water. Underlying employment and population growth, some 3-4% above the average for MDB areas, support the conclusion of a more resilient economy by comparison with areas such as Balonne and Bourke.

Predicted Changes in Indicators of Wellbeing and Resilience

Little or no variation in indicators of wellbeing and resilience was predicted in Campaspe from reductions in irrigation water, and there is little apparent variation in irrigation water use to detect any trends.

Factors Affecting Wellbeing and Resilience

Campaspe LGA has a number of positive indicators of wellbeing and resilience including its proximity to larger urban centres such as Bendigo and Melbourne, size, and low level of indigenous residents suggest that it is likely to experience less adverse impacts on indicators of wellbeing than some areas with populations that are more remote and perhaps residualised. However, its population size has not reached the critical mass of a large regional centre[45] that makes it independent of the fortunes of its agricultural base, and its employment remains reliant on irrigated agriculture and associated industries, particularly dairy. Reduced capability, output and employment in these industries will likely have an impact on total employment, population and resilience due to this reliance. The following table provides an overview of the key factors for the Campaspe case study area showing changes with time.

[45] JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

Table 30: Key Factors in Community Resilience

Statistically Significant Factors	Likely to be Resilient	Comment	Changes Over Time
Remoteness	√	Much less remote than MDB average with 'Regional Centre' ABS status	
Degree of Urbanisation: • Population Size	√?	Campaspe LGA at 36,000 residents has not reached a 'critical mass' of 50,000, but is reported to be getting larger retail stores that would previously have attracted people to Bendigo and Shepparton. However, it would probably not want to lose population at this stage.	Population has been under the 50,000 persons threshold since 1996, increasing by about 2,000 persons (6%) between 1996 and 2006.
• Proximity to a large regional centre	√	Reasonable proximity to Melbourne and Bendigo so advantage for 'tree change' and tourism.	
Indigenous Population	√	Much lower than MDB average, lowest of the case study areas.	Increased by 29% (from 1.4% to 1.8%) between 1996 and 2006, slightly higher than the average increase of 26% for areas in the MDB (from 3.9% to 4.9%) and much higher than the national increase of 15% (from 2.0% to 2.3%).
Age	X ?	Equal to MDB average but much older than Australia, and oldest of case study areas. Older farmers and smaller rural communities, as well as reported 'tree change' relocation to area. Issues of succession planning and future workforce.	In Campaspe, the median age increased by four years between 1996 and 2006, from 36 to 40. Comparatively, the MDB average increased by five years, from 35 to 40, and the national median increased by three years, from 34 to 37.
% of employment by industry compared with Australian benchmark	X	Lower than MDB and national averages for economic diversity. Remains highly reliant on agriculture and related industries. Decline in agriculture would need to be offset by new or expanded industries. Tourism is perceived to be strong but employment in key sectors such as accommodation, food and recreation are average or below average. Therefore, visitation does not necessarily seem to be translating	Large decrease of 30% in the proportion of persons directly employed in agriculture between 1996 and 2006, substantially larger than the average decrease of 17% in areas in the MDB and slightly larger than the national decrease of 27%.

Statistically Significant Factors	Likely to be Resilient	Comment	Changes Over Time
		into jobs.	

Status on Community Resilience Indicators

The following table provides a 'report card' on the extent to which the current status of Campaspe LGA compares with the MDB and National benchmarks. Findings show a community that has prospered from its agricultural base and likely proximity to other centres in terms of lower levels of disadvantage, low unemployment rates and higher school participation rates. The older age profile of the community is likely related to its performance against health and disability indicators, which likely signifies the influx of retirees to the area as well as the ageing of the existing population.

Table 31: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Likely to be Resilient	Comment	Changes Over Time
Community Wellbeing:			
SEIFA Disadvantage	√	Less disadvantaged than MDB average, though more disadvantaged than Australia. Became more disadvantaged since 2001, though this likely related to an ageing population.	In 1996 and 2001 Campaspe was the least disadvantaged of the case study areas, with a score on par with the national score, and less disadvantaged than areas in the MDB on average.
SEIFA Economic Resources	√	Higher value than the MDB average, and lower than Australia. Residents have greater access to economic resources than MDB, which indicates higher incomes and higher level of home ownership than lower incomes and low rents.	In 1996 Campaspe had the second highest score of the case study areas, higher than the MDB average score but lower than the national score. By 2001, however, it had fallen to the fourth lowest of the areas, though still somewhat higher than the MDB average.
Median Household Income	√	At $791 per week, its median household income is much lower than Australia ($1027) but higher than MDB average of areas ($779).	In 1996, the median household income in Campaspe was higher than for the MDB average and Australia by over $100 per week. Between 1996 and 2001, however, it fell by about $150 per week (with inflation taken into account), while in areas in the MDB on average it fell by about $50 per week and nationally rose by about $90. The result of this was that in 2001, while still about $20 per week higher than the MDB average, it was about $130 per week lower than the national median.
Social Capital:			
Volunteering rate	√	Just above MDB average, and much higher than Australia.	Not included in 1996 and 2001 censes.
Disability Support Pension	√?	On par with MDB but higher than Australia. Likely related to older population.	In 1996, was higher than MDB average rate (by 13%) and national rate (by 40%). Rose by 13% between 1996 and 2008, while MDB average rate rose by 30% and national rate rose by 26%.
Premature Death	√	Lower than MDB but higher than Australia.	Rose by 10 deaths per 100,000 persons (3.7%) between the mid-nineties and 2008, while MDB average rate fell by four (1.3%) and national rate rose by 31 (13.7%).

Proxy Indicator of Resilience	Likely to be Resilient	Comment	Changes Over Time
Profound or severe disability	X	Higher than MDB and Australia. Likely related to older population.	
Chronic Ill Health	√?	Equal to MBD average but higher than Australia, again likely related to older population.	
Self-reported health 'fair' or 'poor'		In 2007/08, 15.5% of Campaspe residents aged 15 years and over reported their health as 'fair' or 'poor', 2.0% higher than the MDB average rate of 15.2% and 5.4% higher than the national rate of 14.7%.	Between 1995 and 2007/08, fell by 3.1% (from 16.0% to 15.5%), while the MDB average rate fell by 1.3% (from 15.4% to 15.2%) and the national rate by 2.0% (from 15.0% to 14.7%). The MDB average and national rates peaked in 2004/05 at 16.7% and 15.6% respectively.
Economic Growth:			
Change in Total Employment 2001-06	√	At 3.9%, three times the MDB average but only one-third of national growth. However, reported to be job losses since 2006 arising from closure of a number of enterprises and downturn in dairy.	Rose by 4.7% between 1991 and 1996, compared with a 0.5% decrease in areas in the MDB on average and a 7.8% increase nationally, and rose by a further 8.9% between 1996 and 2001, compared with a 5.1% increase for the MDB and 8.7% nationally.
Labour force participation 15+ years	X	Slightly lower than MDB and Australia. Possible early retirement, but also note higher school retention rate.	Rose by 2.4% between 1996 and 2006, compared with a 0.2% increase in areas in the MDB on average and a 0.8% increase nationally.
Labour force participation 65+ years	√	Much lower than MDB average and low for a rural area. Likely influenced by early retirement, with farmers likely to be older – as demonstrated by age profile of the Lockington hinterland.	Rose by 17.0% between 1996 and 2006, compared with an increase of 8.5% for areas in the MDB on average and 42% nationally. Lower than the MDB average rate between 1996 and 2006, but higher than the national rate.
Post-school qualification (skills base)	√?	On par with MDB but much lower than Australia. Highest of the case study areas.	Between 1996 and 2006, the proportion of persons aged 15 years and over with tertiary qualifications rose by 38% (from 23.0% to 31.7%), remaining in line with the average rate for areas in the MDB, though substantially lower than the national rate, which rose by 32% (from 29.8% to 39.4%).
School participation at 16 years	√	Much higher than MDB average and higher than Australia. Reported that may be related to few entry-level jobs in	

Comment	Changes Over Time
agriculture and related industries and encouragement to stay at school.	
In 2006, Campaspe had quite a high secondary school participation rate of 80%, compared with 75% on average in areas in the MDB and 77% nationally, and the highest rate of the eight case study areas.	Quite a large decreased of 6.1% between 1996 and 2006 (from 84.9% to 79.7%), compared with an average decrease of 2.1% for areas in the MDB (from 76.7% to 75.1%) and a 2.8% decrease nationally (from 79.3% to 77.1%).
Well below MDB average and much lower than Australia. Reflects overall human capital resources, the nature of employment and possibly an ageing population.	In 1996 and 2001, score was similar to the score for the MDB average, though still well below the national score.
Like other areas of the MDB, the Campaspe shows quite a high level of polarisation between the 'haves' and 'have nots' based on household income.	Rose from 0.37 to 0.39 between 1996 and 2006, as did the MDB average.
Lower than MDB and Australian averages, may also reflect higher school retention rate. Perception that this may have worsened with reduced agricultural production since 2006.	The youth unemployment rate in Campaspe fell substantially between 1996 and 2006, from 13.5% to 9.3% (a fall of 31%), while the MDB average rate fell from 17.0% to 10.4% (a fall of 39%) and the national rate fell from 15.7% to 10.2% (a fall of 35%).
Lower than average, but perception that this may have worsened with reduced agricultural production since 2006.	Lower than the MDB average and national rates in 1996 and 2001, peaking in 2001 as it also did in the MDB and Australia. Rose by 14.6% between 1996 and 2006, while in the MDB the rate rose by 6.3% on average and nationally fell by 1.4%.

Proxy Indicator of Resilience	Likely to be Resilient	Comment	Changes Over Time
Population Growth /Retention	√	Reasonable population growth at double the MDB average but only half the national rate.[46] Population growth of Echuca likely to be coming equally from small towns and hinterland within LGA and from outside the LGA. Some smaller towns and villages likely to be more vulnerable to reduced water and resultant population loss than Echuca.	Population rose by 4.6% between 1991 and 1996, compared with a fall of 0.2% on average for areas in the MDB and a 6.2% rise nationally. This was followed by another period of growth between 1996 and 2001 of 3.9%, compared with 0.5% for the MDB and 6.0% for the nation.
In-migration	√?	Same as MDB average. Likely equally due to 'tree changers' arriving from outside LGA, and also from those Campaspe residents moving into Echuca from the hinterland and smaller towns.	Also similar to MDB average rate between 1991 and 2001, and somewhat lower than the national rate. Rate rose by 2.3% between 1996 and 2006, while in the MDB it rose by 5.6% and nationally fell by 4.7%.

Source: JSA

[46] Note that there is a discrepancy between population change for Campaspe LGA between the two ABS measurements by 'place of usual residence' and 'place of enumeration'; this is discussed further at section 3.4.3.

7 Dalby-Wambo

7.1 How Resilient is Dalby-Wambo likely to be to permanent reductions in water availability?

7.1.1 Summary

7.1.2 Overview of findings from Report 4

Dalby-Wambo appears to be quite resilient, with very low levels of unemployment, relatively stable population base over the past 30 years, a small amount of recent population and employment growth and a diverse, and an expanding economic base. It is also less disadvantaged than the other Northern Basin case study areas, and compares quite favourably on most indicators of wellbeing. It is relatively close to the major service centres of Toowoomba, Brisbane and the coast, which is likely to be an attractive location for relocation of younger and older people. Dalby has the critical mass of services and facilities to support a population of 15,000 in town and its immediate hinterland. These attributes are likely to mitigate the loss of agricultural employment to some extent, particularly in the short-to medium-term, if water availability for agriculture were to decline significantly. They indicate that the area is far less vulnerable to the short-term shocks and long-term stress than more remote case study areas in the Northern Basin like Moree Plains, Bourke and Balonne Shires, which have a far less diverse economic base and less favourable locational attributes.

7.1.3 Changes to irrigated agriculture 1996-2006

The table below shows changes to agriculture, including irrigated agriculture, in Dalby-Wambo between 1996 and 2006.

Table 32: Agricultural Land Use Dalby-Wambo 1996-2006 (Ha)

	Horticulture	Cotton	Grazing (1)	Other
1996	190	24,869	64,991	155,801
2001	333	24,170	270,394	190,222
2006	157	17,944	228,932	155,433

Source: ABS and JSA calculations

Table Notes:

(1) Data unreliable as definitions of range lands are not consistent over time.

7.1.4 Population and Employment Impacts Forecast

Predicted changes in population and employment

The effects of cuts to irrigation water on Dalby-Wambo are small by comparison with other case study areas. This is because irrigated agriculture forms a small proportion of agricultural industries in the area and there are important non-agricultural industries in the area.

Between 1996 and 2001 there was a 2% increase in use of irrigation water (using land area as a proxy) with a 26% decrease between 2001 and 2006. The 2% increase is predicted to be undetectable, with the 26% decrease predicting a 0.3% decrease in employment and a 0.4% decrease in population.

Between 1996 and 2001, employment gain in Dalby Wambo was 40% of the Australian value and 69% of the MDB value. Values for 2001-06 were 15% and 125% respectively. This suggests that Dalby-Wambo is less responsive than a typical MDB area to changes in agriculture, supporting the Report 4 conclusion of a resilient community. Nonetheless, drought in 2006 has had an impact on employment growth although the impact is much less than that experienced in other northern case study areas.

Predicted Changes in Indicators of Wellbeing and Resilience

Modelling of impacts on indicators of community wellbeing and resilience for Dalby-Wambo from reduced water availability predict that these indicators are expected to be generally unchanged.

Factors Affecting Wellbeing and Resilience

Dalby-Wambo is well positioned against the key factors found to affect community wellbeing and resilience. The area's location on primary transport routes and its close proximity to a larger regional centre (Toowoomba) and a capital city (Brisbane) are key strengths. While its population is around 15,000, not yet achieving the critical mass of larger regional centres, it services many more remote and smaller communities further to the west for particular products and services related to agriculture and mining. While agriculture plays a dominant role in the local economy, it is also reasonably diverse with value adding industries as well as significant employment in manufacturing, mining and energy. Moreover, as the mining and energy sectors further develop in the coming years this diversity and strength in other areas beyond agriculture is likely to continue.

As such, though there may be adverse impacts on agriculture from permanent reductions in surface water through existing and forthcoming Federal policy, the fortunes of Dalby-Wambo are not as tied to its agricultural base as other smaller, more remote and less economically diverse case study areas in the Northern or Southern Basin. In any case, as noted earlier, these are overshadowed currently by potential groundwater and land use impacts related to expansion of extractive industries. The following table provides an overview of these key factors, including trends with time.

Table 33: Key Factors in Community Resilience

Statistically Significant Factors	Likely to be Resilient?	Comment	Changes Over Time
Remoteness	√	One of the least remote case study areas under the ABS Remoteness Classification, and less remote than MDB average.	
Degree of Urbanisation: Population Size	√?	Dalby-Wambo has over 15,000 people, and services a wider amalgamated LGA of around 30,000 people. It is also a service centre for a wider hinterland for mining and agriculture related products and services.	Dalby-Wambo has grown since 1996, with the population increasing by about 300 persons (2%) between 1996 and 2006, from 14,700 to 15,000.
Proximity to a large regional centre	√	Within commuting distance to Toowoomba (< 1 hr) and to Brisbane and the coast (2.5 hrs).	
Indigenous Population	√	Equivalent to MDB average (4.9%), but higher than Australia. Limited impacts on indicators of wellbeing and resilience expected (2.3%).	Indigenous population increased by over 60% (from 3.0% to 4.9%) between 1996 and 2006, a much larger increase than for areas in the MDB on average and Australia, where there was an increase of 26% (from 3.9% to 4.9%) and 15% (from 2.0% to 2.3%) respectively.
Age	√	Younger than the MDB and Australian median age. Likely to attract and retain a younger workforce including in entry-level jobs in agriculture, mining and related sectors. The strong agricultural sector is also reported to be leading to greater retention of younger people than some areas.	Between 1996 and 2006, the median age in Dalby-Wambo increased by three years, from 33 to 36. Nationally there was also a three year increase, from 34 to 37, while in areas in the MDB on average there was a higher increase of five years, from 35 to 40 years.
% of employment by industry compared with Australian benchmark	√?	Reasonably diverse economic base compared with MDB, but not as diverse as Australia. Some benefits of being a district service centre, and having other opportunities in manufacturing, mining and energy. Remains relatively dependent upon agriculture and related industries (e.g. value-adding and services to agriculture).	Little change in the proportion of persons directly employed in agriculture between 1996 and 2001, but then a very large decrease of 24% between 2001 and 2006. Comparatively, between 1996 and 2006 there was a 17% decrease on average in areas in the MDB, and a 27% decrease nationally.

Source: JSA

Current Status on Community Resilience Indicators

The current status of Dalby-Wambo regarding key socio-economic indicators is necessary to understand its resilience or vulnerability to changes in employment related to reduced water availability. The following provides a 'report card' on the extent to which the current status of Dalby-Wambo compares with the MDB and National benchmarks.

In summary, the following shows a community that has prospered from its agricultural base and related industries, its proximity to a larger regional centre and capital city in terms of lower levels of disadvantage, higher levels of economic resources, low levels of unemployment and steady employment and population growth. However, there are some indicators of vulnerability including relatively low education and occupation index, low skills base, low level of school participation at 16 years and mixed health indicators. The adaptive capacity of the workforce may be an issue if there is a change in availability of lower skilled jobs, or significant structural economic change. There also appears to be significant turnover in the population with a high level of in-migration yet modest overall growth, which may reflect a more transient and less stable community. Moreover, the inter-censal statistics indicates an area that is not 'booming' but rather 'holding its own'.

Table 34: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Change Over Time
Community Wellbeing:			
SEIFA Disadvantage (includes indicators related to people's access to material and social resources, and their ability to participate in society)	√	Less disadvantaged than MDB, though more disadvantaged than the Australian value.	Dalby-Wambo was the third least disadvantaged of the case study areas in 1996, and the second least disadvantaged in 2001, having a score higher than the MDB average score in both years, though somewhat lower than the national score.
SEIFA Economic Resources (including income, housing expenditure and assets of households)	√	Higher than the MDB, but lower than the Australian average. Residents have greater access to economic resources than MDB, indicates higher incomes and higher level of home ownership, higher value assets, better incomes, etc.	Third highest of the case study areas in 1996, though second lowest in 2001. In both 1996 and 2001, had a similar score to the MDB average, though much lower than the national score.
Median Household Income	√	Lower than Australian median, but much higher than the MDB average, likely due to increased diversity of jobs including in construction, manufacturing and mining and those associated with a regional centre including professional services.	In 1996, the median household income in Dalby-Wambo was about $100 higher than for the MDB average and Australia. However, between 1996 and 2001 this fell by about $140 per week (taking inflation into account), meaning that in 2001 the median for Dalby-Wambo was about $20 per week higher than the MDB average but $135 lower than for Australia. Between 2001 and 2006 this recovered to about $10 per week lower than its 1996 value.
Social Capital /Volunteering rate	√?	Slightly lower than MDB average, but much higher than Australia and higher than many of the case study areas.	Not included in the 1996 and 2001 censes.
Disability Support Pension	√	Slightly lower than MDB average but higher than Australia, in part likely to be due to the range of services available as a regional service centre.	Increased by 8.5% (from 5.9% to 6.4%) between 1996 and 2008, while on average the rate for areas in the MDB increased by 30% (from 5.3% to 6.9%) and the national rate rose by 26% (from 4.3% to 5.4%).

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Change Over Time
Premature Death	X	Slightly higher than MDB and Australian average, may be due to a higher level of industry-related accident and injury, and suicide, and possibly disadvantaged populations including indigenous people.	Rose by 77 deaths per 100,000 persons (31.7%) between the mid-nineties and 2008, while the MDB average rate fell by four deaths per 100,000 persons (1.3%) and the national rate rose by 31 (13.6%). Between 1992 and 1995, the average rate of premature death in Dalby-Wambo was about 7% higher than the national rate, and 19% lower than the MDB average rate.
Profound or severe disability	√	Lower than both the MDB and equivalent to Australia, likely due to a lower median age.	
Chronic Ill Health	X	Higher than both the MDB and Australian averages, potentially due to some industry and demographic effects, and being a better-serviced centre.	
Self-reported health 'fair' or 'poor'		In 2007/08, 16.8% of Dalby-Wambo residents aged 15 years and over reported their health as 'fair' or 'poor', 11% higher than the MDB average rate of 15.2% and 14% higher than the national rate of 14.7%.	In 1995, the rate for Dalby-Wambo was 14.8%, slightly lower than the MDB average and national rates of 15.4% and 15.0% respectively. Between 1995 and 2007/08, however, this rate increased to 16.8%, a 13.5% increase. The MDB average and national rates in 1995 were similar to their respective 2007/08 rates, though they did both peak in 2004/05 at 16.7% and 15.6% respectively.
Economic growth/Human Capital :			
Change in Total Employment 2001-06	√?	Equivalent to MDB at 1.5%, but much lower than Australia's total growth (almost 10%). Not 'booming' but 'holding its own', with construction and development associated with mining, energy and residential sectors occurring, and some buffering against drought effects experienced in other parts of the Northern Basin probably due to greater economic diversity.	Has experienced employment growth since 1991, with the number of employed persons increasing by 3.1% between 1991 and 1996, and by 3.5% between 1996 and 2001, compared with national growth rates of 7.8% and 8.7% respectively, and on average in the MDB a fall of 0.5% between 1991 and 1996, and growth of 5.1% between 1996 and 2001.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Change Over Time
Labour force participation 15+ years	√	Slightly higher than MDB & national average. Likely influenced by opportunities for entry-level and higher skilled jobs in agriculture, mining and related sectors.	Remained almost unchanged between 1996 and 2006, as it did in areas within the MDB on average and nationally.
Labour force participation 65+ years	X	Slightly higher than the MDB, and double the national average. Likely associated with an older farming work force, though also reported to be reasonable retention of younger people in more profitable sectors like cotton.	Increased by 29.4% (from 12.6% to 16.3%) between 1996 and 2006, while in areas in the MDB on average the increase was 8.5% (from 14.2% to 15.4%) and nationally 42.4% (from 5.9% to 8.4%). The rate in Dalby-Wambo in 1996 was about 11% lower than the MDB average and about double the national rate, but by 2001 it was 12% higher than the MDB average rate.
Post-school qualification (skills base)	X	10% lower than MDB and 28% lower than the national average, likely related to availability of entry-level job opportunities and the nature of industry sectors. Raises issues related to adaptive capacity of the local workforce in relation to structural change.	Increased by 40% between 1996 and 2006, compared with a similar increase on average for areas in the MDB and a 32% increase nationally. In 1996, the rate was 11% lower than the MDB average rate and 32% lower than the national rate.
School participation at 16 years	X	10% lower than MDB and 15% below Australia, again likely related to availability of entry-level jobs, and low youth unemployment rate. Again raises issues related to adaptive capacity of the local workforce in relation to structural change.	
Secondary school participation rate		In 2006, Dalby-Wambo had quite a low rate of secondary school participation of 63%, compared with an average rate of 75% for areas in the MDB and 77% for Australia. Third lowest rate of the eight case study areas.	Fell by 7.4% between 1996 and 2006 (from 68.0% to 63.0%), quite a large decrease compared with an average decrease of 2.1% for areas in the MDB (from 76.7% to 75.1%) and a 2.8% decrease nationally (from 79.3% to 77.1%).

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Change Over Time
SEIFA Index of Education and Occupation (brings together relevant Census variables on the general level of education and occupation-related skills of people within an area)	X	Well below MDB average and much lower than Australia, likely reflecting underlying lower level of human capital resources related to the nature of local employment. Indicates there may be many people with few qualifications, or unemployed or in low skilled occupations; and few people with a high level of qualifications or in highly skilled occupations. Again, the adaptive capacity of the workforce may be an issue if there is a change in availability of lower skilled jobs.	Dalby-Wambo had the third lowest score of the case study areas in 1996, though by 2001 it had the second highest. Its 1996 and 2001 scores were similar to the MDB average scores, though still substantially lower than the national scores.
GINI co-efficient of household income distribution/polarisation	X	Like other areas of the MDB, Dalby-Wambo shows quite a high level of polarisation between the 'haves' and 'have nots' based on household income.	Rose from 0.36 in 1996 to 0.38 in 2006, generally having a slightly lower score than the MDB average and Australia over the ten year period.
Youth unemployment rate	√?	Lower than average youth unemployment, this is reported to be lower since the post-2006 expansion of mining and energy. Reports of recent labour and skill shortages for agriculture and other industries, and impacts on cost and supply of labour through competition with mining and energy sector.	Fell by 31% (from 12.7% to 8.7%) between 1996 and 2006, compared with a fall of 39% (from 17.0% to 10.4%) for areas in the MDB on average and 35% (from 15.7% to 10.2%) for the nation.
General unemployment rate	√?	Lower than average unemployment, which is again reported to be lower since the post-2006 expansion of mining and energy. Reports of recent labour and skill shortages, and again increased competition for labour.	In 1996, the general unemployment rate was 4.1%, compared with a rate of 4.8% for the MDB average and 7.4% for the nation. This then peaked at 6.2% in 2001, compared with 6.3% for the MDB average and 9.2% for the nation, before falling to 4.8% in 2006.
Amenity:			
Population Growth /Retention	√?	At 1.4%, growth was higher than the MDB average of areas, but around one-quarter of the average growth for Australia. Not an obvious 'tree change' location, though consultations indicated that the area is advertised as such. Again, not 'booming' but holding its own.	Dalby-Wambo experienced consistent growth from 1991 to 2006. Its population increased by 1.1% in the period from 1991 to 1996, compared with an average decrease of 0.2% for areas in the MDB and a 6.2% growth nationally.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	Change Over Time
In-migration	√?	30% moved in from outside the SLA, which was much higher than the MDB and Australia. Relatively low total population growth signifies high turnover of population indicative of more transient industries like mining and construction.	Dalby-Wambo has had a high rate of in-migration between 1991 and 2006. In 1996, 25.9% of residents in the area had moved in from outside in the last five years, higher than the rate for any of the other case study areas, the MDB average and Australia. By 2006, this rate had increase by about 15.8%, compared with an average increase of 5.6% for the MDB average and a fall of 4.7% nationally.

Source: JSA

8 Griffith

8.1 How Resilient is Griffith LGA Likely to be to Change?

8.1.1 Summary

Griffith was found to be quite sensitive to changes in irrigation water, however impacts were somewhat less than predicted in Report 4, with differences in water security and trade in water mitigating these impacts significantly in Griffith.

Population growth was slightly less than jobs growth, contrary to our model predictions, and perhaps reflecting 'stickiness' in structural change, as noted for Balonne and Bourke.

The data supports our Report 4 assessment of Griffith as a community particularly vulnerable to changes in irrigation water, but with opportunities for mitigation of impacts.

8.1.2 Overview of Findings from Report 4

Whilst Griffith is a vibrant regional hub with a number of strengths such as a relatively young population, low unemployment levels and a high median household income level it is particularly vulnerable to further permanent reductions in water availability due to its remoteness, lack of a 'critical mass' in terms of population, and its continued reliance on irrigated agriculture for its economic base including significant value-adding manufacturing, warehousing and distribution industries related to agriculture locally and in the wider hinterland. Many irrigated agricultural enterprises in the area, both small and large, have made significant on-farm efficiency gains to use water more wisely and expand their businesses in order to remain profitable while using less water. For many, further permanent reductions in entitlements will have a tremendous impact on their business model with few options to further improve efficiencies to make up the loss. Due to the role irrigated agriculture plays in the local economy, these impacts will quickly flow from farms through to local and regional communities. Cumulative impacts are also expected as certain service thresholds are reached in response to population decline.

8.1.3 Changes to irrigated agriculture 1996-2006

The table below shows changes to agriculture, including irrigated agriculture, in Griffith LGA between 1996 and 2006.

Table 35: Agricultural Land Use Griffith LGA 1996-2006 (Ha)

	Horticulture	Cotton	Grazing (1)	Rice	Other
1996	15,143	0	29,664	22,776	38,150
2001	19,913	0	51,118	23,900	48,439
2006	20,662	0	43,441	16,412	53,065

Source: ABS and JSA calculations

Table Notes:

(1) Data unreliable as definitions of range lands are not consistent over time.

8.1.4 Population and Employment Impacts Forecast

Predicted changes in population and employment

Using land as a proxy and allowing for water application for rice about three times other uses, between 1996 and 2001 irrigation water use in Griffith grew by about 8%, falling by 26% between 2001 and 2006. Report 4 modelling predicted a 4% increase in employment and a 5% increase in population between 1996 and 2001, and a 10% reduction in employment and 13% reduction in population between 2001 and 2006.

Actual employment growth was 10.6% for 1996-01 with a reduction of 0.5% in 2001-06. Our modelling was based on equal cuts across all users, however it is likely that differences in water security and trade in water have mitigated these impacts significantly in Griffith. Horticulture would be expected to add around 500 jobs (1,000 with multipliers) between 1996 and 2001, while between 2001 and 2006, horticulture would be expected to add around 75 jobs (150 with multipliers). In the same period, rice would be expected to add 17 jobs (34 with multipliers), with 128 jobs (256 with multipliers) lost between 2001 and 2006. In net terms, a gain of around 1,000 jobs or about a 10% growth in jobs is expected between 1996 and 2001, with a loss of about 100 jobs (about 0.9%) between 2001 and 2006. This is quite good correlation between the model predictions and empirical data, with the lower than expected job losses perhaps reflecting stickiness in multiplier jobs in the early part of the drought.

Population growth was slightly less than jobs growth, contrary to our model predictions, and perhaps reflecting 'stickiness' in structural change, as noted for Balonne and Bourke.

The data supports our Report 4 assessment of Griffith as a community particularly vulnerable to changes in irrigation water.

Predicted Changes in Indicators of Wellbeing and Resilience

Modelling of impacts on indicators of community wellbeing and resilience for Griffith from reduced water availability also indicates impacts on such indicators will accompany

employment and population loss. Notable changes[47] are projected to be an increase in labour force participation 65+, an increase in youth unemployment, and a more mobile population. On the positive side, a higher level of voluntary work is also predicted. Changes are difficult to discern against wider background trends but the following are noted.

Compared to Australia, labour force participation 65+ decreased consistently across the period, compatible with Report 4 predictions of growth in irrigation industries but not with decline between 2001 and 2006.

Again compared to Australia, youth unemployment increased through the period, contrary to Report 4 expectations. Similarly, change of SLA data were contrary to Report 4 expectations.

This supports a view that correlations between industry and indicators of wellbeing and resilience are tenuous, and more likely to be affected by broader trends.

Factors Affecting Wellbeing and Resilience

The following table provides an overview of the key factors for the Griffith LGA case study area. Griffith's low level of indigenous residents and relatively young median age indicate that it is likely to experience less adverse impacts on indicators of wellbeing than some areas with populations that are already more residualised. However, the relative remoteness of the area, lack of strategic advantage in terms of its distance from other major centres and lack of a transport hub make it very vulnerable to changes in the productivity of its economic base and related industries. Employment in Griffith LGA remains highly reliant on irrigated agriculture and associated industries. Reduced capability, output and employment in these industries will likely have significant impacts on total employment, population and resilience due to this heavy reliance. Cumulative impacts are also likely, as Griffith decreases in size and certain service thresholds are reached.

[47] More than 5% change

Table 36: Key Factors in Community Resilience

Statistically Significant Factors	Resilient?	Comment	Changes Over Time
Remoteness	X	More remote than MDB average and equivalent to case study areas of Moree Plains and Mildura. Not located on a major highway or transport hub.	
Degree of Urbanisation: • Population Size • Proximity to a large regional centre	X	Griffith LGA at 24,000 has not reached the 'critical mass' to be a stand-alone centre. It did not grow in the inter-censal period (2001-2006) and would be adversely affected by loss of population at this stage of its development. Reasonably remote from larger regional centres, so unlikely to benefit from relocation of major enterprises.	Population of Griffith increased by about 2,000 persons (10%) between 1996 and 2006, from 22,000 to 24,000.
Indigenous Population	√	Lower than MDB average	Increased by 15% (from 3.3% to 3.8%) between 1996 and 2006. The national increase was also 15% (from 2.0% to 2.3%), while the MDB average increase was larger at 26% (from 3.9% to 4.9%).
Age	√	With a median age of 35 years, it is younger than the national average and much younger than the MDB. It appears to be retaining more young people than other rural areas, probably due to entry level jobs in agriculture and processing, and cultural factors including family businesses. Farmers and smaller rural communities generally have much older age structures; as a result there may be fewer opportunities for succession planning and greater vulnerability to change. The youth of the labour force is a definite advantage, but one that may be threatened with a decline in entry level jobs in agriculture, related industries and any contraction of the economic base.	Increased by three years between 1996 and 2006, from 32 to 35. Nationally, the median age also increased by three years, from 34 to 37, while the MDB average median increased by five years, from 35 to 40 years of age.

Statistically Significant Factors	Resilient?	Comment	Changes Over Time
% of employment by industry compared with Australian benchmark	X	Lower than MDB and national averages for economic diversity. Remains highly reliant on irrigated agriculture and related industries. Decline in agriculture would need to be offset by new or expanded industries, which appears unlikely given locational disadvantages.	Griffith has become much less reliant on agriculture in recent years, with the proportion of persons directly employed in agriculture decreasing by almost 40% between 1996 and 2006. Comparatively, in areas in the MDB on average there was a 17% decrease, and a 27% decrease nationally.

Source: JSA

Status on Community Resilience Indicators

The current status of Griffith LGA regarding key socio-economic indicators is necessary to understand its resilience or vulnerability to changes in employment related to reduced water availability. The following provides a 'report card' on the extent to which the current status of Griffith LGA compares with the MDB and National benchmarks.

The 'report card' signifies a community that has prospered from irrigation, relatively high levels of water security, and a diverse irrigated agricultural and related industrial base in terms of lower levels of disadvantage, selected health indicators and income, though it is noted that some of this would be strongly related to its younger age structure.

Those indicators related to future resilience are not as positive, particularly in relation to lack of overall diversity of the economic base, lack of locational advantage and relative remoteness, and the lower than average underlying economic, educational and employment status of the population which make it potentially less adaptive to change. Unemployment was much lower than average in 2006, however study participants indicated that unemployment has increased in subsequent years. Moreover, there is reasonable exposure to increased unemployment due to lower human capital indicators and locational disadvantages if water for irrigation were to substantially decrease.

Table 37: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	**Changes Over Time**
Community Wellbeing:			
SEIFA Disadvantage	√	Much less disadvantaged than MDB average though somewhat more disadvantaged than Australia. Somewhat more disadvantaged in 2006 than 2001, which may relate to a 1.2% drop in employment.	Griffith had quite a high score in 1996, the second-highest of the case study areas, higher than the MDB average score but slightly lower than the national score. By 2001, however, its score had fallen to the fourth-lowest of the case study areas, lower than both the MDB average and national scores, before recovering somewhat between 2001 and 2006.
SEIFA Economic Resources	X	Lower than Australia and the MDB average. Indicates that in comparison, Griffith has more households on low incomes or paying low rents and fewer with high incomes or owning homes.	Between 1996 and 2006, Griffith consistently had the highest score of the case study areas, much higher than the MDB average score, but slightly lower than the national score.
Median Household Income	√	Much higher than the MDB average and slightly lower than Australia.	The median household income in Griffith in 1996 was $27 per week lower than its median in 2006 (with inflation taken into account). It reached a low in 2001, falling by $65 per week between 1996 and 2001, before recovering between 2001 and 2006. Between 1996 and 2006, has been consistently $150 to $200 per week higher than the MDB average, and while in 1996 it was about $150 per week higher than the national median, by 2006 it was $30 per week lower.
Social Capital / Volunteering rate	X	Very low for a regional area, and around 70% lower than the MDB average.	Not included in 1996 and 2001 censes.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	**Changes Over Time**
Disability Support Pension	√	Lower than MDB average but on par with Australia, likely due to a younger median age.	Has remained unchanged between 1996 and 2008, while the MDB average rate has increased by 30% and the national rate by 26%. In 1996, rate was similar to the MDB average rate and about 20% higher than the national rate.
Premature Death	√	Much lower than MDB but on par with Australia, signalling less accidents and suicide, but also likely to be due to a lower proportion of indigenous people.	Has remained similar between the mid-nineties and 2008, as did the MDB average rate, while the national rate increased by about 30 deaths per 100,000 persons annually. In the mid-nineties, rate for Griffith was 60 deaths per 100,000 persons (20%) lower than MDB average rate, and 14 deaths per 100,000 persons (6%) higher than the national rate.
Profound or severe disability	√	Lower than MDB average and equivalent to Australia, likely due to a younger median age.	
Chronic Ill Health	√	Slightly lower than MBD average and Australia, likely due to younger population and lower proportion of indigenous people.	
Self reported health 'fair' or 'poor'		In 2007/08, Griffith had a slightly higher than average proportion of persons aged 15 years and over reporting 'fair' or 'poor' health, 16.0% compared with the MDB average and national rates of 15.2% and 14.7% respectively.	In 1995, the rate in Griffith was slightly lower than the MDB average rate, and slightly higher than the national rate. Between 1995 and 2007/08, the rate increased from 15.2% to 16.0% (an increase of 5.3%), with a peak of 17.0% in 2004/05. The MDB average and national rates in 1995 were similar to their respective 2007/08 rates, though they did both peak in 2004/05 at 16.7% and 15.6% respectively.
Economic growth:			

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	**Changes Over Time**
Change in Total Employment 2001-06	X	A slight contraction of the local economy (-0.5%), which was strongly against the national trend (+10% growth) and also the MDB average (+1.2%). Reported to be high job loss since 2006 arising from low general security water allocations and contraction in rice, related processing and flow-ons, some of which are likely to be delayed.	Between 1991 and 2001, Griffith experienced quite a large increase in the number of persons employed, with a 14.5% increase between 1991 and 1996, and a 10.6% increase between 1996 and 2001, compared with a 0.5% decrease and then a 5.1% increase on average in areas in the MDB, and a 7.8% increase followed by an 8.7% increase nationally.
Labour force participation 15+ years	√	Higher than both MDB and Australia. Low youth unemployment and entry level job opportunities likely to be a factor.	Small decrease of 0.9% in Griffith between 1996 and 2006, compared with small increase of 0.2% in the MDB on average and 0.8% nationally.
Labour force participation 65+ years	X	Much higher than MDB and especially national average. Farmers and those working in family processing businesses and in smaller communities likely to be older and working longer.	Substantial increase of 21.5% between 1996 and 2006, compared with 8.5% increase in MDB average rate and 42.4% increase nationally. Consistently slightly lower than MDB average rate, and consistently much higher than national rate, between 1996 and 2006.
Post-school qualification (skills base)	X	Lower than MDB average with trade or better qualifications and much lower than Australia, likely related to predominance of agriculture and related industries in the local economy.	Large increase between 1996 and 2006, as with the MDB and the nation. In Griffith, increased by 33% over the ten-year period, compared with 39% increase on average in areas in the MDB and 32% increase nationally.
School participation at 16 years	X	Very low school participation rate compared with both MDB and Australia, possibly due to entry level job opportunities in the local economy.	

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	**Changes Over Time**
Secondary school participation rate		In 2006, the rate of secondary school participation in Griffith was 72%, somewhat lower than the MDB average rate (75%) and the national rate (77%).	Between 1996 and 2006, the secondary school participation rate in Griffith fell substantially, by 7.7% (from 77.6% to 71.6%), while the MDB average rate fell by 2.1% (from 76.7% to 75.1%) and the national rate fell by 2.8% (from 79.3% to 77.1%). In 1996, the participation rate in Griffith was actually slightly higher than the MDB average rate, though still lower than the national rate.
SEIFA Index of Education and Occupation	X	Well below MDB average and much lower than Australia, and one of the lowest case study areas. Indicative of a population with many people with few qualifications, unemployed or in low skilled jobs and few people with high qualifications or in high skilled occupations. Likely reflects lower underlying human capital resources and nature of employment, and indicate less adequate capacity to industry sector change.	In 1996, similar to the MDB average score and most of the other case study areas. By 2001, was slightly lower than the MDB average score, and was substantially lower by 2006. Consistently much lower than the national score between 1996 and 2006.
GINI co-efficient of household income distribution / polarisation	X	Like other areas of the MBD, Griffith LGA shows quite a high level of polarisation between the 'haves' and 'have nots' based on household income.	Increased substantially between 1996 and 2006, from 0.36 to 0.39. Lower than MDB average and national scores in 1996 and 2001.
Youth unemployment rate	√	Much lower than average, which likely reflects employment opportunities. Exposure to increased unemployment, due to lower underlying level of human capital indicators, if current employment opportunities decline.	Consistently lower than the MDB average and national rates. However, while the rate in Griffith decreased by 5.7% (from 8.8% to 8.3%) between 1996 and 2006, the MDB average rate decreased by 39% (from 17.0% to 10.4%) and the national rate decreased by 35% (from 15.7% to 10.2%) over the same period of time.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	**Changes Over Time**
General unemployment rate	√	Lower than average, but perception that this may have worsened with reduced agricultural production since 2006, especially associated with rice and related industries, though some of this may have been taken up in other agricultural industries. Exposure to increased unemployment, due to lower underlying level of human capital indicators, again signifying potentially lower adaptive capacity.	Consistently lower than the MDB average and national rates between 1996 and 2006. Rate was 3.2% in 1996, compared with 4.8% on average in areas in the MDB and 7.4% nationally. Peaked in 2001, as did the MDB and national rates, at 5.2% in Griffith, 6.3% for MDB average and 9.2% for Australia, before falling between 2001 and 2006.
Amenity:			
Population Growth/Retention 2001-2006	X	No inter-censal population growth, much lower than other Southern Basin areas and Australia. Perception of increased growth related to residential construction in Griffith, but likely to be coming from small towns and hinterland within the LGA as well as some natural increase. Some smaller towns and villages likely to be more vulnerable to reduced water availability.	Substantial increase in population between 1991 and 1996 of 5.2%, slightly lower than the national rate of 6.2% over the same period, but much higher than the MDB average (a decrease of 0.2%). This was followed by a large increase of 10.2% in population between 1996 and 2001, larger than the national increase of 6.0% and much higher than the MDB average increase of 0.5%.
In-migration	X	Very low levels of in-migration from outside the LGA evident, which support the above. It does not have the 'tree change' / 'life-styler' characteristics of some other Southern Basin case studies, and is not within commuting distance to a major regional centre or capital city.	Consistently much lower than MDB average and national rates between 1991 and 2006. Between 1996 and 2006, proportion of persons who had moved into Griffith in the past five years fell by 7.8% (from 14.1% to 13.0%), compared with an average increase of 5.6% in areas in the MDB (from 21.5% to 22.7%) and a decrease of 4.7% nationally (from 25.4% to 24.2%) in the proportion of residents who had moved into their current SLA of residence in the past five years.

Source: JSA

9 Mildura

9.1 How Resilient is Mildura Rural City likely to be to permanent reductions in water?

9.1.1 Summary

The data is supportive of an assessment of Mildura as dependent on agriculture (and therefore quite sensitive to changes in irrigated agriculture), but with resilience associated with its role as a regional city, that is with a significant underlying industry that is not dependent on agriculture.

Population change lagged employment change, similar to trends found in other centres and contrary to the predictions of Report 4, and supportive of a hypothesis of sticky employment change.

9.1.2 Overview of Findings from Report 4

Mildura Rural City

The impacts of a permanent reduction to irrigation water on **Mildura Rural City case study area** were expected to be significant, as irrigated agriculture forms a large proportion of both agricultural industries and the total economy of Mildura.

Existing indicators of community resilience and wellbeing for Mildura Rural City do not generally compare favourably with the MDB and national averages, and Mildura's relative disadvantage, relatively poor health indicators and measures of underlying human capital indicate that there would be constraints to flexible adaptation to structural change, particularly for more vulnerable groups. These socio-economic indicators are predicted to be somewhat worse with reductions of irrigation water modelled, but with some reductions in crime and increase in voluntary work associated with reduced population.

It is likely that there will continue to be benefits from trade in irrigation water, with Sunraysia likely to be a net importer, though this will depend on cost, relative value of produce, and supply of tradable water depending of the amount and location of reductions in SDLs under the forthcoming *Basin Plan*. There are likely to be quite different impacts from open trade in water on different growers, industry sectors and communities, as there have been in the past few years, with winners and losers from water trade between different users and at different scales.

9.1.3 Changes to irrigated agriculture 1996-2006

The table below shows changes to agriculture, including irrigated agriculture, in Mildura between 1996 and 2006.

Table 38: Agricultural Land Use Mildura 1996-2006 (Ha)

	Horticulture	Cotton	Grazing (1)	Other
1996	18,816	0	168,255	273,712
2001	24,350		534,022	328,901
2006	23,589	0	335,153	398,069

Source: ABS and JSA calculations

Table Notes:

(1) Data unreliable as definitions of range lands are not consistent over time.

9.1.4 Population and Employment Impact Forecast

Predicted changes in population and employment

Irrigation grew by about 29% between 1996 and 2001, falling by about 3% between 2001 and 2006. Report 4 modelling predicts a 9% increase in employment and 10% increase in population between 1996 and 2001, with a 1% decrease in employment and population between 2001 and 2006.

Between 1996 and 2001, employment in Mildura grew at 13%, about 4% greater than employment in Australia generally and suggesting an underlying rate of employment growth independent of agriculture of about 4%. Between 2001 and 1996, employment grew by 4%, some 6% less than Australia and suggesting an underlying rate of employment growth independent of agriculture of about 5%. If this is taken as face value, it is supportive of the Report 4 assessment of Mildura as dependent on agriculture (and therefore quite sensitive to changes in irrigated agriculture), but with resilience associated with its role as a regional city, that is with a significant underlying industry that is not dependent on agriculture.

Population change lagged employment change, similar to trends found in other centres and contrary to the predictions of Report 4, and supportive of a hypothesis of sticky employment change.

Predicted Changes in Indicators of Wellbeing and Resilience

Notable predicted impacts[48] are an increase in labour force participation 65+ and a more mobile population with a reduction in irrigation water.

The trend is for labour force participation 65+ to decrease with increasing employment, supporting a hypothesis that employment growth is fuelled by a younger workforce, while employment decline is characterised by an older workforce. As predicted by Report 4, population mobility decreased with increasing employment.

[48] More than 5% change at 50% level of reduction.

Factors Affecting Wellbeing and Resilience

A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study,[49] including changes in employment and population. These included degree of remoteness,[50] degree of urbanisation (population size), proportion of indigenous people particularly remote populations,[51] and age of the population.[52] Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,[53] though our findings indicate that these factors are largely a function of other more endogenous factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries, and to a large extent not within the control of a local community, though strong community leadership from local government, regional development agencies and the like can assist in capturing investment opportunities.

The following table provides an overview of these key factors, which are discussed in more detail in the body of this case study report.

In summary, the main factor in Mildura's resilience in the face of permanent reduction in irrigation water is likely to be its size, with a population of at least 50,000 identified as a critical threshold for some degree of independence from the fortunes of its agricultural base. [54] Other positive factors are its somewhat younger age profile compared to the MDB average, and relatively low proportion of Aboriginal residents, though it is noted that areas like adjoining Wentworth LGA have significant Aboriginal populations.

Less positively, Mildura is relatively remote, and is not located near a capital city, though other locational advantages are evident. It lacks diversity in a number of productive industry sectors not related to agriculture or value-added processing, though again a strong retail and service sector in public administration, health and education is evident. At least one-third of local employment is directly or indirectly related to irrigated agriculture, and Mildura acts as a service, processing and distribution centre for a much wider hinterland, so that cumulative

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[49] JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

[50] As set out in *Statistical Geography: Volume 1 Australian Standard Geographical Classification (ASGC), 2006 (cat. no. 1216.0*).

[51] It is noted that, although 'indigenous people' is a proxy indicator, it is not being Aboriginal *per se* that signifies disadvantage but a range of attributes that are more likely to found among Aboriginal people, such as low income, educational and employment status, being sole parent, lower likelihood of home ownership, etc

[52] JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

[53] JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

[54] See JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

impacts from less water in the region would be significant. For example, most of the jobs associated with 'vegetables' were in 'processing' rather than growing and are likely to be affected by cuts in production in surrounding LGAs.

Mildura's reported popularity as a high amenity 'tree change' location may also work in its favour if faced with a significant reduction in irrigation water, though a contraction in its economic base may deter younger age groups and families from remaining in or relocating to the area. Moreover, there would need to be significant expansion in alternative employment opportunities to offset job losses arising from a major reduction in irrigation water, in Rural City of Mildura and the wider region.

Table 39: Key Factors in Community Resilience

Statistically Significant Factors	Likely to be Resilient?	Comment	Changes Over Time
Remoteness	X	Mildura LGA is more remote on the ABS Remoteness classification than the MDB average, and of similar remoteness to Griffith, also in the Southern MDB, and Moree in the Northern Basin. It would likely rate as even more remote if not for its size. It is classified as 'Outer Regional' while some areas within the LGA are classified as 'Remote'.	
Degree of Urbanisation:			
• Population Size	√	At around 50,000 'usually resident' people in 2006, Mildura may have reached the 'critical mass' to be a self-sustaining service centre, and population estimates indicate that it has grown since this time. It is reported to service a wide hinterland from Robinvale to the SA border.	Population in 1996 was about 45,000. Increased by about 5,000 persons (11%) between 1996 and 2006, reaching the 'critical mass' to become a self-sustaining centre in 2006.
• Proximity to a large urban centre	X?	However, it is remote from larger urban centres and capital cities. Together with its high reliance on agriculture and value-added processing and warehousing including from its large hinterland, it remains vulnerable to direct and cumulative loss of jobs and population if substantial economic alternatives for job replacement are not found.	
Indigenous Population	√	Mildura's indigenous population is much lower than the MDB average, and slightly higher than Australia, though there was a 25% increase on 2001.	Increased by about 60% between 1996 and 2006, from 1.8% to 2.9%. This was a much larger increase than the MDB average increase of 26% (from 3.9% to 4.9%) and the national increase of 15% (from 2.0% to 2.3%).
Age	√	Younger than the MDB average and equivalent to Australia. Likely to relate to employment and educational opportunities (e.g. Uni campus), and cultural factors related to the multicultural nature of its population base.	The median age in Mildura increased by three years between 1996 and 2006, from 34 to 37 years of age. The national median also increased by three years, from 34 to 37, while the MDB average median increase by a larger amount of five years, from 35 to 40 years of age.

% of employment by industry compared with Australian benchmark	?	Much higher reliance on agriculture, value-adding and alternative productive industry sectors not related to agriculture. Services including health and education, and retail are the exceptions, which indicate Mildura's importance as a regional centre. Around 20% of direct employment is in agriculture, and at least 40% is related to agriculture when flow ons and likely under counting are considered. Importantly, 75% of local agriculture is irrigated agriculture, which is reported anecdotally to have much higher multipliers than dryland farming. This indicates that at around one-third of local jobs are related to irrigated agriculture. Significant impacts from a contraction in production in surrounding LGAs are again noted. For example, most jobs identified in 'vegetables for the Mildura LGA were in processing. A decline in irrigated agriculture would therefore need to be offset by significant new or expanded industries, which appears problematic given locational issues outlined below. Nonetheless, strong civic and industry leadership is evident in efforts to maintain and expand the area's economic base, though this may prove difficult if large reductions in permanent irrigation water are sustained.	Mildura has become much less reliant on agriculture as a source of employment in recent years, with the proportion of persons directly employed in agriculture decreasing by about 30% between 1996 and 2006, similar to the national decrease of 27%, though substantially higher than the average decrease in areas in the MDB of 17%.

Source: JSA

Status on Community Resilience Indicators

Overall, Mildura Rural City's existing indicators of community resilience and wellbeing do not compare favourably with the MDB average of areas, and are generally much less favourable than the national statistics. It is relatively disadvantaged on key ABS Indexes of social and economic wellbeing, and has become more so over the inter-censal period, though median income is slightly higher than the MDB average and has increased from 2001-06. Health indicators related to premature death and profound or severe disability are slightly worse than the MDB average and much worse than the national situation, despite the relative youth of its population and low proportion of Aboriginal residents. Indicators related to the educational and employment status of the population including those related to underlying human capital are also quite low for a regional area, and again much lower than the national averages, which indicate that the labour force or segments within it are likely to be quite vulnerable to changes in the structural economic base in terms of ability to flexibly adapt. Like other areas of the MDB, the income profile is quite polarised. Whilst there are clearly very well off residents, there are also a range of more vulnerable groups within the community, and the overall profile is not affluent.

It is positive that the area experienced population and employment growth from 2001-06, and its attractions as a high amenity and well-serviced 'tree change' location are clear in this regard. This is supported by observations from field visits. Mildura is reported to be attracting both older people and younger families leaving larger metropolitan areas. It is also likely to be attracting people from smaller towns and more remote communities, including older people and those with a disability requiring improved services. The absorption of people from its hinterland is likely as drought effects become more apparent post-2006, and if there are significant reductions in irrigation water in the future. That said, the overall socio-economic profile and the deterioration of SEIFA Indexes related to disadvantage, economic resources, and education and employment in the inter-censal period indicate that the area is attracting its share of people who are less well off, seeking more affordable housing and employment opportunities in lower skilled jobs, as well as better off 'lifestylers'.

Moreover, Mildura's socio-economic profile indicates that it is quite vulnerable to changes in its economic base, notwithstanding its size and reasonable growth from 2001-06. The impacts of the most recent drought years and further reductions in water will be important to monitor, and would be expected to arrest growth and may reverse such positive trends in the longer-term unless there are significant growth in alternative employment opportunities. Mildura urban centre could be expected to maintain its population or grow at the expense of smaller more remote towns and LGAs in its hinterland.

Table 40: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience / Wellbeing	Likely to be Resilient?	Comment	Changes Over Time
Community Wellbeing:			
SEIFA Disadvantage (includes indicators related to people's access to material and social resources, and their ability to participate in society)	?	Slightly less disadvantaged than MDB average but much lower than Australia (958 compared with 1000). The area became somewhat more disadvantage on the Index since 2001 (then at 980 on the Index), which may reflect the increase in indigenous people, and/or increasing lower skilled people coming in take up entry level jobs.	Similar (slightly lower) to the MDB average score in 1996 and 2001, having the fourth-highest score of the eight case study areas in 1996 and the third highest in 2001. Substantially lower than the national score both in 1996 and 2001.
SEIFA Economic Resources (including income, housing expenditure and assets of households)	X	Low at 928 compared with 1000 for Australia, most likely related to low skilled jobs, lower asset value, etc.	Quite low both in 1996 and 2001, being slightly lower than the MDB average score in 1996 and slightly higher in 2001, though in 2001 the MDB average score was also quite low. Much lower than the national score in both 1996 and 2001. The fourth highest score of the case study areas in 1996, and the third lowest in 2001.
Median Household Income	√?	Slightly above the MDB average ($785 compared with $779) but much lower than Australia ($1,027). Increased in real terms since 2001 (from $750).	Decreased by $89 per week or 10.2% (with inflation taken into account) between 1996 and 2006, compared with an average decrease of $25 per week (3.1%) in areas in the MDB and an increase of $211 per week (25.9%) nationally. In 1996, the median weekly household income in Mildura was $58 (7.1%) higher than the national value, but by 2006 it was $242 (23.6%) lower, though still consistently on par or above the MDB average value over the ten year period.
Disability Support Pensions	X?	Equivalent to the MDB average (around 6.8-6.9%), but much higher than Australia (5.4%), which is interesting given other health indicators below that are normally related to an older age profile with a high proportion of disadvantaged including indigenous people. This could be accounted for by Mildura's services, with these attracting people with special service needs from a wide hinterland.	Increased by 21.4% (from 5.6% to 6.8%) between 1996 and 2008, compared with a 30.2% increase (from 5.3% to 6.9%) in areas in the MDB on average, and a 25.6% increase (from 4.3% to 5.4%) nationally. Higher rate than both the MDB average and Australian rates.

Proxy Indicator of Resilience / Wellbeing	Likely to be Resilient?	Comment	Changes Over Time
Premature Death	X	Slightly higher than the MDB average, and much higher than Australia. May be related to elevated levels of accidents and injuries, suicide, or pockets of disadvantage given the indigenous population is low.	Increase of 50 premature deaths per 100,000 persons annually (18.9%) between the mid-nineties and 2008, compared with a slight decrease of four (1.3%) on average in areas in the MDB and an increase of 31 (13.7%) nationally. In the mid-nineties, the average annual rate of premature death per 100,000 persons in Mildura was 36 persons (12.0%) lower than the MDB average rate and 38 persons (16.7%) higher than the national rate.
Profound or severe disability	X	Slightly higher than the MDB average, and much higher than Australia. Again, this is somewhat surprising given the age of the population and relatively low proportion of Aboriginal people in the local area. Like the above less favourable health indicators, this warrants further investigation, and again may be related to the attraction of those with health and disability issues from the hinterland.	
Self-reported health 'fair' or 'poor'		Very low number of persons aged 15 years and over reporting 'fair' or 'poor' health in 2007/08, only 7%, which is about half the MDB average and national rates of 15.2% and 14.7% respectively.	In 1995 and 2004/05, the rate in Mildura (15.2% and 16.1% respectively) was similar to the MDB average rate (15.4% and 16.7% respectively) and the national rate (15.0% and 15.6% respectively), but fell dramatically between 2004/05 and 2007/08.
Economic growth:			
Change in Total Employment 2001-06	√	A 4% increase in employment was well above the MDB average of 1.2% but much lower than national growth of 10%. The area doing quite well and clearly holding its own but not necessarily 'booming' (for example, compared with areas with extractive industries). There was reported to be employment loss post-2006/07 due to more recent reductions in allocations with the prolonged drought, with the area relatively cushioned prior to this time due to high levels of water security.	Experienced constant employment growth between 1991 and 2006, with an employment growth peak of 12.7% in the period from 1996 to 2001, compared with 5.1% on average in areas in the MDB and 8.7% nationally over the same period. At 3.2%, the growth between 1991 and 1996 was much smaller, less than half the national rate, though higher than in areas in the MDB, in which number of persons employed decreased by half a percent on average.

Proxy Indicator of Resilience / Wellbeing	Likely to be Resilient?	Comment	Changes Over Time
Labour force participation 15+ years	X	Slightly below the MDB and national averages, which is interesting given the somewhat lower school participation rate and the higher youth unemployment rate.	Increased slightly (by 1.0%) between 1996 and 2006, as in areas in the MDB on average (by 0.2%) and Australia as a whole (by 0.8%).
Labour force participation 65+ years	√	Very low for a regional area, though equivalent to Australia, and likely related to better retention of younger people and in-migration of families, so that 'succession planning' is feasible for local businesses.	Increased from 8.6% in 1996 to 8.9% in 2006 (a 3.5% increase), with a peak of 9.6% in 2001. By comparison, the MDB average rate increased by 8.5% (from 14.2% to 15.4%) over the same period, and the national rate rose by 42.4% (from 5.9% to 8.4%). Over the ten year period, the rate in Mildura has consistently been higher than the national rate and substantially lower than the MDB average rate.
Post-school qualification (skills base)	X	Lower than MDB and much lower than the Australian average. May be related to the nature of employment opportunities including entry-level employment in agriculture and value-adding industries.	As in the other eight case study areas, this rose dramatically between 1996 and 2006, from 21.2% to 29.4% (a 39% increase). Comparatively, the MDB average rate rose by 39% (from 22.8% to 31.6%) and the national rate rose by 32% (from 29.8% to 39.4%).
School participation at 16 years	X	Slightly lower than MDB and much lower than the Australian average. Again, may be related to opportunities for entry-level employment in agriculture and value-adding industries, which is again interesting given the higher youth unemployment rate and the lower labour force participation rate.	
Secondary school participation rate		In 2006, the secondary school participation rate in Mildura was 77.7%, quite high compared with the MDB average rate of 75.1% and the national rate of 77.1%.	Between 1996 and 2006 the secondary school participation rate in Mildura fell by 6.3% (from 82.9% to 77.7%), quite a large decrease compared with the MDB average decrease of 2.1% (from 76.7% to 75.1%) and national decrease of 2.8% (from 79.3% to 77.1%). From 1996 to 2006, the participation rate in Mildura was consistently higher than the MDB average and national rates.

Proxy Indicator of Resilience / Wellbeing	Likely to be Resilient?	Comment	Changes Over Time
SEIFA Index of Education and Occupation (includes relevant Census variables on the general level of education and occupation-related skills and status of a community)	X	Much lower than the MDB average and particularly compared with Australia. Likely reflects lower underlying human capital resources and nature of employment. There was a slight deterioration in this measure from 2001-06. Together with the above education and employment indicators, this indicates that the adaptive capacity of the work force as a whole or for some segments may be problematic in the face of structural change.	On par with the MDB average score in 1996 and 2001, though was lower in 2006. Similar to the scores of the majority of the other case study areas, though much lower than the national score, over the ten year period.
GINI co-efficient of household income distribution/polarisation	X	Like other areas of the MBD, the Murray Bridge shows quite a high level of polarisation between the 'haves' and 'have nots' based on household income.	Rose from 0.37 to 0.39 between 1996 and 2006, as did the average value for areas in the MDB.
Youth unemployment rate	X	Higher than average (12% compared with 10% for MDB and Australia).	Fell by 27% between 1996 and 2006 (from 16.1% to 11.8%), compared with 39% decrease (from 17.0% to 10.4%) on average in areas in the MDB and a 35% decrease (from 15.7% to 10.2%) nationally.
General unemployment rate	√	Lower than the MDB at 5.7%, though lower than the national average.	Increased from 5.4% to 5.7% between 1996 and 2006 (a 5.6% increase), with a peak in 2001 at 6.7%. The MDB average and national rates followed similar patterns, with the MDB rising from 4.8% to 5.1% between 1996 and 2006 (a rise of 6.3%), peaking at 6.3% in 2001, and the national rate fell slightly from 7.4% in 1996 to 7.3% in 2006 (a 1.4% decrease), with a peak of 9.2% in 2001. Between 1996 and 2006, the unemployment rate in Mildura was consistently somewhat higher than the MDB average rate, and substantially lower than the national rate.

Proxy Indicator of Resilience / Wellbeing	Likely to be Resilient?	Comment	Changes Over Time
Amenity: Population Growth	√	4.3% increase in the 'usually resident population' (around 2,000 people) was well above the MDB average, but lower than national growth of around 6%.	Experienced consistent growth between 1991 and 2006, peaking at 6.5% in the period between 1996 and 2001, compared with 0.5% on average in areas in the MDB and 6.0% nationally for the same period. Prior to this, in the 1991-96 period, there was a 2.5% increase in the population of Mildura, compared with an MDB average decrease of 0.2% and a national increase of 6.2%.
In-migration	?	There was a relatively low level in-migration from outside the LGA compared with the MDB average and Australia from 2001-06 (16% compared with 23% and 24% respectively), which indicates that there was a relatively stable population underlying the 4% growth noted above. Perception of increased growth post-2006 are related to development approvals and residential dwelling construction in Mildura, but are likely to be coming from small towns and hinterland as well as some natural increase. Reported to be a mixture of older 'tree changers' and younger families seeking lifestyle options and more affordable housing and job opportunities. Some smaller towns and villages likely to be more vulnerable to population loss to larger centres, so that some absorption of the hinterland population into Mildura is likely. The actual growth of Mildura may be somewhat different to recent estimates in light of more recent and projected constraints to irrigation water, and will be clearer from the 2011 Census.	Rate of in-migration decreased by 5.9% between 1991 and 2006; in 1996 16.9% of residents had moved into Mildura in the past five years, and in 2006 15.9% had. The rate of in-migration into SLAs in Australia on the whole also decreased, by 4.7% (from 25.4% to 24.2%), and for areas in the MDB on average in increased by 5.6% (from 21.5% to 22.7%). Between 1991 and 2006, Mildura consistently had a substantially lower rate of in-migration than the MDB average rate, and a much lower rate than the national rate.
Volunteering rate	X	Relatively low volunteering rate for a regional area (22% compared with 29% for the MDB), but somewhat higher than the national rate (18%).	Not included in 1996 and 2001 census.

Source: JSA

10 Moree Plains

10.1 How Resilient is Moree Plains likely to be to permanent reductions in water?

10.1.1 Summary

Modelling with respect to employment and population with changes to irrigated agriculture was supported if an underlying trend of decreasing employment in Moree Plains is accepted. Alternatively, the positive effects of increasing irrigation are much less in impact than the negative effects of decreasing irrigation. The first explanation seems more likely. Similar to other areas, population change lagged employment change, suggesting 'sticky' structural change.

Generally, predicted impacts on indicators of wellbeing and resilience were not supported, however this is just as likely to be because the predicted impacts were small and masked by larger trends, as to deficiencies in the modelling.

10.1.2 Overview of Findings

Despite the fact that Moree Plains has certain locational and natural advantages compared with more remote case study areas in the Northern Basin like Bourke and Balonne, its very high level of reliance on agriculture, lack of economic alternatives such as mining, energy or manufacturing, relative remoteness and attributes that make it less attractive as a 'tree change' location make it more vulnerable to permanent changes to water availability under the forthcoming *Basin Plan* and government water policy more generally.

Though not as significant as Bourke, Moree Plains' relatively heavy reliance on public or community sector employment and high proportion of residents in receipt of welfare payments also make it particularly vulnerable to ongoing changes in government policies related to centralisation of services and administrative functions. It is noted that over 60% of employment appears to be in agriculture and industries related to public or quasi-public sector funded employment.

10.1.3 Changes to irrigated agriculture 1996-2006

The table below shows changes to agriculture, including irrigated agriculture, in Moree Plains Shire between 1996 and 2006.

Table 41: Agricultural Land Use Moree Plains Shire 1996-2006 (Ha)

	Horticulture	Cotton	Grazing (1)	Other
1996	715	75,486	188,258	429,469
2001	950	134,390	1,123,179	586,415
2006	1,713	84,532	673,964	741,067

Source: ABS and JSA calculations

Table Notes:

(1) Data unreliable as definitions of range lands are not consistent over time.

10.1.4 Population and Employment Impact Forecast

Predicted changes in population and employment

Between 1996 and 2001, there was a 78% increase in irrigation water use in Moree Plains Shire using land use as a proxy. Between 2001 and 2006, irrigation water use fell by 36%. Using these figures, Report 4 predictions are for a 12% and 14% increase in employment and population respectively for 1996-01, with a 5% and 7% decrease respectively in employment and population for 2001-06.

Employment increased by 3.3% for 1996-01, but declined by 16.1% for 2001-06. This suggests the positive effects of increasing irrigation is much less than the negative effects of decreasing irrigation, or alternatively that the increase in irrigation 1996-01 served only to arrest and briefly reverse an underlying trend of loss of employment. In addition, decline in employment from decreasing irrigation in 2006 may have been exacerbated by drought impacts in grazing and other broadacre cropping, however this is not reflected in land use data, with cropped area increasing between 2001 and 2006.

As found in other areas, population change lagged employment change, supporting a hypothesis of sticky structural change.

Predicted Changes in Indicators of Wellbeing and Resilience

Modelling of impacts on indicators of community wellbeing and resilience for Moree Plains from reduced water availability also predicts that there will be significant adverse impacts on such indicators as a result of employment and population loss (or failure to regain population and jobs in a post-drought period). Such adverse socio-economic impacts are generally a result of a more residualised population which is both older and has a greater proportion of disadvantaged indigenous people. Notable changes[55] are likely to be:

[55] More than 5% change at 50% level of reduction.

- a decrease in median household income;
- an increase in disability support pension rates;
- an increase in residents with a profound or severe disability;
- a decrease in labour force participation 65+;
- an increase in youth and general unemployment; and
- decreased in-migration or population replacement.

Median household incomes in Moree Plains increased in both periods, and more rapidly than Australia between 2001 and 2006.

Disability support pensions increased between 1996 and 2008.

Impacts on labour force participation 65+ were the opposite of predicted impacts, decreasing absolutely and relative to Australia with growth in agriculture between 1996 and 2001, and increasing relative to Australia with drought between 2001 and 2006.

Youth unemployment increased relative to Australia in 1996-01, decreasing relative to Australia for 2001-06, the opposite of predicted impacts, with a similar trend for general unemployment.

In-migration increased with growth in agriculture and decreased 2001-06 in line with Report 4 modelling.

Factors Affecting Wellbeing and Resilience

Moree Plains performs poorly against the key factors that indicate how resilient a community is likely to be in the face of change. It is a relatively 'remote area', with a very high proportion of indigenous residents who are likely to be more disadvantaged than average. Its population of just fewer than 14,000 in 2006 follows a dramatic decline from 2001. As a result, it has not achieved the critical mass that makes it in any way independent of the fortunes of its predominantly agricultural economy. It lacks economic diversity and has few alternative economic options to replace a significant loss of jobs predicted with permanent reductions in irrigation water. It has a younger than average age profile, which is likely due to its youthful indigenous population.

Moreover, it is an area that cannot afford to lose employment or population through permanent reductions in water for consumptive uses, and whose post-drought recovery is likely to be severely constrained by such permanent reductions in water. As such, the drought and resultant years of low allocations can be seen as a real time simulation for more permanent reductions in water. The following table provides an overview of these key factors, which are discussed in more detail in the body of the case study report.

Table 42: Key Factors in Community Resilience

Statistically Significant Factors	Resilient?	Comment	Changes Over Time
Remoteness	X	More remote than MDB average, but not as remote as Bourke and Balonne.	
Degree of Urbanisation: • Population Size • Proximity to a large regional centre	X X	It is positive that its population is greater than 10,000 (14,000 in 2006) thus enabling its status as a district service centre. However, it is vulnerable to further employment and population loss and resultant loss of services should population thresholds be reached. Locational disadvantage is evident as Moree is not close to a capital city or major regional centre. Brisbane is approximately 6 hours away, while Sydney is 8 hours. Tamworth, with around 35,000 residents (still below the 50,000 population threshold) is 3.5 hrs away.	Population increased by about 200 persons (1.5%) between 1996 and 2001, from 15,500 to 15,700. Between 2001 and 2006, this decreased by about 1,500 persons to 14,000, a 10% decrease.
Indigenous Population	X	19.5% of the population which equates to around 5 times the MDB average and 9 times the national average. Strongly associated with increased disadvantage, poor health outcomes, etc. Any contraction in economic base and resultant loss of opportunities are predicted to exacerbate these trends.	Increased by about 10% between 1996 and 2006, from 17.4% to 19.4%. Comparatively, the national rate increased by 15%, from 2.0% to 2.3%, and the MDB average rate increased by 26%, from 3.9% to 4.9%.
Age	√?	Much younger median age than MDB and Australia, largely due to its large indigenous population. However, this median likely masks the older age profile of non-indigenous residents, particularly among farmers and smaller communities within the LGA. Any contraction in economic base is also predicted to exacerbate ageing of non-indigenous population as young and middle-aged residents leave the area in search of work.	Median age increased by four years between 1996 and 2006, from 30 to 34 years of age. The MDB average increase was higher at five years, from 35 to 40, while the national increase was lower at three years, from 34 to 37 years of age.

Statistically Significant Factors	Resilient?	Comment	Changes Over Time
% of employment by industry compared with Australian benchmark	X?	Highly reliant upon agriculture and related industries. Some benefits from being a district service centre are evident such as the higher % of public sector and retail jobs, but this also indicates vulnerability to ongoing centralisation of public services and jobs to other larger centres such as Tamworth and Dubbo.	Became slightly less reliant on agriculture between 1996 and 2006, with the proportion of persons directly employed in agriculture falling by 10% over the ten year period. However, in terms of actual numbers, between 2001 and 2006 the number of persons working in agriculture fell from 1,962 to 1,580, a fall of 19% over five years. By comparison, in areas in the MDB on average there was a fall of 17% in the proportion of persons working in agriculture, and nationally there was a 27% fall.

Source: JSA

Current Status on Community Resilience Indicators

The current status of Moree Plains regarding key socio-economic indicators is necessary to understand its resilience or vulnerability to changes in employment related to reduced water availability. The following provides a 'report card' on the extent to which the current status of Moree Plains compares with the MDB and National benchmarks. Findings show a community that has significant indicators of vulnerability in terms of disadvantage, employment loss, low education and occupation index, low skills base, low level of school participation at 16 years and mixed health indicators. These factors indicate the likelihood that the local labour force will be less adaptive to changes in the economic base. There also appears to be a lower than average rate of volunteering coupled with low in-migration from outside the area, which does not necessarily suggest strong connection and engagement in the area across the board, but rather a residualisation of the population when the recent decline in employment and population is taken into consideration.

Table 43: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Resilient?	Comment	Change Over Time
Community Wellbeing:			
SEIFA Disadvantage	X	Very disadvantaged compared with MDB and Australia, most likely due to its high indigenous population.	Very low score in 1996 and 2001, much lower than the MDB average and national scores. Had the third-lowest score of the eight case study areas in 1996, and the second-lowest in 2001.
SEIFA Economic Resources	X	Much lower than the MDB and Australian average in relation to overall level of economic resources in the community. Residents have reduced access to economic resources, indicates lower incomes, lower level of home ownership and more households paying low rents.	Substantially lower score than the MDB average score, and much lower than the national score in 1996, though by 2001 had a much higher score than the MDB average of areas, though still substantially lower than the national score. Fourth-lowest score of the case study areas in 1996, but second-highest in 2001.
Median Household Income	√	Much higher than the MDB average and close to the Australian median, and a notable contrast to the low level on the SEIFA Index of Economic Resources. This probably indicates the presence of sufficient higher income households to influence the median.	Increased substantially between 1996 and 2006, by $106 per week or 12.6% (with inflation taken into account), compared with a $25 per week (3.1%) decrease on average for areas in the MDB, and a $211 per week (25.9%) increase nationally. In 1996, was $24 per week (2.9%) higher than the national rate, though by 2001 was $24 per week (2.7%) lower. However, the median household income in Moree Plains was consistently higher than the MDB average rate between 1996 and 2006.
Social Capital /Volunteering rate	X?	Well below the MDB average, but higher than Australia. Lowest rate among the northern basin case study areas.	Not included in 1996 and 2001 censes.

Proxy Indicator of Resilience	Resilient?	Comment	Change Over Time
Disability Support Pension	√	Lower than MDB average but slightly higher than Australia, likely due to a younger median age.	Large increase between 1996 and 2008, rose by over 50% (from 3.8% to 5.8%). By comparison, the MDB average rate rose by 30% (from 5.3% to 6.9%) and the national rate by 26% (from 4.3% to 5.4%). In 1996, the rate in Moree Plains was 28% lower than the MDB average rate and 12% lower than the national rate.
Premature Death	X	Much higher than MDB and Australian averages, possibly related to its large indigenous population, higher rate of chronic ill health; more road, workplace and other accidents, injury and suicide.	Slight increase of seven premature deaths per 100,000 persons annually (1.8% increase) between the mid-nineties and 2008, compared with a slight decrease of four deaths (1.3%) on average in areas in the MDB and an increase of 31 (13.7%) nationally. Moree Plains had a higher rate than both the MDB and Australia in the mid-nineties (27% and 68% higher respectively).
Profound or severe disability	√	Much lower than both the MDB and Australian averages, most likely due to much lower median age.	
Chronic Ill Health	X	Much higher than both the MDB and Australian averages, most likely due to the high proportion of indigenous people, despite its much younger median age.	
Self-reported health 'fair' or 'poor'		In Moree Plains in 2007/08, 16.6% of residents aged 15 years and over reported their health as 'fair' or 'poor', nine percent higher than the MDB average rate of 15.2% and thirteen percent higher than the national rate of 14.7%.	The rate in Moree Plains in 1995 was quite low at 13.7%, eleven percent lower than the MDB average rate of 15.4% and nine percent lower than the national rate of 15.0%. Between 1995 and 2004/05, this rose by 42% to 19.4%, before falling by 14% between 2004/05 and 2007/08. Comparatively, the MDB average and national rates in 1995 were similar to their respective 2007/08 rates, though they did both peak in 2004/05 at 16.7% and 15.6% respectively.
Economic growth/Human Capital			

Proxy Indicator of Resilience	Resilient?	Comment	Change Over Time
Change in Total Employment 2001-06	X	Very high rate of employment loss (-16.1%), which was strongly against the Australian and MDB trends (+10% and +1.2% growth respectively).	Number of persons employed fell by 5.4% between 1991 and 1996, compared with an average decrease of half a percent in areas in the MDB and a 7.8% increase nationally. This was followed by a 3.3% increase between 1996 and 2001, while in the MDB there was a 5.1% increase on average and nationally an 8.7% increase.
Labour force participation 15+ years	√	Slightly higher than MDB and national average. Likely influenced by the large older workforce, remoteness of the area, and opportunities for entry-level jobs in agriculture and related sectors.	Decreased by 4.9% between 1996 and 2006 (from 65.0% to 61.8%), while the MDB average and Australian rates changed by less than one percent. In 1996, the rate in Moree Plains was about 9% higher than the MDB average and national rates, and in 2001 it was about 7% higher.
Labour force participation 65+ years	X?	Three times the national average, much higher than MDB average and similar to other remote northern basin case study areas. Negative aspects include limited succession planning and less retention of younger workers. Positive aspects reported to include ability to use skills of older people, who find it easier to find employment in rural areas.	Increased by 20.0% between 1996 and 2006, from 17.0% to 20.4%, compared with an 8.5% increase in the MDB average rate and a 42.4% increase nationally. From 1996 to 2006, the rate in Moree Plains has consistently been over twice the national rate, and substantially higher than the MDB average rate.
Post-school qualification (skills base)	X	Lower than MDB and much lower than the national average. Likely related to predominance of agriculture and related industries in the local economy, indigenous people and lower skills of those remaining that have not left the area for work or study.	Increased by 29% between 1996 and 2006 (from 22.4% to 28.9%), compared with an average increase of 39% (from 22.8% to 31.6%) for areas in the MDB, and a national increase of 32% (from 29.8% to 39.4%). Rate was consistently slightly lower than the MDB average rate between 1996 and 2006, and significantly lower than the national rate.
School participation at 16 years	X	Very low school participation rate compared with both MDB and Australia, possibly due to entry level job opportunities in the local economy and high proportion of indigenous young people.	

Proxy Indicator of Resilience	Resilient?	Comment	Change Over Time
Secondary school participation rate		In 2006, Moree Plains had a secondary school participation rate of 60%, quite low compared with the MDB average rate of 75% and the national rate of 77%. It also had the lowest rate of the eight case study areas.	Between 1996 and 2006, the secondary school participation rate in Moree Plains fell dramatically, from 69.8% to 60.1%, a decrease of 13.9% over ten years. The MDB average and national rates also fell, though less dramatically, the MDB average rate falling by 2.1% (from 76.7% to 75.1%) and the national rate by 2.8% (from 79.3% to 77.1%) over the ten year period.
SEIFA Index of Education and Occupation (brings together relevant Census variables on the general level of education and occupation-related skills of people within an area)	X	Well below MDB average and much lower than Australia, reflecting underlying human capital resources and nature of local employment, and high proportion of indigenous residents. Likely to limit the ability to flexibly adapt to structural changes in the economy.	In 1996, on par with the MDB average score, well below the national score, and fourth lowest score of the eight case study areas. By 2001, score was somewhat lower than MDB average score, still well below the national score, and the second lowest of the case study areas.
GINI co-efficient of household income distribution/polarisation	X	Polarised area like most Basin areas, and slightly higher than MBD average with regard to household income.	In 1996, had a Gini coefficient of 0.37, par with the MDB average and lower than the national score of 0.39, indicating greater income equality than for Australia on the whole. This score fell to 0.36 between 1996 and 2001, as it did for the nation, while the MDB average score remained at 0.37. Over the next five years, between 2001 and 2006, the MDB and national scores rose to 0.39, while the score for Moree Plains rose to 0.40.
Youth unemployment rate	√?	Much lower than average, which likely reflects entry level employment opportunities. Unemployment actually decreased from 2001 to 2006, which indicates that employable people are more likely to leave the town to seek jobs elsewhere including in mining. Problems with employability of those remaining was noted in consultations and indicates increased residualisation of those who remain.	Fell by 26% between 1996 and 2006 (from 17.6% to 13.1%), while the MDB average rate fell by 39% (from 17.0% to 10.4%) and the national rate fell by 35% (from 15.7% to 10.2%). Was consistently higher than the MDB average and national rates between 1996 and 2006.

Proxy Indicator of Resilience	Resilient?	Comment	Change Over Time
General unemployment rate	√?	Lower than average, though a perception that this may have worsened with reduced agricultural production since 2006. Decrease in u/e from 2001-06 indicates that more employable people are less likely to stay, which is consistent with other research on rural and remote areas.	The unemployment rate in Moree Plains in 1996 was similar to its 2006 rate, though it peaked at 9.3% in 2001. The MDB average and national rates followed a similar pattern, peaking at 6.3% and 9.2% respectively in 2001. The unemployment rate for Moree Plains in 1996 was lower than the national rate but higher than the MDB average rate. Its 2001 peak rate was also higher than the MDB average, and similar to the national rate.
Amenity:			
Population Growth / Retention	X	Very high population loss accompanying even higher employment loss related to remoteness and size. A high % of people will leave town when jobs are lost, though a lag time in their departure is likely.	Moree Plains experienced a growth of 1.4% in its population between 1996 and 2001, compared with half of a percent growth on average in areas in the MDB, and 6.0% growth nationally. In the five year period prior to this, however (between 1991 and 1996), Moree Plains lost 8.3% of its population, compared with an average loss of 0.2% for areas in the MDB and a 6.2% growth nationally.
In-migration	X	Relatively low rate of in-migration from outside the LGA compared with movement within the MDB and nationally. Also lowest of the northern basin case studies.	Rate of in-migration has remained quite similar between 1991 and 2006, peaking in the period between 1996 and 2001 (in 2001 18.4% of Moree Plains residents had moved into the SLA in the past five years). Has consistently been lower than the MDB average and national rates over the fifteen year period.

Source: JSA

11 Murray Bridge

11.1 How Resilient is Murray Bridge Likely to be to Permanent Reductions in Water?

11.1.1 Summary

Changes in irrigation water usage had little discernible impact in Murray Bridge, supporting the Report 4 Assessment of Murray Bridge as a community likely to be quite resilient in the face of changes in irrigation water usage.

11.1.2 Overview of Findings from Report 4

Modelling of various irrigation water reduction scenarios for City of Murray Bridge case study area indicates that impacts of such reductions are likely to be significant, but lesser in magnitude than for other selected case study areas, as irrigated agriculture forms a relatively small proportion of agricultural industries in Murray Bridge. That said, the effects on Murray Bridge are likely to be understated due to Census undercounting, and its role as a major service centre for the Murraylands Region and the relatively high rate of jobs in value-adding agricultural processing, transportation, storage, packing and distribution. Impacts are likely to be more significant in the regional context, where most areas are highly dependent on agriculture. Smaller, more remote and agriculturally dependent areas are likely to be far more seriously affected, as has been the case in the latter part of the drought.

Exacerbating factors include existing indicators of significant community vulnerability including very high levels of disadvantage, unemployment, educational and employment status, disability and ill health. Such factors point to limited adaptive capacity of some people and communities to changes in its economic base.

Overall, and by comparison with other case study areas, the outcome of reduced water availability in Murray Bridge is likely to be continued existence and growth, but in a different form, changing from an agricultural economy to one that is increasingly dominated by manufacturing, services and retail and by overspill from the Adelaide housing and labour market, albeit generally at the lower cost and potentially lower skilled end of the spectrum. Although growth is likely to continue, rates of growth with reduced water will likely be less than would otherwise be expected. However, other areas are reported in the region are reported to have been 'devastated' by the recent drought, and to some extent Murray Bridge will grow at the expense of these areas, particularly if water for irrigation is permanently reduced in the future. For smaller centres attractive as new urban settlement areas (like Woodlane), it is likely that the demographic mix and character of the area will change significantly.

11.1.3 Changes to irrigated agriculture 1996-2006

The table below shows changes to agriculture, including irrigated agriculture, in Murray Bridge between 1996 and 2006.

Table 44: Agricultural Land Use Murray Bridge 1996-2006 (Ha)

	Horticulture	Cotton	Grazing (1)	Other
1996	876	0	28,195	36,144
2001	768	0	67,498	48,706
2006	1,091	0	72,553	43,249

Source: ABS and JSA calculations

Table Notes:

(1) Data unreliable as definitions of range lands are not consistent over time.

11.1.4 Population and Employment Impacts Forecast

Predicted changes in population and employment

Using land use data as a proxy, irrigation in Murray Bridge decreased by 12% between 1996 and 2001, and increased by 42% between 2001 and 2006. Predicted impacts based on Report 4 modelling are a 0.5% decrease in employment 1996-01 with a 2% growth 2001-06, accompanied by a 0.7% decrease and 2.6% increase respectively in population. The predicted changes are not detectable in the data, although employment growth 2001-06 was greater than that for 1996-01, and it would be expected that some of this growth came from the expansion of irrigated agriculture. Similar to other areas, population change lagged employment change, suggesting 'sticky' structural change.

Predicted changes in indicators of wellbeing and resilience

No changes in indicators of greater than 5% were predicted.

Factors Affecting Wellbeing and Resilience

A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study,[56] including changes in employment and population. Our findings for the MDB were generally in line with other research on rural and regional communities, and included the degree of 'remoteness', degree of urbanisation (population size), proportion of Aboriginal people particularly remote populations, and age of the population.[57] The degree of

[56] JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri

[57] JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience &*

economic diversity and opportunities to diversify were also relevant factors identified in the literature,[58] though our findings indicate that these are largely a function of other factors such as remoteness, proximity to a large urban centre, or the presence of other economic resources such as extractive industries.

The Table below provides an overview of these key factors. In summary, City of Murray Bridge is likely to be more resilient in the face of changes to water allocations than most of the other case study communities, and certainly compared to areas that are smaller, more remote and more dependent on local agricultural production including some of those in the wider Murraylands Region. Murray Bridge's advantages include its relative degree of urbanisation (including size and proximity to Adelaide), relatively low level of Aboriginal people, and relative economic diversity compared with the MDB average. Its continued population and employment growth over the last census period and the fact that it is targeted for growth under the State Government's strategic planning framework[59] also indicate that it is likely to be relatively resilient.

That said, Murray Bridge has not yet achieved the size or critical mass found to be important in the previous stage of this study to make it fully independent of the fortunes of its agricultural base and related industries,[60] and remains somewhat vulnerable in this regard. Supportive State Government regional development policy remains important to the future of the area.

irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

[58] JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper,* Cotton Catchment Communities Co-Operative Research Centre, Narrabri

[59] SA Department of Planning and Local Government (2010), *The 30 Year Plan for Greater Adelaide: A volume of the South Australian Planning Strategy.*

[60] JSA (2010) *Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*.

Table 45: Key Factors in Community Resilience

Statistically Significant Factors	Likely to be Resilient	Comment	Changes Over Time
Remoteness	✓	Murray Bridge is much less remote on the ABS Remoteness classification than the MDB average of areas, and has the status of 'Inner Regional Australia'.	
Degree of Urbanisation: • Population Size	?	At around 18,000 people, Murray Bridge has not achieved the critical mass to be a stand-alone service centre. Nonetheless, it acts a service centre for a wide agricultural hinterland.	In 1996, the population of Murray Bridge was about 16,000. Over the next ten years this increased by about 1,500 (10%) to about 17,500.
• Proximity to a large regional centre	✓	Murray Bridge is less than 1 hour from Adelaide by expressway.	
Indigenous Population	✓	Though almost double the national average (4.2% compared with 2.3%), Murray Bridge's Aboriginal population is lower that the MDB average (4.9%), and much lower than most of the Northern Basin areas.	Increased by about 8% between 1996 and 2001 (from 3.9% to 4.2%), and remained stable thereafter. Comparatively, the national rate increased by 15% (from 2.0% to 2.3%) between 1996 and 2006, and the MDB average rate increased by 26% (from 3.9% to 4.9%).
Age	?	Older than the national average (39 compared with 37 years), but younger than the MDB average of areas (40 years).	Median age in Murray Bridge increased by five years between 1996 and 2006, from 34 to 39 years of age. The MDB average median age also increased by five years, from 35 to 40, while the national median increased by a smaller amount of three years, from 34 to 37 years of age.
Degree of economic diversity	✓?	20% of jobs in agriculture, which was lower than the MDB (29%) but much higher than Australia (3.5%). A more diversified rural economy than the MDB average, though considerably less diverse than the national economy, indicating its role as a regional service centre; and a strong value-adding manufacturing sector that sources agricultural produce and livestock from a wide hinterland and in some cases interstate, and related transport, storage and wholesaling sectors. Continued economic growth will depend upon ongoing population growth, confidence of existing businesses, relocation of projected	After rising by about 4% between 1996 and 2001, the proportion of persons in Murray Bridge directly employed in agriculture fell by almost 40% over the following five year period (from 2001 to 2006), a very large decrease considering that in areas in the MDB on average and nationally there was a 17% and 27% decrease respectively over the ten year period from 1996 and 2006. This large decrease in Murray Bridge was partially due to an increase in the number of persons employed, but mainly due to a decrease in actual numbers of persons directly employed in agriculture.

Statistically Significant Factors	Likely to be Resilient	Comment	Changes Over Time
		new businesses, and the extent to which sectors related to agricultural production source their produce from the hinterland and areas within the MDB affected by reductions in water.	

Source: JSA

Status on Community Resilience Indicators

The current status of City of Murray Bridge regarding key indicators of community wellbeing and resilience are also important in understanding its vulnerability to changes in water.

Despite the generally positive outlook for Murray Bridge noted in the Table above, Murray Bridge is the most disadvantaged of the eight case study areas when indicators related to socio-economic status and health are considered. The area also performs poorly against a number of key indicators of resilience, including having a relatively low-skilled labour force, very low indices of economic, educational and occupational resources, high unemployment and low levels of labour force participation. These indicate the presence of very vulnerable populations, and a potentially less adaptive work force, so that the area cannot necessarily be complacent about its future wellbeing despite projected housing and employment growth. The nature of its housing and employment sectors means that it is likely to continue to absorb less advantaged groups from the Adelaide housing and labour market, and it is not a typical 'tree change' location.

Table 46: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	**Change Over Time**
Community Wellbeing:			
SEIFA Disadvantage (includes indicators related to people's access to material and social resources, and their ability to participate in society)	✘	The most disadvantaged of the eight case study areas on the index of SEIFA Disadvantage at 900 compared with 1000 for Australia.	Very low score between 1996 and 2006, consistently the lowest of the case study areas, and much lower than the MDB average and national scores.
SEIFA Economic Resources (including income, housing expenditure and assets of households)	✘	Low at 928, compared with 1000 for Australia, most likely related to low skilled jobs and availability of cheaper housing including social rental accommodation.	Murray Bridge has consistently scored low in this respect, substantially lower than the MDB average score and much lower than the national score. In 1996, Murray Bridge had the third-lowest score of the case study areas, and by 2001 it had by far the lowest score, though it did recover somewhat between 2001 and 2006.
Median Household Income	✘	Very low compared with MBD and the national median ($672 compared with $779 and $1027 respectively), probably as a result of the high level of employment in low skilled and entry level jobs (e.g. in manufacturing, warehousing, value adding processing), high unemployment, relatively low work force participation rate, and high reliance on pensions and benefits.	Decreased by $34 per week or 4.8% (with inflation taken into account) between 1996 and 2006, compared with an average decrease of $25 per week (3.1%) for areas in the MDB and a $211 per week (25.9%) increase nationally. Consistently about $100 per week (about 15%) lower than the MDB average median between 1996 and 2006, and substantially lower than the national median.
Social Capital / Volunteering rate	✓?	Much higher than Australia, but low for a regional area (25% compared with 29% for the MDB). Very high in some smaller communities.	Not included in the 1996 and 2001 censes.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	**Change Over Time**
Disability Support Pension	✘	Much higher than the MDB and national average, likely due to high proportion of social housing and low cost accommodation, an older population, as well as a better level of services than much of the hinterland.	Increased by almost 50% (from 6.5% to 9.7%) between 1996 and 2008, compared with an average increase of 30% (from 5.3% to 6.9%) for areas in the MDB and 26% (from 4.3% to 5.4%) nationally. Murray Bridge had a substantially higher rate than the MDB and Australia in both 1996 and 2008.
Premature Death	✓	Higher than Australia, but slightly lower than the MDB average of areas, signalling less accidents and suicide, but also likely due to a lower % of Aboriginal people.	Remained quite stable from the early nineties, as it did in areas in the MDB on average, though the national rate increased by about 30 premature deaths per 100,000 persons annually, an increase of 14% over about 15 years. In Murray Bridge in the mid-nineties, there were about 60 premature deaths per 100,000 persons annually (26%) more than the national rate, and 14 (5%) fewer than the MDB average.
Profound or severe disability	✘	Highest of the case study areas and considerably more than the MDB and national average (5.2% compared with 4.6% and 4.1% respectively), likely due to the presence of older people, high proportion of social housing, low cost accommodation, and MB's role as a service centre.	
Chronic Ill Health	✘	Somewhat higher than the MDB and national average, and likely due to higher than average social housing, age structure and general disadvantage.	

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	**Change Over Time**
Self-reported health 'fair' or 'poor'		In 2007/08, Murray Bridge had a high proportion of residents aged 15 years and older reporting 'fair' or 'poor' health. At 19.0% it had the highest rate of the eight case study areas, 25% higher than the MDB average rate of 15.2% and 29% higher than the national rate of 14.7%.	In 1995, at 17.7% the rate in Murray Bridge was somewhat lower than its 2007/08 rate, though still about 15% higher than the MDB average and national rates. Between 1995 and 2004/05, this rate increased by 10% to 19.4%, before falling slightly between 2004/05 and 2007/08. By comparison, the MDB average and national rates in 1995 were similar to their respective 2007/08 rates, though they did both peak in 2004/05 at 16.7% and 15.6% respectively.
Economic growth:			
Change in Total Employment 2001-06	✓	Much higher than the MDB average (7.1% compared with 1.2%) though lower than Australia (9.7%), likely due to the proximity to Adelaide, its attractiveness for industry relocation, and the growth in retail, manufacturing and wholesale/distribution jobs	Overall, almost no growth between 1991 and 2001, while MDB average growth was 4.6% and national growth was 17.2% over the same period. Murray Bridge experienced a 4.5% decrease between 1991 and 1996, followed by a 4.9% increase between 1996 and 2001, compared with a 0.5% decrease on average in areas in the MDB followed by a 5.1% increase. Nationally, there was a 7.8% increase in the number of persons employed between 1991 and 1996, followed by an 8.7% increase between 1996 and 2001.
Labour force participation 15+ years	✘	Lower level labour force participation compared with the MDB and national averages (57% compared with 60% and 61% respectively), likely due to higher levels of welfare dependence, disability and lower skilled people including in social housing and the local prison.	Declined by 2.6% (from 57.1% to 55.6%) between 1996 and 2006, while MDB average and national rates remained almost unchanged. Lower than the MDB average and national rates over the ten year period.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	**Change Over Time**
Labour force participation 65+ years	✓	Very low level of participation by older people, despite its large agricultural base, and less than half the MDB average (7% compared with 15%).	Increased by 33.3% (from 5.4% to 7.2%) between 1996 and 2006, compared with an average increase of 8.5% (from 14.2% to 15.4%) for areas in the MDB and 42.4% (from 5.9% to 8.4%) nationally. Consistently slightly lower than the national rate, and less than half the MDB average rate over the ten year period.
Post-school qualification (skills base)	✘	Very low level of post-school qualifications among the local labour force (26% compared with 32% for MDB and 39% for Australia).	Increased dramatically between 1996 and 2006, by about 45% (from 17.9% to 25.9%), compared with a 39% increase on average for areas in the MDB (from 22.8% to 31.6%) and a 32% increase nationally (from 29.8% to 39.4%). Between 1996 and 2006, the proportion of residents with tertiary qualifications in Murray Bridge has consistently been substantially lower than the MDB average rate and much lower than the national rate.
School participation at 16 years	✘	Somewhat lower than MDB and Australia (70% compared with 71% for MDB and 75% for Australia).	
Secondary school participation rate		In 2006, the secondary school participation rate in Murray Bridge was 67.3%, substantially lower than the MDB average rate of 75.1% and the national rate of 77.1%.	Between 1996 and 2006, the secondary school participation rate in Murray Bridge rose by 11.2%, from 60.5% to 67.3%, compared with a decrease in the MDB average rate of 2.1% (from 76.7% to 75.1%) and a decrease of 2.8% in the national rate (from 79.3% to 77.1%).

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	**Change Over Time**
SEIFA Index of Education and Occupation (includes relevant Census variables on the general level of education and occupation-related skills and status of a community)	✘	Very low at 876 compared with 953 for MDB and 1000 for Australia. The ABS (2006) SEIFA Index of Education and Occupation focuses on the general level of education and occupation-related skills of people within an area, and brings together relevant Census variables.	Scored very low between 1996 and 2006, being by far the lowest scoring of the case study areas over the ten year period, much lower than the MDB average and national scores.
GINI co-efficient of household income distribution / polarisation	✘	Like other areas of the MBD, the Murray Bridge shows quite a high level of polarisation between the 'haves' and 'have nots' based on household income.	Increased substantially from 0.36 to 0.39 between 1996 and 2006, compared with an average increase for areas in the MDB from 0.37 to 0.39, while the national score stayed at 0.39 (though it fell to 0.36 in 2001). This means that incomes in Murray Bridge have become more polarised.
Youth unemployment rate	✘	Much higher than the national and MDB average (around 14% compared with 10% for the MDB and Australia), despite the presence of opportunities in low skilled and entry level jobs.	Fell dramatically between 1996 and 2006, by 31% (from 19.6% to 13.5%), while the MDB average rate fell by 39% (from 17.0% to 10.4%) and the national rate fell by 35% (from 15.7% to 10.2%) over the same period. The youth unemployment rate was consistently substantially higher than the MDB and national rates over the ten year period.
General unemployment rate	✘	Much higher than the MDB average (7% compared with 5%), and among the highest of the case study areas, despite the presence of opportunities in low skilled and entry level jobs.	At 6.7%, about 40% higher than the MDB average rate in 1996, though 9.5% lower than the national rate. Peaked at 9.8% in 2001, about 56% higher than the MDB average rate of 6.3% and 6.5% higher than the national rate of 9.2%.
Amenity			

Proxy Indicator of Resilience	Likely to be Resilient?	Comment	**Change Over Time**
Population Growth /Retention 2001-06	✓	MB's 5.4% growth was almost equal to national growth (5.8%) from 2001-06, and around 5 times the MDB average, likely due to MB's proximity to Adelaide, low cost housing, availability of entry-level and low skilled jobs, industrial land, etc. A 70% population increase for City of Murray Bridge is forecast over the next 30 years under the *30 Year Plan for Greater Adelaide*, with commensurate job growth also an aim of the Plan.	Stable population between 1991 and 1996 (0.1% growth), compared with slight decrease for areas in the MDB on average (0.2%) and 6.2% growth nationally. Followed by a 4.0% increase between 1996 and 2001, while in areas in the MDB on average population increased by 0.5% and nationally by 6.0%.
In-migration 2001-06	✘	Shows a relatively low level of in-migration compared with MDB and Australia (19% compared with 23% for the MDB and 24% for Australia), which indicates that a reasonable amount of the change in population may be from natural increase and retention of the existing population from 2001-06.	The rate of migration into Murray Bridge remained quite similar between 1991 and 2006. In 1996, 18.2% of residents had moved into the SLA in the past five years, while in 2006 the rate was 19.3%, an increase of 6.0%. By comparison, the MDB average rate rose by 5.6% (from 21.5% to 22.7%) and the national rate fell by 4.7% (from 25.4% to 24.2%). Over the fifteen year period, the rate of migration into Murray Bridge has been about 15% lower than the MDB average rate and 20-30% lower than the national rate.

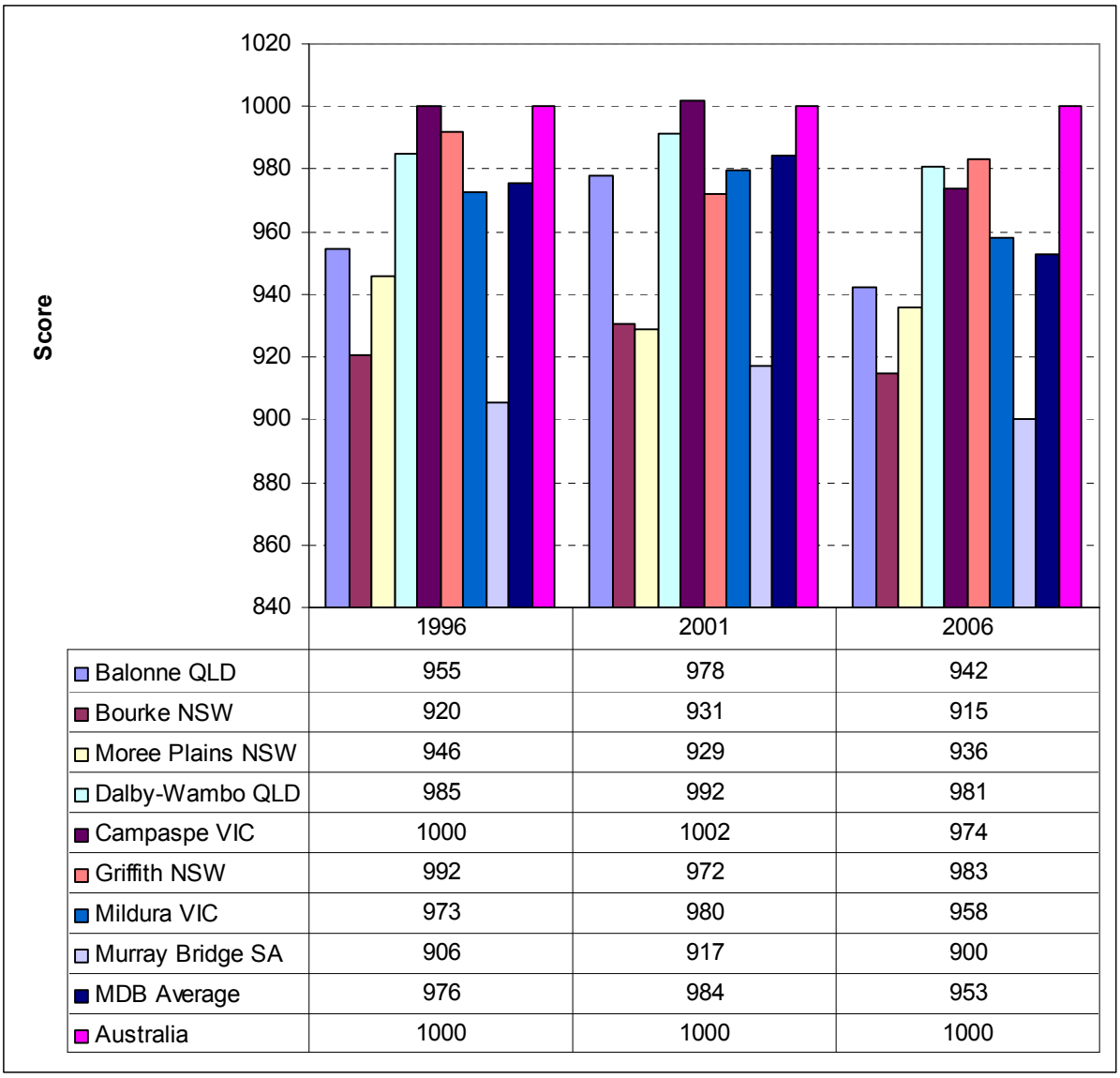
Source: JSA

12 Appendix A - Changes in Socio-economic indicators with time in Case Study Communities

12.1 SEIFA Disadvantage

12.1.1 Summary

- In 2006, the most disadvantaged of the case study areas were Murray Bridge and Bourke, which had substantially lower scores than the MDB average score and much lower scores than Australia.
- The areas with the highest scores were Griffith, Dalby-Wambo and Campaspe, and although the scores for these areas were higher than the MDB average score, they were still lower than the national score.
- Between 1996 and 2006, Murray Bridge and Bourke have consistently scored very low, and Moree Plains has also consistently scored quite low.
- Dalby-Wambo and Campaspe have consistently scored above the MDB average, and although Griffith scored above the MDB average in 1996, it scored below in 2001.



	1996	2001	2006
Balonne QLD	955	978	942
Bourke NSW	920	931	915
Moree Plains NSW	946	929	936
Dalby-Wambo QLD	985	992	981
Campaspe VIC	1000	1002	974
Griffith NSW	992	972	983
Mildura VIC	973	980	958
Murray Bridge SA	906	917	900
MDB Average	976	984	953
Australia	1000	1000	1000

Figure 13: Socio-Economic Index for Areas (SEIFA) Index of Relative Disadvantage (Score) – Area Comparison

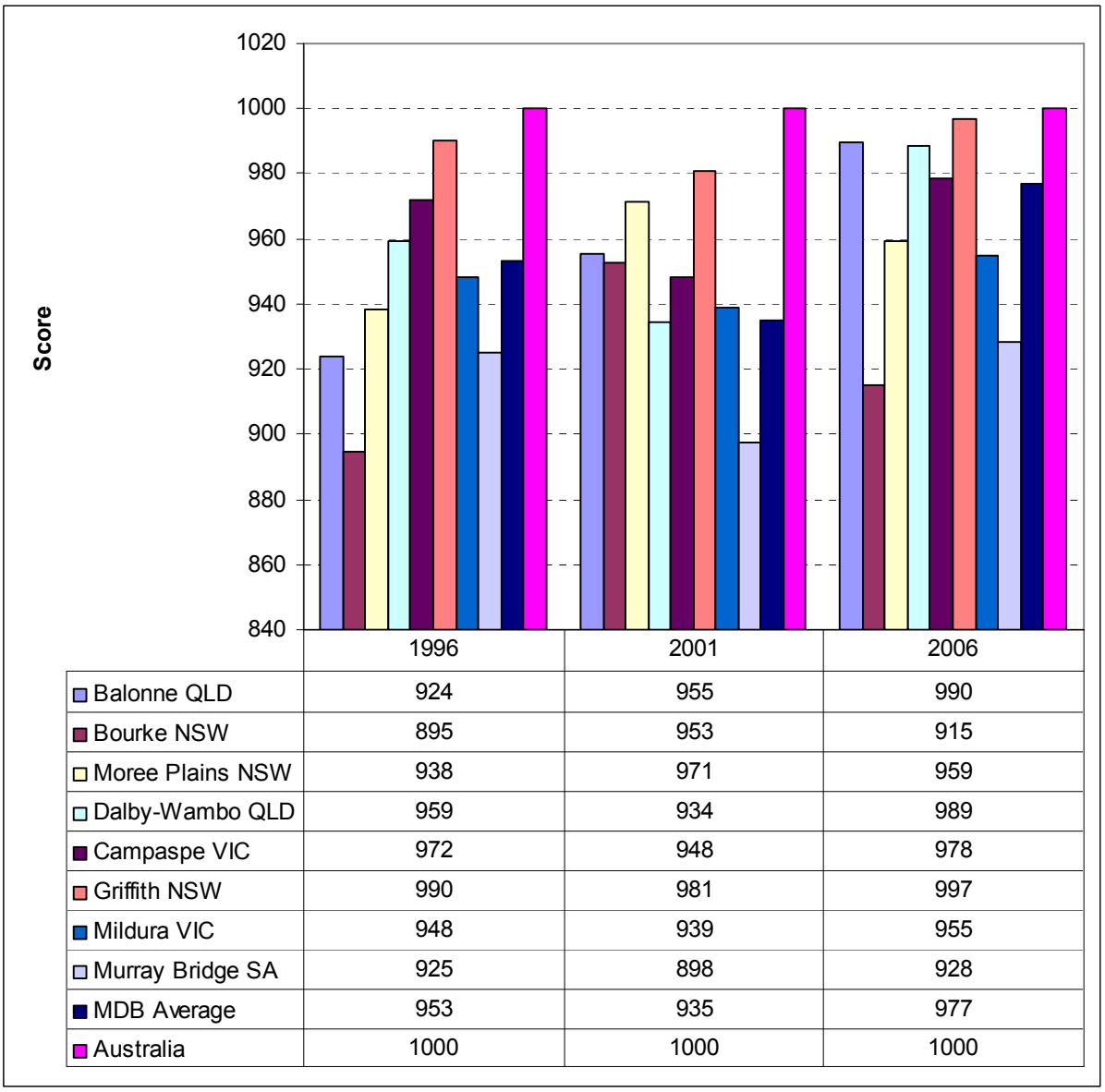
Source: JSA (2011), derived from ABS (1996, 2001, 2006)

12.2 SEIFA Economic Resources

12.2.1 Summary

- In 2006, as with SEIFA disadvantage, the lowest scoring case study areas were Murray Bridge and Bourke. Murray Bridge also scored under the MDB average score in 2001 and 1996, and although Bourke scored very low in 1996 it scored higher than the MDB average in 2001.
- In 2006, the highest scoring case study areas were Griffith, Balonne and Dalby-Wambo. Griffith consistently scored highly between 1996 and 2006, higher than the MDB average, though lower than the nation.

- Although the score for Balonne in 2001 was also reasonably high, in 1996 it had the second lowest score of the case study areas, substantially lower than the MDB average score and much lower than the national score.



	1996	2001	2006
Balonne QLD	924	955	990
Bourke NSW	895	953	915
Moree Plains NSW	938	971	959
Dalby-Wambo QLD	959	934	989
Campaspe VIC	972	948	978
Griffith NSW	990	981	997
Mildura VIC	948	939	955
Murray Bridge SA	925	898	928
MDB Average	953	935	977
Australia	1000	1000	1000

Figure 14: Socio-Economic Index for Areas (SEIFA) Index of Economic Resources (Score) – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006)

12.3 Premature Death

- Bourke SLA has a very high rate of premature death, over twice the rate for Australia. This rate increased substantially (by about 50 persons per 100,000 or 9%) between the mid-nineties and the year 2008.
- The premature death rate in Moree Plains is also quite high, 50% higher than the rate for Australia in 2008.
- The average rate of premature death for SLAs in the MDB in 2008 was 15% higher than the rate for Australia, similar to the rates for Balonne, Dalby-Wambo, Campaspe, Mildura and Murray Bridge.
- The premature death rate for Dalby-Wambo also increased substantially between the mid-nineties and 2008, by almost 80 persons per 100,000 or just over 30%.
- Of the eight case study areas Griffith SLA has the lowest rate of premature death, similar to the rate for Australia.

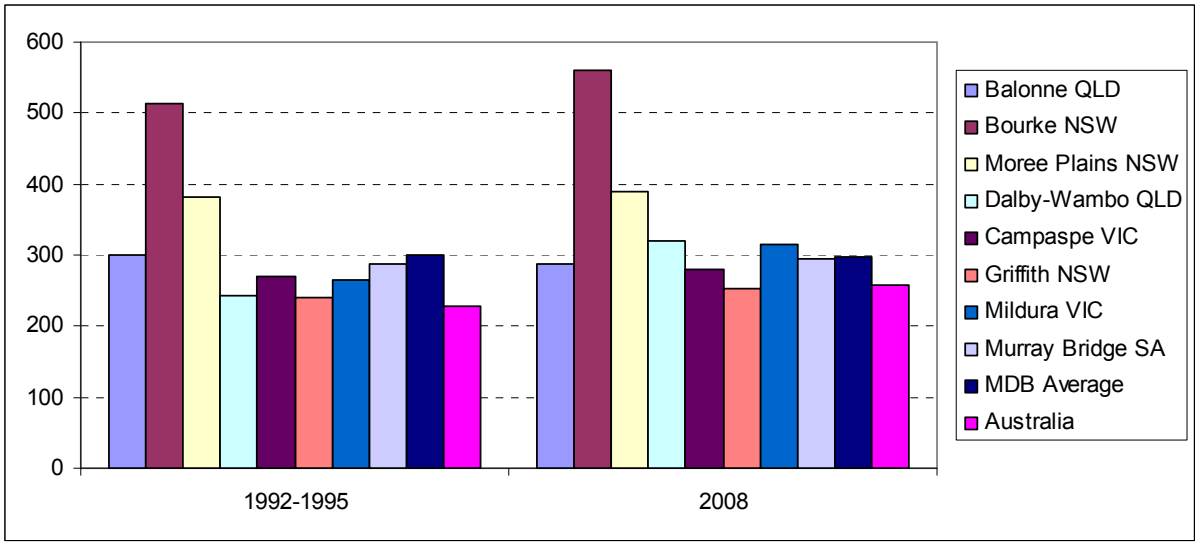
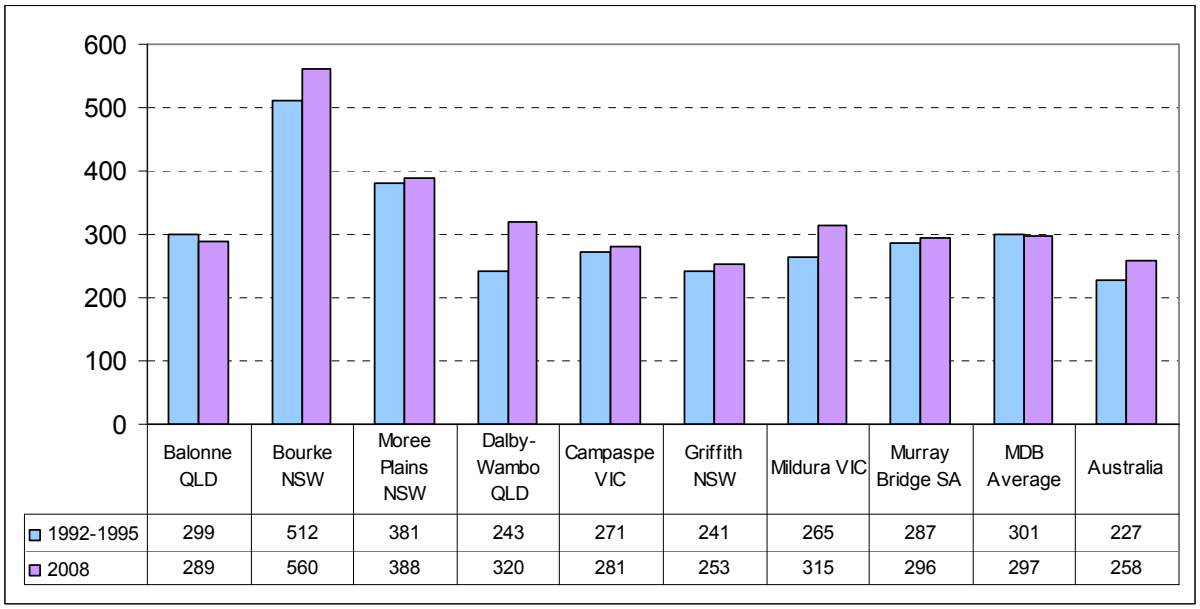


Figure 15: Premature Death – Average Annual Rate per 100,000 persons – Area Comparison
Source: JSA (2011), derived from PHIDU (2008)

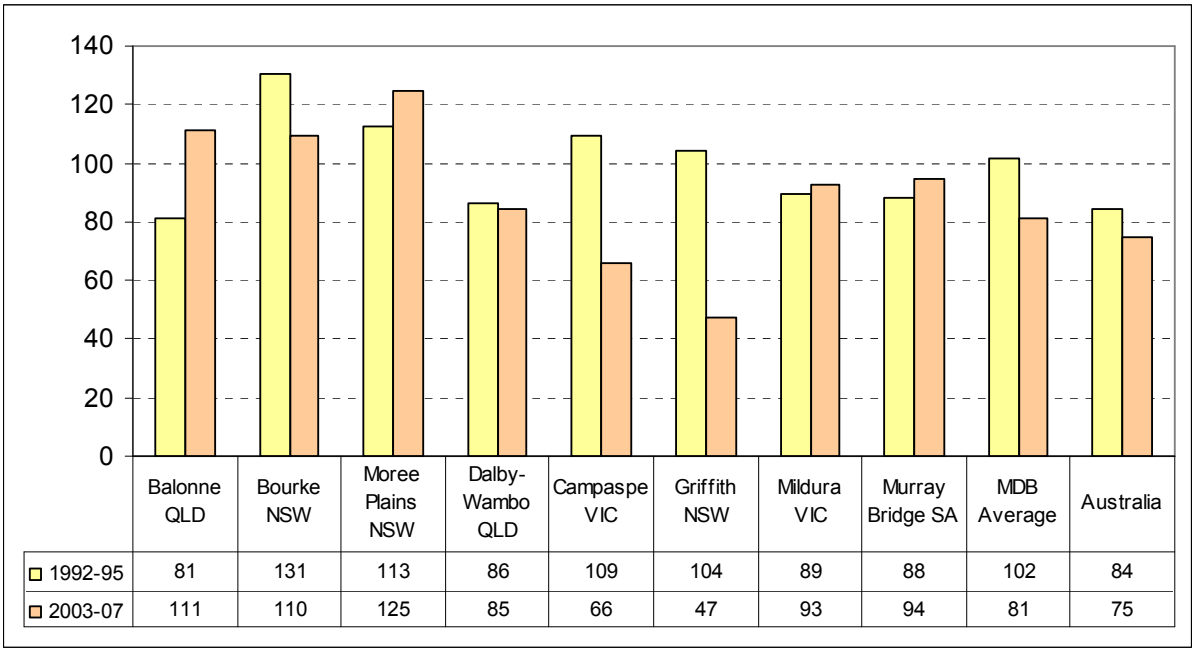


	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1992-1995	299	512	381	243	271	241	265	287	301	227
2008	289	560	388	320	281	253	315	296	297	258

Figure 16: Premature Death – Average Annual Rate per 100,000 persons – Time Comparison

Source: JSA (2011), derived from PHIDU (2008)

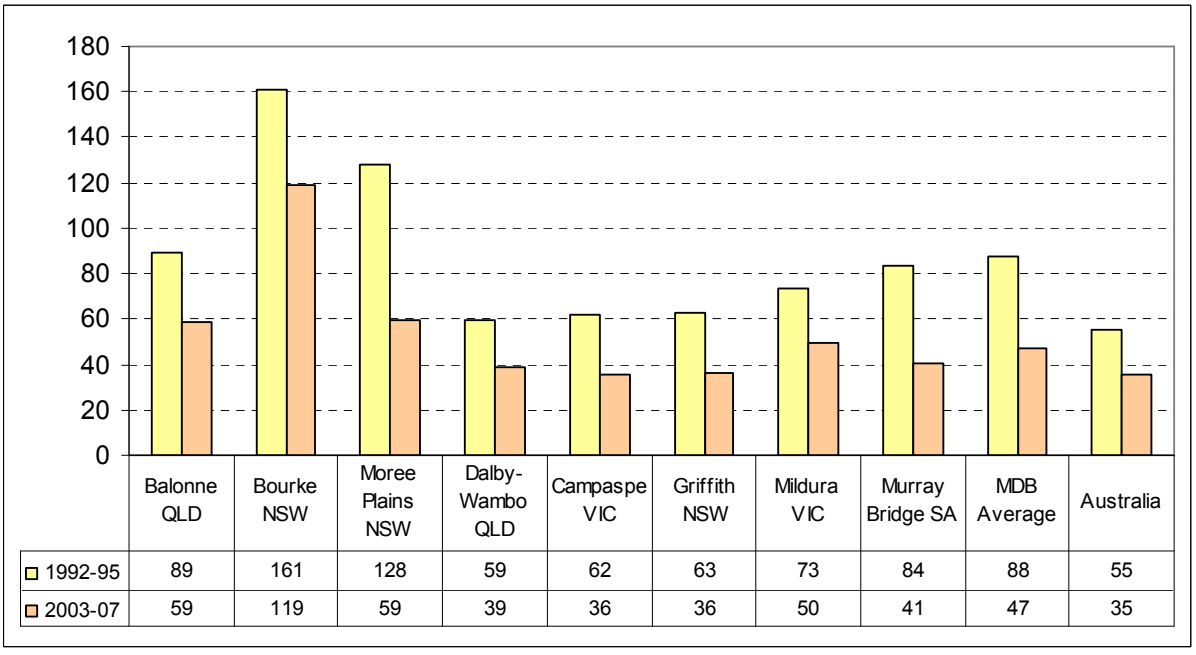
12.4 Premature Death by Selected Causes



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1992-95	81	131	113	86	109	104	89	88	102	84
2003-07	111	110	125	85	66	47	93	94	81	75

Figure 17: Deaths of persons aged 15-64 years from cancer (average annual rate per 100,000 persons)

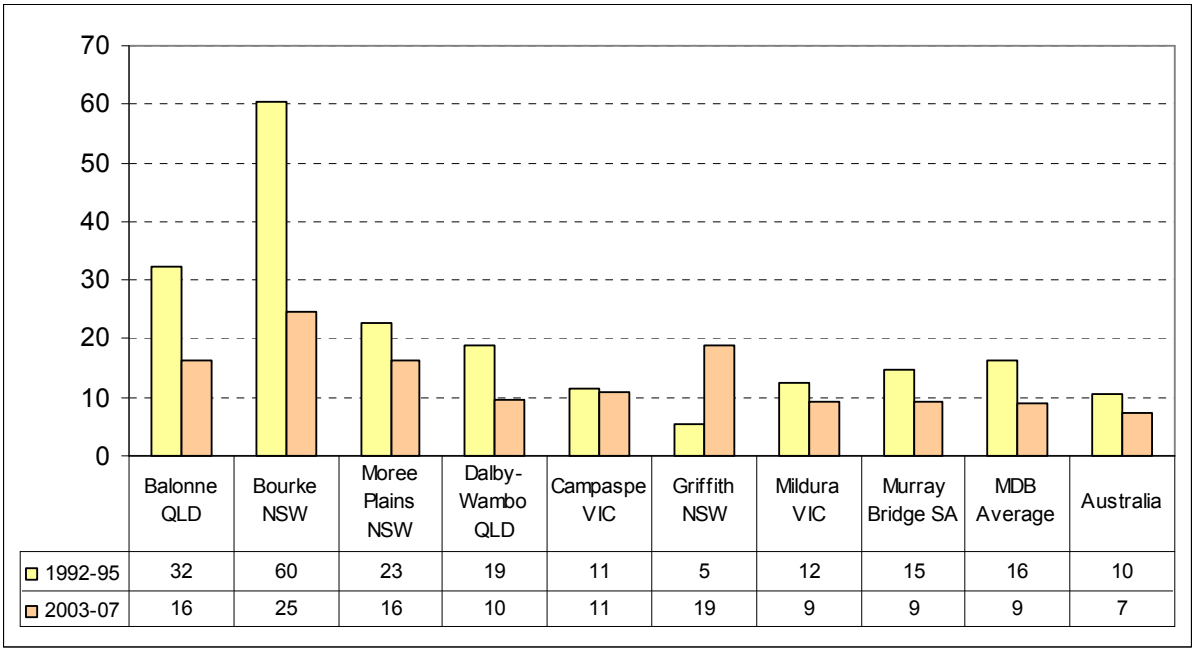
Source: JSA (2011), derived from PHIDU (2010)



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1992-95	89	161	128	59	62	63	73	84	88	55
2003-07	59	119	59	39	36	36	50	41	47	35

Figure 18: Deaths of persons aged 15-64 years from circulatory system diseases (average annual rate per 100,000 persons)

Source: JSA (2011), derived from PHIDU (2010)



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1992-95	32	60	23	19	11	5	12	15	16	10
2003-07	16	25	16	10	11	19	9	9	9	7

Figure 19: Deaths of persons aged 15-64 years from respiratory system diseases (average annual rate per 100,000 persons)

Source: JSA (2011), derived from PHIDU (2010)

12.5 Labour Force Participation 15+

- Of the eight case study areas, Balonne Shire has the highest labour force participation rate, 16% higher than the rate for Australia in 2006.
- The labour force participation rates of the other seven case study areas are within five percentage points (10%) of the rate for Australia.
- Murray Bridge has the lowest labour force participation rate, which declined by 1.5 percentage points (2.7%) between 1996 and 2006. The rate for Moree Plains also declined between 1996 and 2006, by 3.2 percentage points (5.2%).
- The average labour force participation rate for the areas within the MDB is similar to the rate for Australia (about 60%).

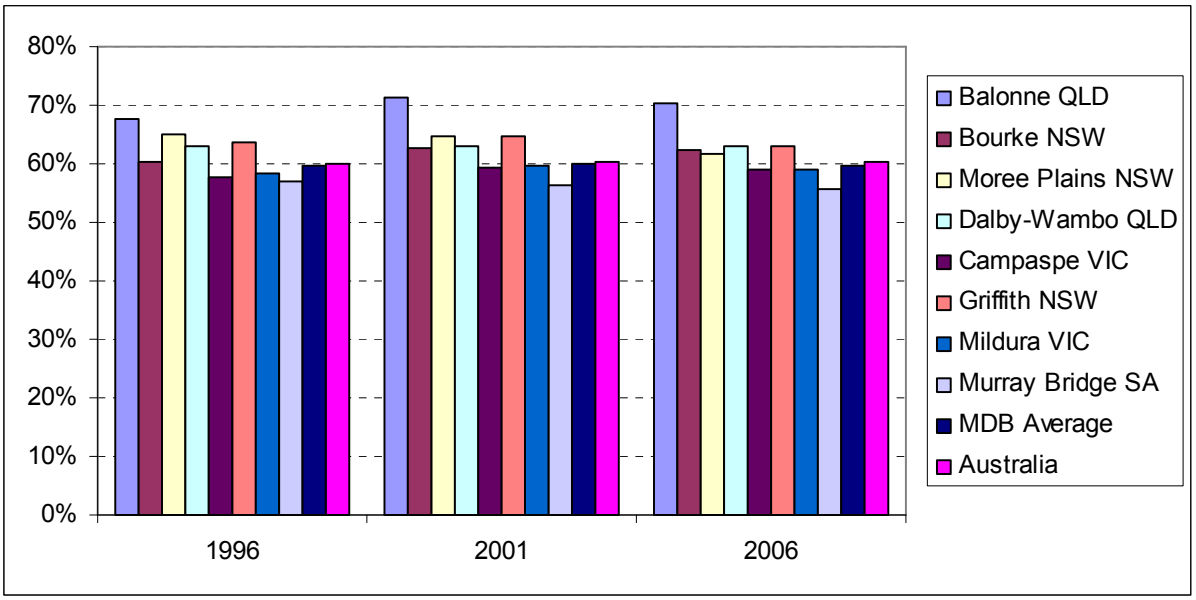
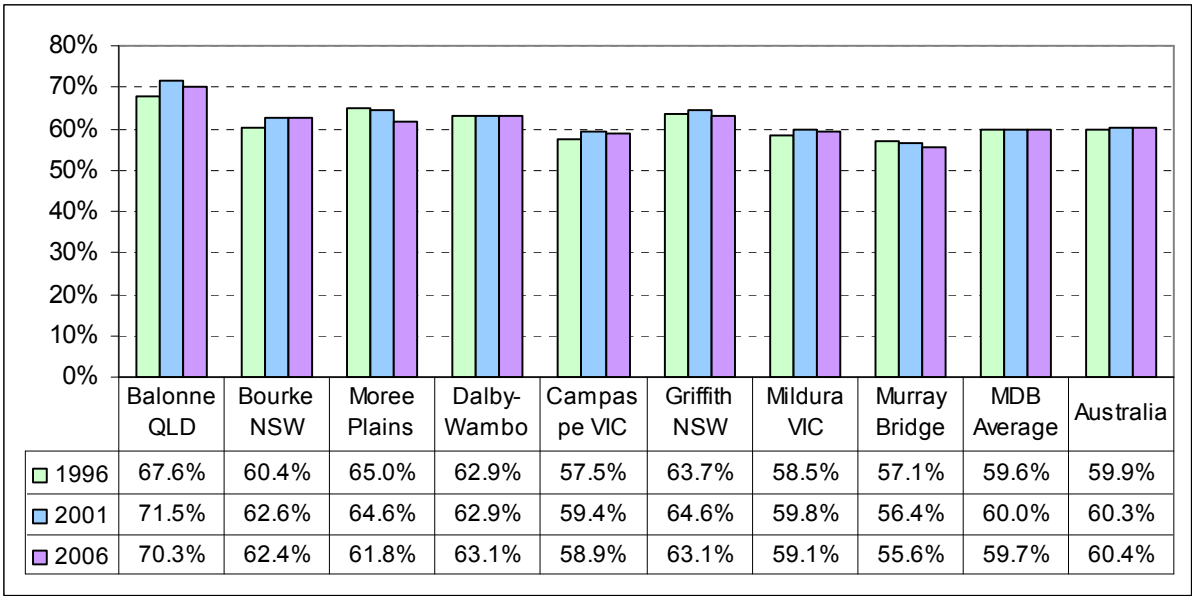


Figure 20: Labour Force Participation Rate (15+ yrs) – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains	Dalby-Wambo	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge	MDB Average	Australia
1996	67.6%	60.4%	65.0%	62.9%	57.5%	63.7%	58.5%	57.1%	59.6%	59.9%
2001	71.5%	62.6%	64.6%	62.9%	59.4%	64.6%	59.8%	56.4%	60.0%	60.3%
2006	70.3%	62.4%	61.8%	63.1%	58.9%	63.1%	59.1%	55.6%	59.7%	60.4%

Figure 21: Labour Force Participation Rate (15+ yrs) – Time Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

12.6 Median Household Income

- The average median household income of areas in the Murray Darling Basin in 1996 was similar to that for Australia. However, while the median household income for Australia rose by about $210 per week (or 25%) between 1996 and 2006 (once inflation has been taken into account), the average for areas within the MDB dropped slightly (by $25 per week).
- In 2006, the average median household income for areas in the MDB was 24% lower than for Australia.
- In 2006, of the eight case study areas Griffith had the highest median household income ($218 per week or 28% higher than the MDB average), followed by Balonne ($195 per week or 25% higher), Moree Plains ($167 per week or 21% higher) and Dalby-Wambo ($117 per week or 15% higher). While the median household income in Griffith remained reasonably constant between 1996 and 2006, in Balonne and Moree Plains it rose by $210 (27%) and $106 (13%) per week respectively.
- Of the eight case study areas, Murray Bridge has the lowest median household income, $107 per week (14%) lower than for the MDB average of areas.
- The median household incomes in Bourke, Campaspe and Mildura are fairly similar to the MDB average of areas.

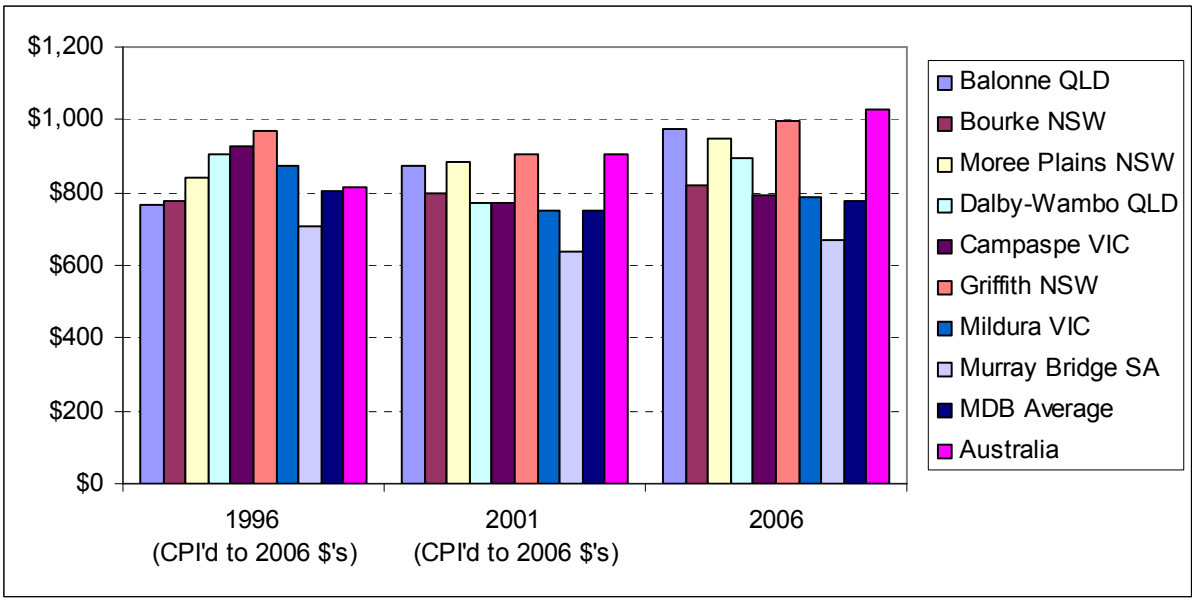
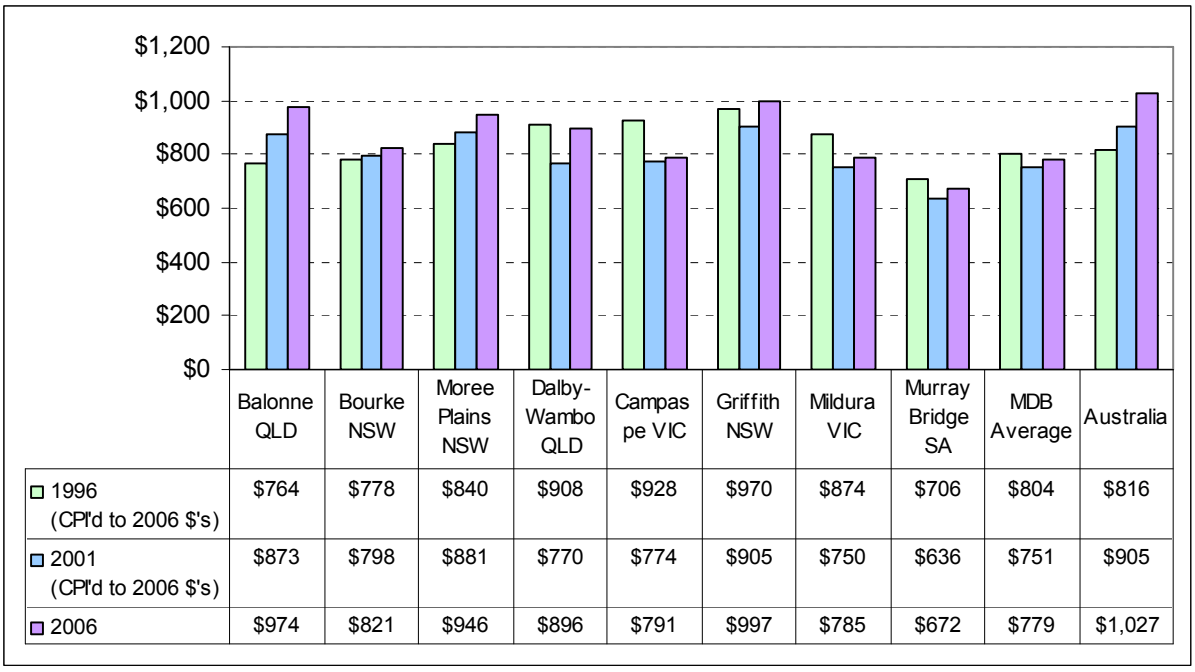


Figure 22: Median Gross Weekly Household Income – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1996 (CPI'd to 2006 $'s)	$764	$778	$840	$908	$928	$970	$874	$706	$804	$816
2001 (CPI'd to 2006 $'s)	$873	$798	$881	$770	$774	$905	$750	$636	$751	$905
2006	$974	$821	$946	$896	$791	$997	$785	$672	$779	$1,027

Figure 23: Median Gross Weekly Household Income – Time Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

12.7 Disability Support Pensioners

- On average, areas in the MDB have quite a large proportion of disability support pensioners, about 25% more than in Australia on the whole. In areas within the MDB on average, this proportion rose by 30% between 1996 and 2008, while in Australia it rose by about 25%.
- Of the eight case study areas, Murray Bridge has the largest proportion of disability support pensioners, in 2008 about 80% more than Australia and 40% more than the MDB average of areas. Between 1996 and 2008, the proportion of disability support pensioners in Murray Bridge increased by about 50%.
- In 2008, Balonne, Griffith and Moree Plains had relatively low proportions of disability support pensioners, 35%, 23% and 16% lower than the MDB average respectively. The proportion of disability support pensioners in Balonne and Griffith remained consistent between 1996 and 2008, while the proportion in Moree Plains rose by about 50%.
- The proportion of disability support pensioners in Bourke, Dalby-Wambo, Campaspe and Mildura are similar to the average proportion in areas within the MDB.

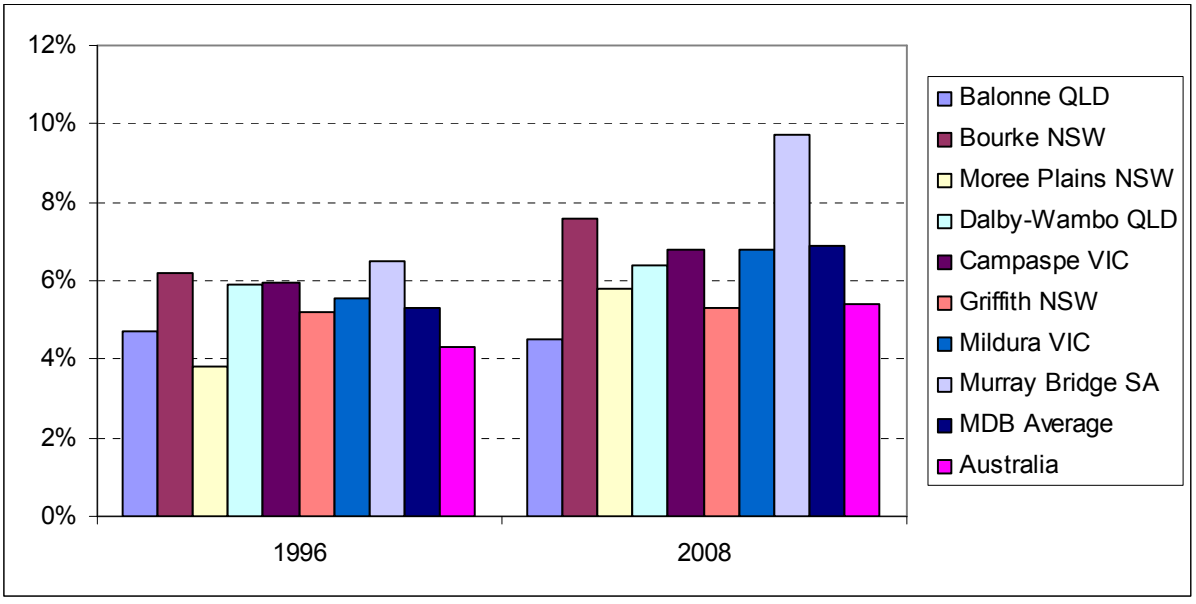
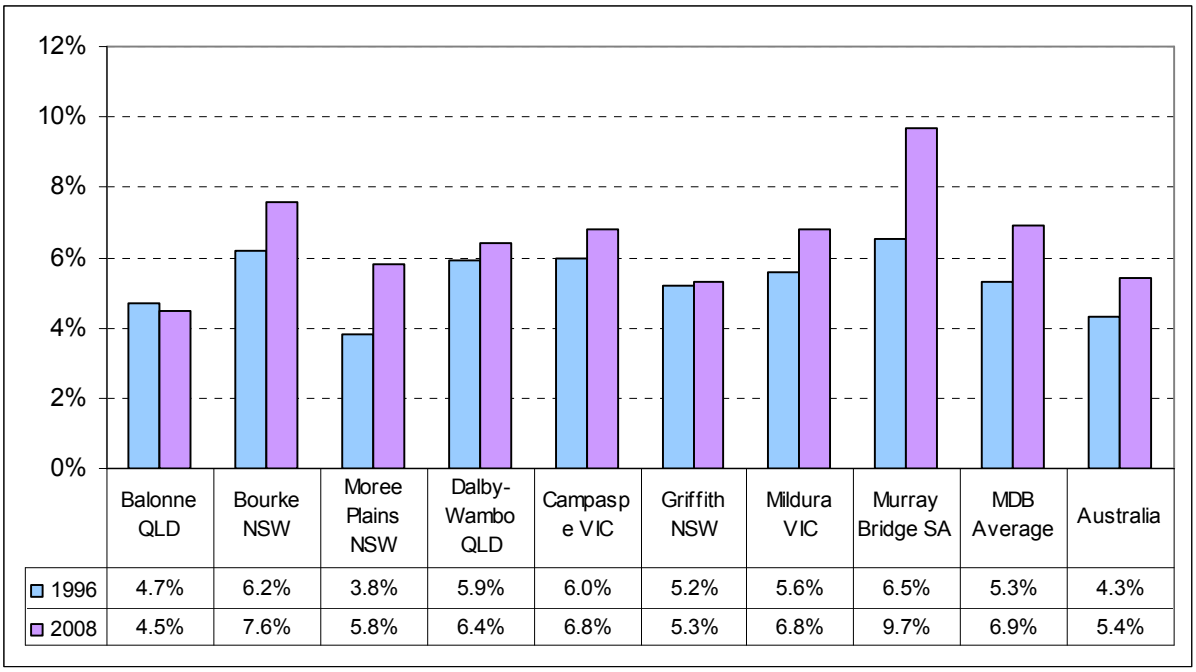


Figure 24: Disability Support Pensioner Rate – Area Comparison

Source: JSA (2011), derived from PHIDU (1996, 2008)



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1996	4.7%	6.2%	3.8%	5.9%	6.0%	5.2%	5.6%	6.5%	5.3%	4.3%
2008	4.5%	7.6%	5.8%	6.4%	6.8%	5.3%	6.8%	9.7%	6.9%	5.4%

Figure 25: Disability Support Pensioner Rate – Time Comparison

Source: JSA (2011), derived from PHIDU (1996, 2008)

12.8 Profound or Severe Disability

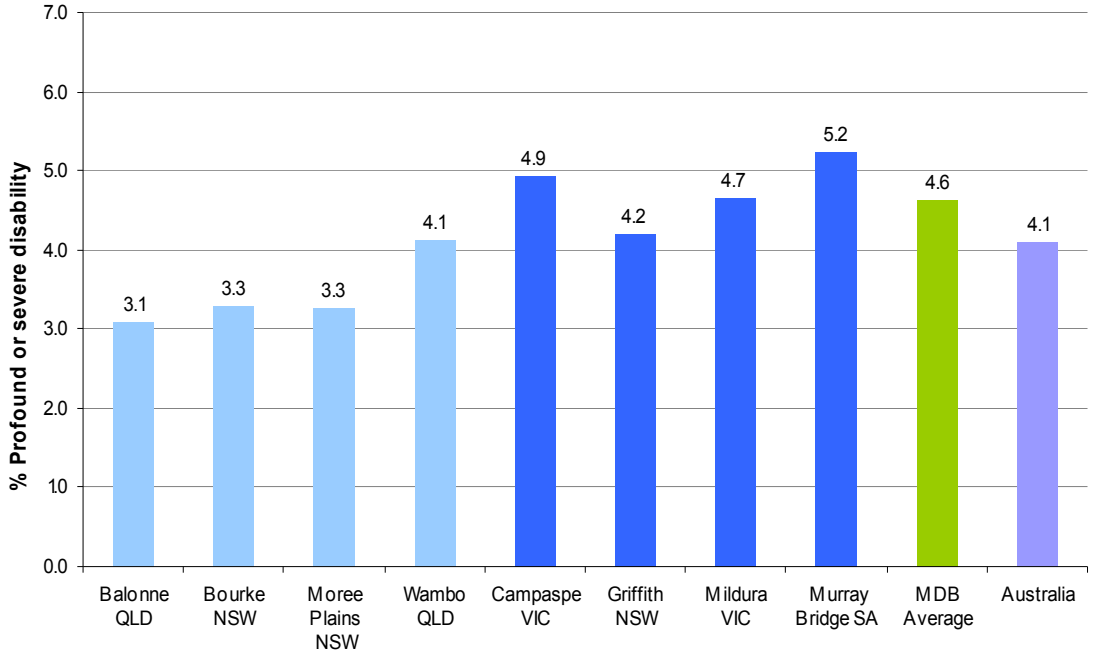


Figure 26: % Population with a profound or severe disability

Source: PHIDU (2008), JSA (2009)

12.9 Chronic Ill Health

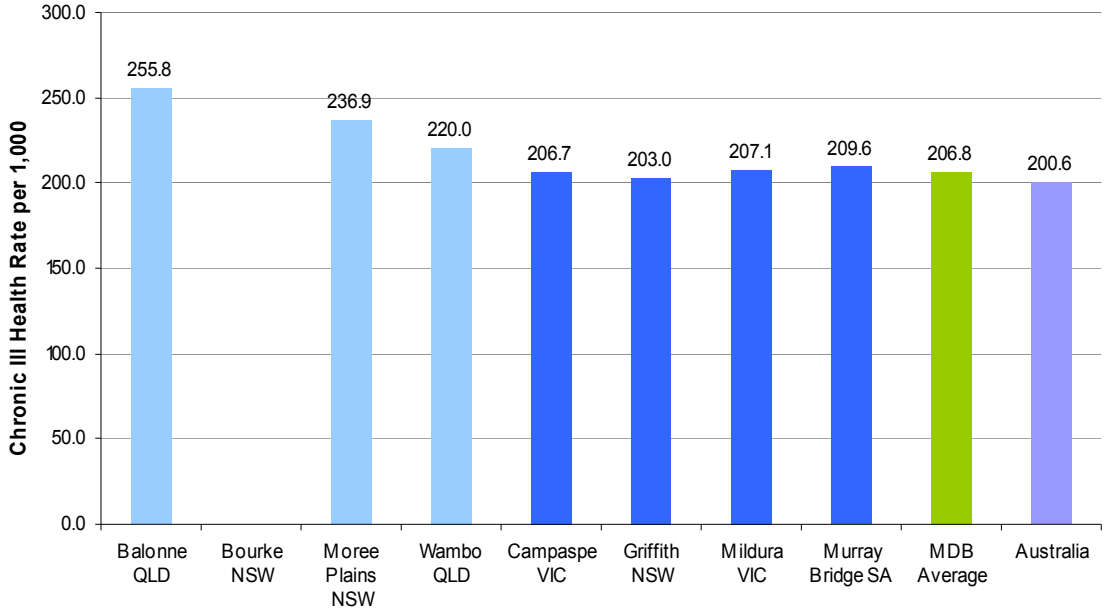


Figure 27: Chronic Ill Health Rate per 1,000 people

Source: PHIDU (2008), JSA (2009)

12.10 Fair or Poor Health

- In 2007-08, the areas with the largest proportion of persons reporting 'fair' or 'poor' health were Murray Bridge and Bourke, at 19.0% and 18.6% respectively, compared with the MDB average rate of 15.2% and national rate of 14.7%.
- The proportion of persons in Mildura reporting their health as 'fair' or 'poor' in 2007-08 was very low at 7.0%, though this should be treated with caution since this value is well outside of the range of the other areas.
- The rates in the other case study areas in 2007-08 were between 15% and 17%, as was the MDB average rate. The national rate was slightly lower at 14.7%.
- In Balonne Shire between 1995 and 2004-05, the proportion of persons reporting 'fair' or 'poor' health rose by almost 50%, from 13.0% to 19.3%, before falling to 16.2% in 2007-08. The rate in Moree Plains also rose dramatically, by about 40%, between 1995 and 2004-05, before falling to 16.6% in 2007-08.
- The proportion of persons reporting 'fair' or 'poor' health in Bourke rose by 24% between 1995 and 2007-08, from 15.0% to 18.6%.
- Comparatively, the MDB average and national rates remained more stable, as they generally did in the other case study areas. The value in Mildura halved between 2004-05 and 2007-08, though as mentioned previously this should be treated with caution.

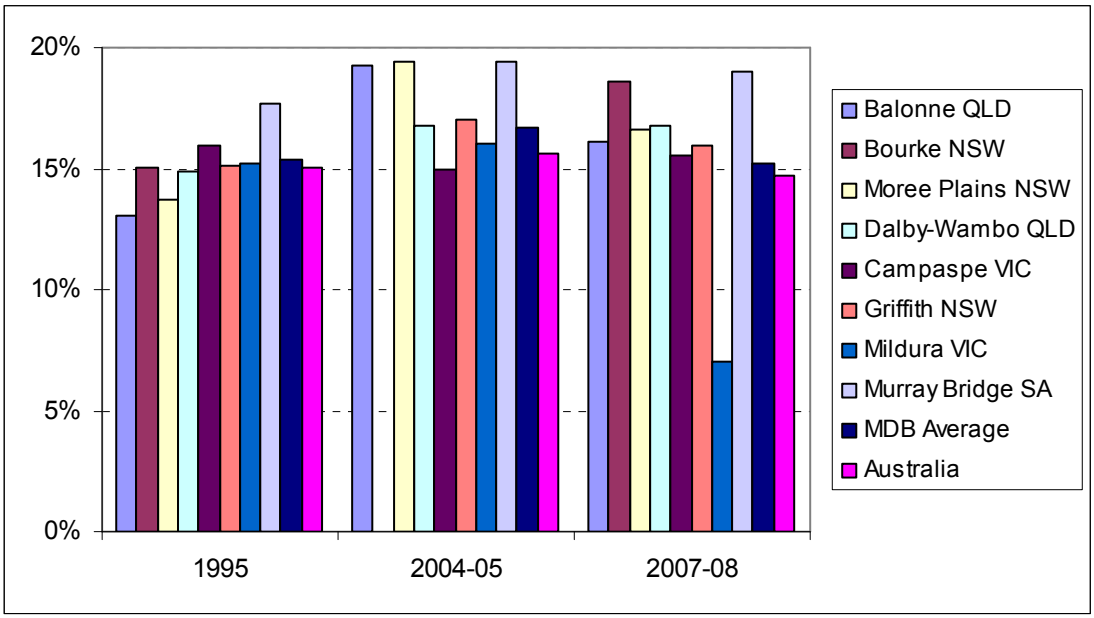
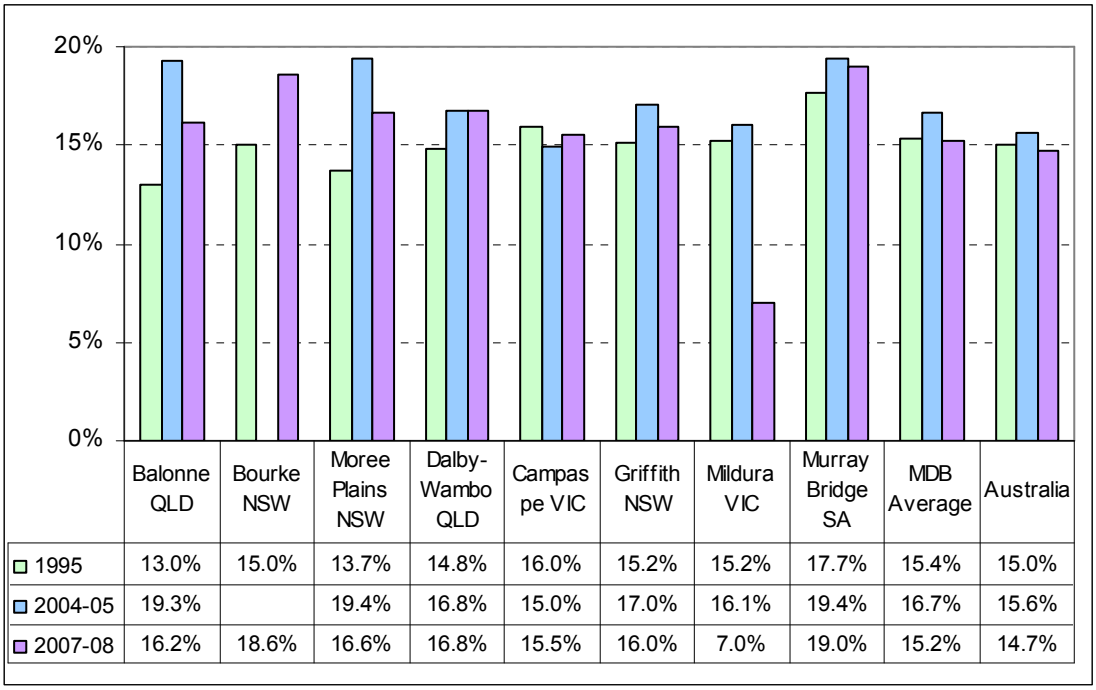


Figure 28: Proportion of persons reporting their health as 'fair' or 'poor' – Area Comparison

Source: JSA 2011, derived from PHIDU Social Health Atlas 1999, 2008



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1995	13.0%	15.0%	13.7%	14.8%	16.0%	15.2%	15.2%	17.7%	15.4%	15.0%
2004-05	19.3%		19.4%	16.8%	15.0%	17.0%	16.1%	19.4%	16.7%	15.6%
2007-08	16.2%	18.6%	16.6%	16.8%	15.5%	16.0%	7.0%	19.0%	15.2%	14.7%

Figure 29: Proportion of persons reporting their health as 'fair' or 'poor' – Time Comparison

Source: JSA 2011, derived from PHIDU Social Health Atlas 1999, 2008

12.11 Population Change 1991-2006

- It is clear that change in population and change in number of persons employed (below) are quite closely related, obviously due to the fact that a lower population will generally mean a smaller workforce. What is not so clear is whether lack of employment is leading to people leaving the areas, and vice-versa, or whether people are leaving / moving into areas for other reasons, and the number of people employed in the areas increases accordingly.
- The three case study areas that experienced substantial population loss between 1991 and 2006 were Balonne, Bourke and Moree Plains. All three areas experienced population loss between 1991 and 1996, of 5.2%, 9.3% and 8.3% respectively, as well as between 2001 and 2006, of 14.6%, 14.6% and 9.9% respectively. However, while Bourke also experienced some population loss between 1996 and 2001, and Moree Plains experienced a slight population increase, Balonne experienced a large population increase of almost 12% during that period, the largest growth of any of the case study areas in that period, and twice the national growth rate.
- Generally the other case study areas experienced growth between 1991 and 2006, the largest growth areas being Griffith, Mildura and Campaspe, while Dalby-Wambo experienced only slight growth. Comparatively, on average the populations of areas in the MDB remained fairly static, while the national growth rate was about 6% each five year period.

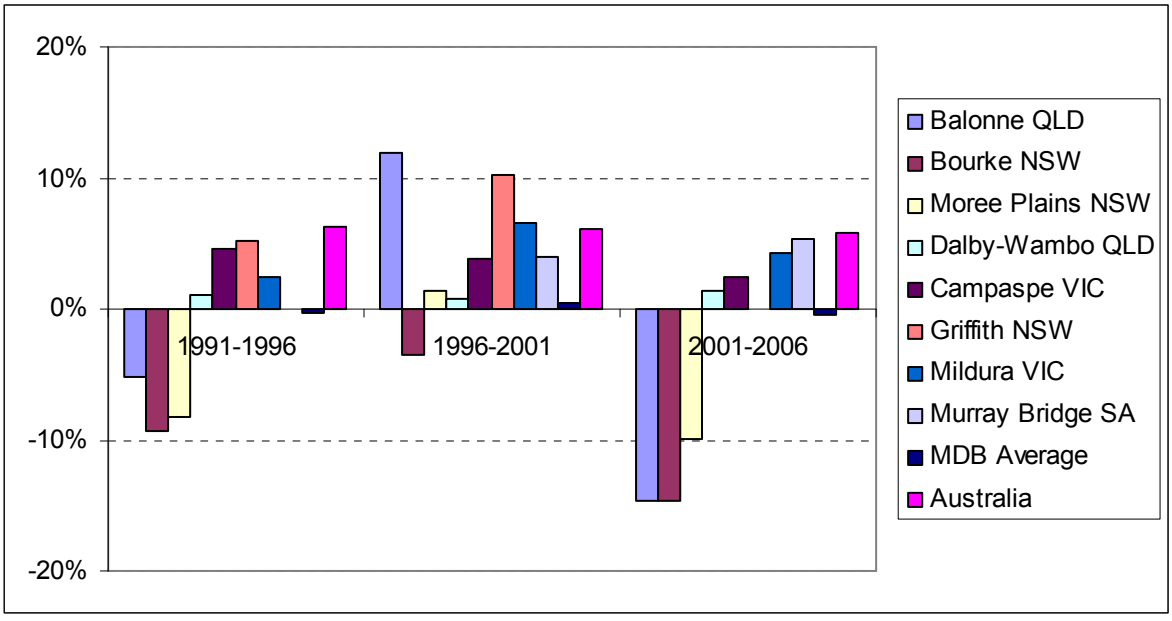
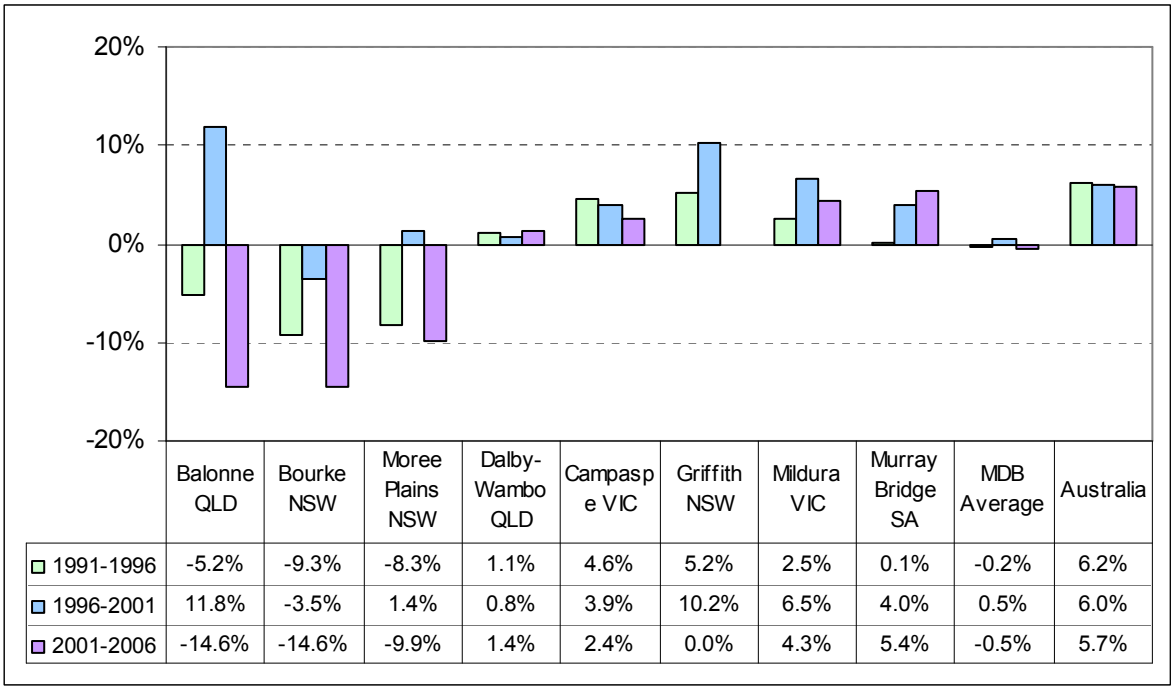


Figure 30: % Change in Population – Area Comparison

Source: JSA (2011), derived from ABS (1991, 1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1991-1996	-5.2%	-9.3%	-8.3%	1.1%	4.6%	5.2%	2.5%	0.1%	-0.2%	6.2%
1996-2001	11.8%	-3.5%	1.4%	0.8%	3.9%	10.2%	6.5%	4.0%	0.5%	6.0%
2001-2006	-14.6%	-14.6%	-9.9%	1.4%	2.4%	0.0%	4.3%	5.4%	-0.5%	5.7%

Figure 31: % Change in Population – Time Comparison

Source: JSA (2011), derived from ABS (1991, 1996, 2001, 2006) Census of Population and Housing

12.12 Employment Change 1991-2006

- On average, the increase in the number of persons employed in SLAs in the MDB between 1991 and 2006 has been lower than in Australia on the whole. While the number of persons employed in Australia has consistently increased by 8-10% each five years over those fifteen years, in the MDB on average the number decreased slightly between 1991 and 1996, and though it increased after 1996 this increase was substantially less than the increase for Australia on the whole.
- The period from 1996 to 2001 was a period of substantial growth in employment within the MDB (5.1% growth on average), especially in the areas of Balonne, Mildura, Griffith and Campaspe, which experienced 25.0%, 12.7%, 10.6% and 8.9% growth respectively, all higher than the growth rate of 8.7% over the same period for Australia on the whole.
- Dalby-Wambo has experienced steady growth in employment from 1991 to 2006, thought this growth was quite low compared with Australia on the whole. Campaspe and Mildura also experienced consistent growth, with a peak in growth in the period from 1996 to 2001.
- Griffith experienced a large growth in employment between 1991 and 2001, larger than for Australia, but then a slight decrease between 2001 and 2006.
- Murray Bridge experienced a substantial decrease in employment between 1991 and 1996 (4.5%), followed by a substantial increase from 1996 to 2001 (4.9%) and 2001 to 2006 (7.1%).
- Balonne, Bourke and Moree Plains each experienced a substantial decrease in the number of persons employed between 1991 and 1996 (8.2%, 9.0% and 5.4% respectively), followed by an increase between 1996 and 2001, (a very large increase for Balonne , and a more slight increase for Bourke (1.5%) and Moree Plains (3.3%)), and then a large decrease between 2001 and 2006 (18.3% for Balonne and 16.1% for Bourke and Moree Plains).

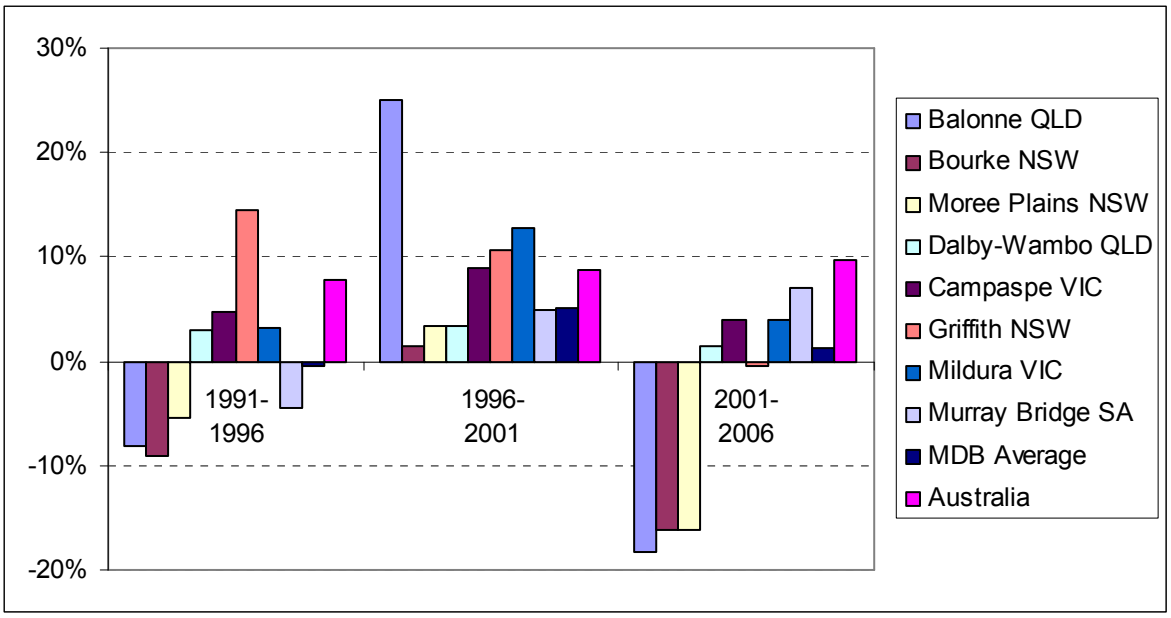
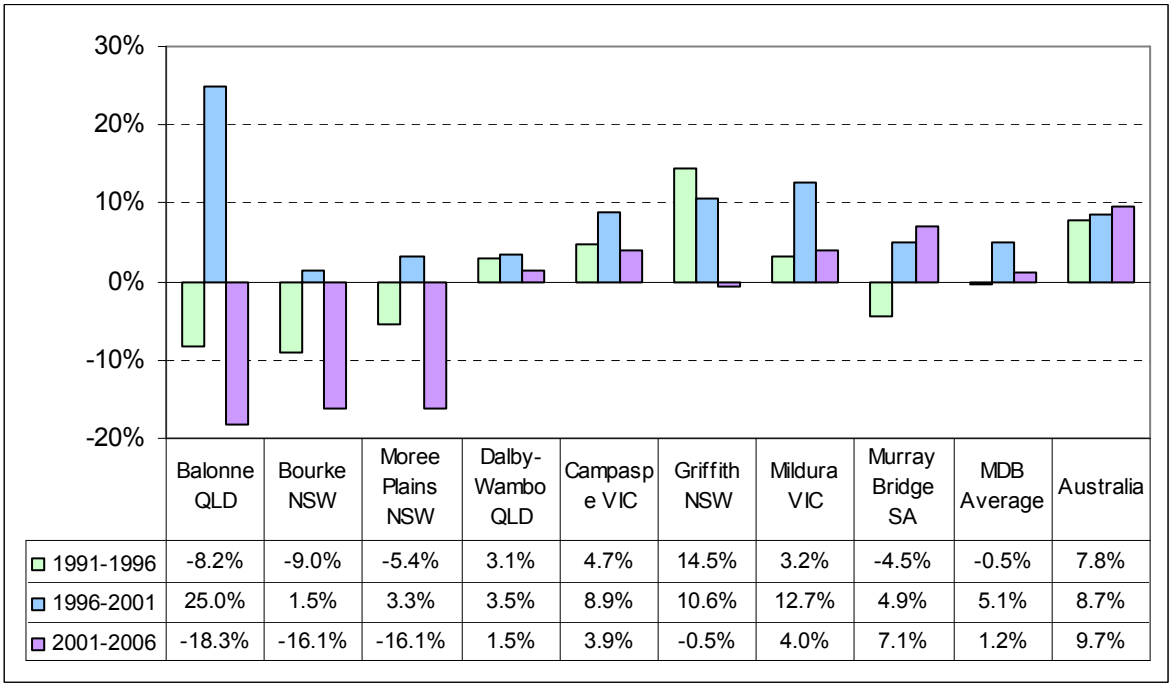


Figure 32: % Change in Number of Persons Employed – Area Comparison

Source: JSA (2011), derived from ABS (1991, 1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1991-1996	-8.2%	-9.0%	-5.4%	3.1%	4.7%	14.5%	3.2%	-4.5%	-0.5%	7.8%
1996-2001	25.0%	1.5%	3.3%	3.5%	8.9%	10.6%	12.7%	4.9%	5.1%	8.7%
2001-2006	-18.3%	-16.1%	-16.1%	1.5%	3.9%	-0.5%	4.0%	7.1%	1.2%	9.7%

Figure 33: % Change in Number of Persons Employed – Time Comparison

Source: JSA (2011), derived from ABS (1991, 1996, 2001, 2006) Census of Population and Housing

12.13 Labour Force Participation 65+

- Compared with Australia on the whole, on average SLAs in the MDB have a high labour force participation rate of persons aged 65 years and over, about twice the rate for Australia. This rate has steadily increased between 1996 and 2006 for both Australia and the MDB average, by 42% and 8% respectively over the ten year period.
- Of the eight case study areas, Balonne has the highest labour force participation rate of persons aged 65 years and over, 46% higher than the average rate of SLAs in the MDB in 2006.
- Bourke and Moree Plains also have quite high labour force participation rates of persons aged 65 years and over, 42% and 32% higher than the MDB average respectively in 2006.
- The rates in Dalby-Wambo and Griffith are similar to the MDB average rate.
- Campaspe, Mildura and especially Murray Bridge have quite low rates of labour force participation of persons aged 65 years and over, with Campaspe and Mildura having rates 33% and 42% lower respectively than the average rate of areas in the MDB, and Murray Bridge having a rate around half that of the MDB average, in 2006.
- Each of the case study areas apart from Mildura had an increase in the proportion of persons aged 65 years and over participating in the labour force between 1996 and 2006 of 10% or more. Murray Bridge had a 33% increase, Dalby-Wambo had a 29% increase, and Bourke had a 24% increase.

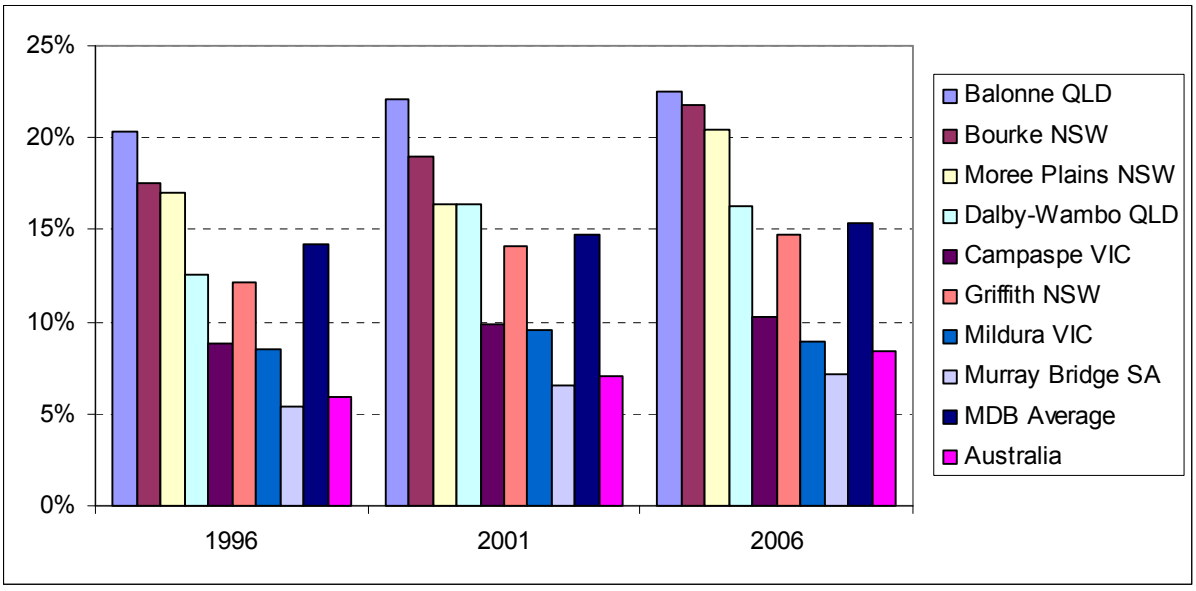
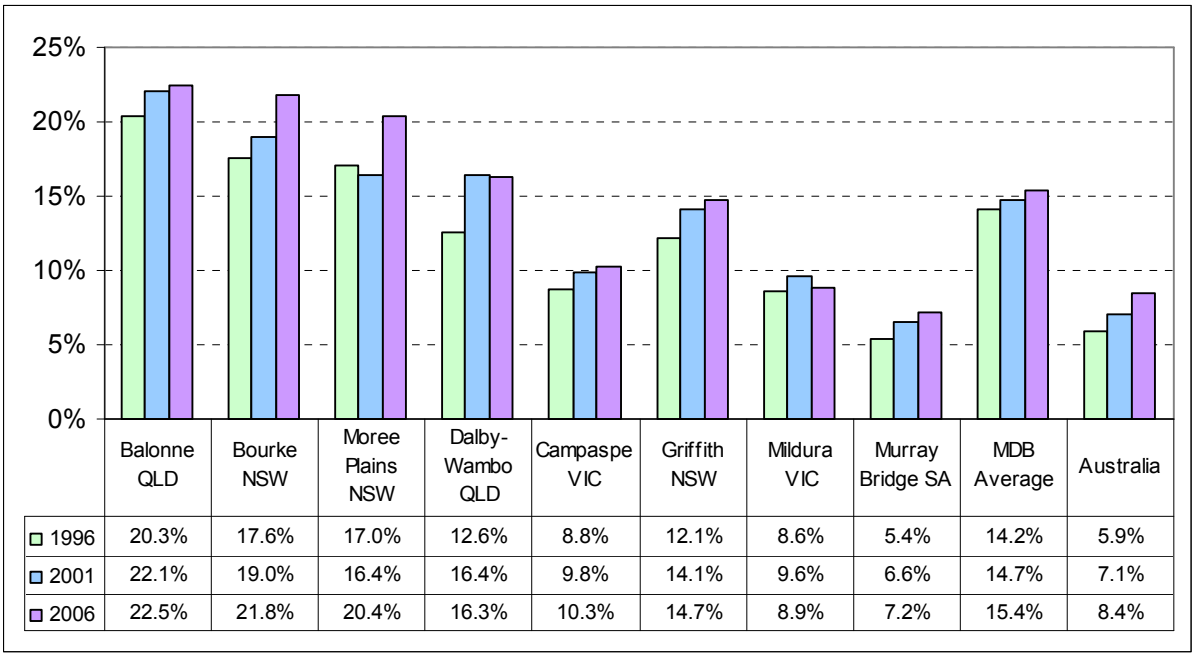


Figure 34: Labour Force Participation Rate Age 65+ yrs – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1996	20.3%	17.6%	17.0%	12.6%	8.8%	12.1%	8.6%	5.4%	14.2%	5.9%
2001	22.1%	19.0%	16.4%	16.4%	9.8%	14.1%	9.6%	6.6%	14.7%	7.1%
2006	22.5%	21.8%	20.4%	16.3%	10.3%	14.7%	8.9%	7.2%	15.4%	8.4%

Figure 35: Labour Force Participation Rate Age 65+ yrs – Time Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

12.14 % of Employed Persons Directly Employed in Agriculture

- In 2006, areas in the MDB on average were very reliant on agriculture as a source of employment compared with the nation, with over six times the proportion of employed persons working in this industry.
- Of the eight case study areas, the most heavily reliant on agriculture is Balonne, where 36% of employed persons work in agriculture, compared with the MDB average rate of 22%. This rate decreased somewhat between 1996 and 2006, falling by about 10% from a 1996 rate of 40%.
- Moree Plains and Bourke are also quite reliant on agriculture, having rates above the MDB average at 27% and 24% respectively.
- The other five case study areas are less reliant on agriculture than areas in the MDB on average, though they are still much more reliant than the national in general.
- The case study area that is least reliant on agriculture is Murray Bridge. At 9%, the proportion of employed persons working in agriculture is less than half the MDB average rate.
- Between 1996 and 2006, the dependence of the case study areas on agriculture as a source of employment has generally decreased, as is also the case in all areas in the MDB on average and nationally.
- There was a large decrease in Griffith, where the proportion of employed persons working in agriculture fell by almost 40% over the ten year period, from 22% to 14%, as well as in Murray Bridge (also fell by about 40% from 15% to 9%) and in Campaspe (fell by 30% from 23% to 16%).

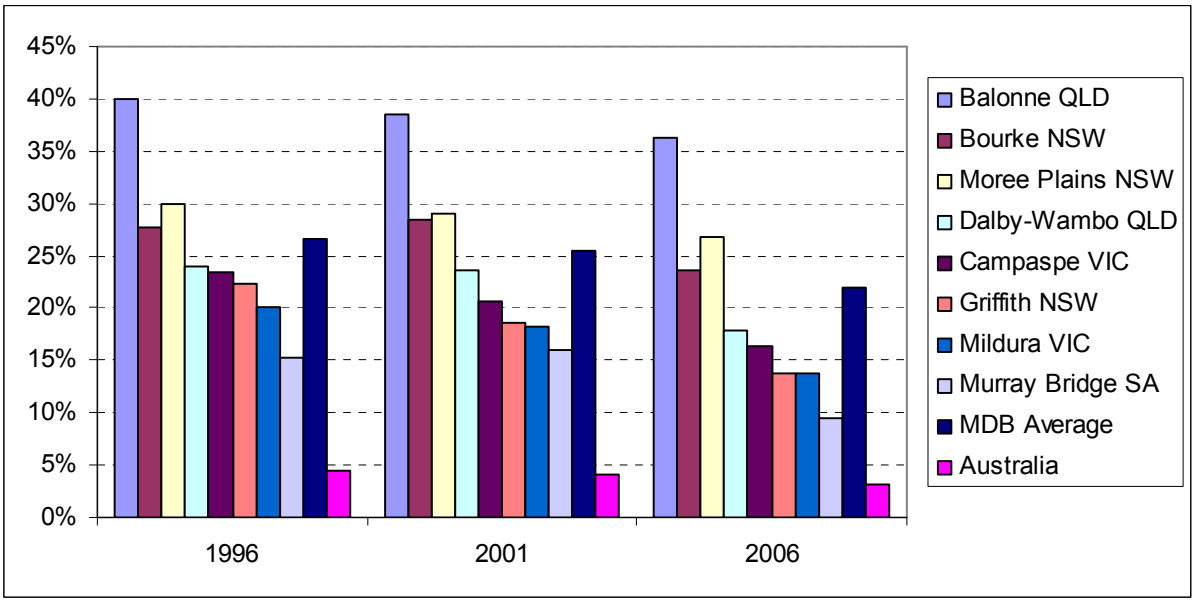
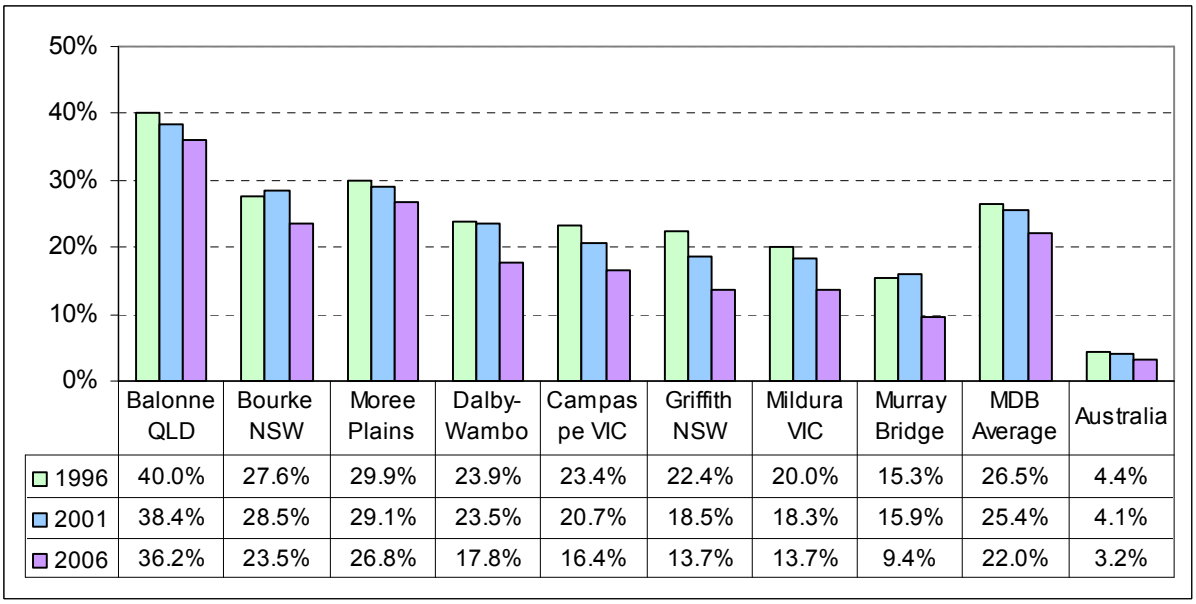


Figure 36: % of Employed Persons Engaged in Agriculture – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains	Dalby-Wambo	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge	MDB Average	Australia
1996	40.0%	27.6%	29.9%	23.9%	23.4%	22.4%	20.0%	15.3%	26.5%	4.4%
2001	38.4%	28.5%	29.1%	23.5%	20.7%	18.5%	18.3%	15.9%	25.4%	4.1%
2006	36.2%	23.5%	26.8%	17.8%	16.4%	13.7%	13.7%	9.4%	22.0%	3.2%

Figure 37: % of Employed Persons Engaged in Agriculture – Time Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

Note:

- Based purely on quantities reported in the ABS Census TSPs under 'Agriculture, Forestry and Fishing'. Does not include jobs that depend on agriculture, for example manufacturing of cotton products.
- Subtracted quantity of persons who did not adequately describe / did not state their industry of employment from the total employed persons when calculating the percentage employed in agriculture.

12.15 Median Age

- Between 1996 and 2006, the median age of persons in each of the eight case study areas, as well as in areas in the MDB on average and in Australia as a whole, has increased by three to five years.
- An increase in median aged of five years between 1996 and 2006 (the largest increase in median age of the case study areas) was seen in Murray Bridge, which is the same as the average increase in areas in the MDB. The other case study areas had an increase of three to four years of age over the same period of time.
- In 2006, the case study area with the highest median age was Campaspe, which had a median age of 40 years, the same as the MDB average of areas. This was followed by Murray Bridge (39 years), Mildura (37 years), Dalby-Wambo (36 years), Griffith (35 years), Moree Plains and Balonne (34 years), and Bourke (33 years). This means that the median age in each of the case study areas apart from Campaspe was lower than the average of areas in the MDB.

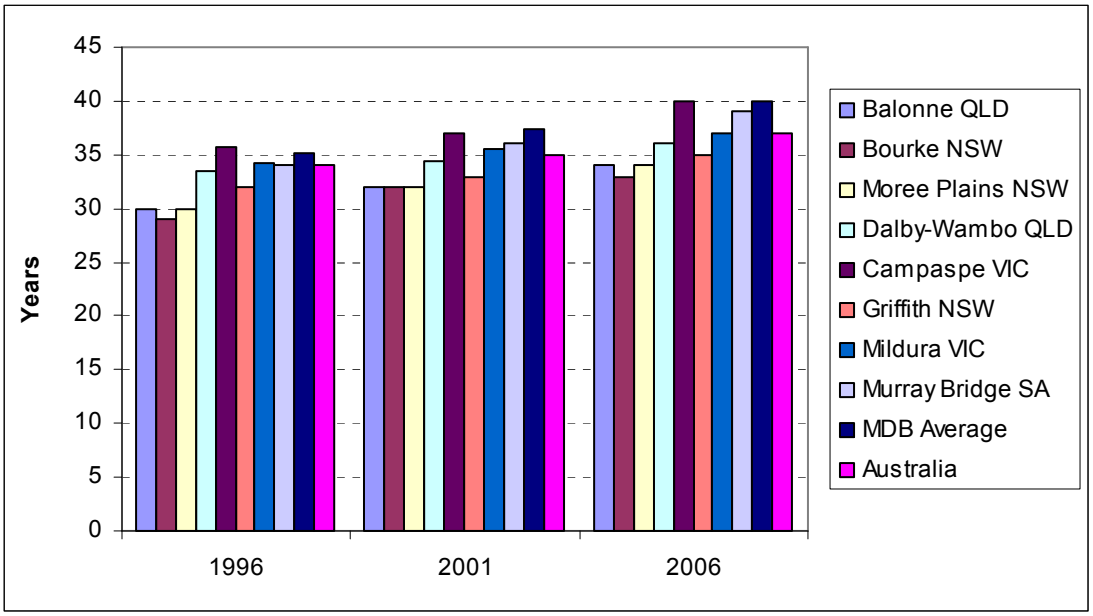
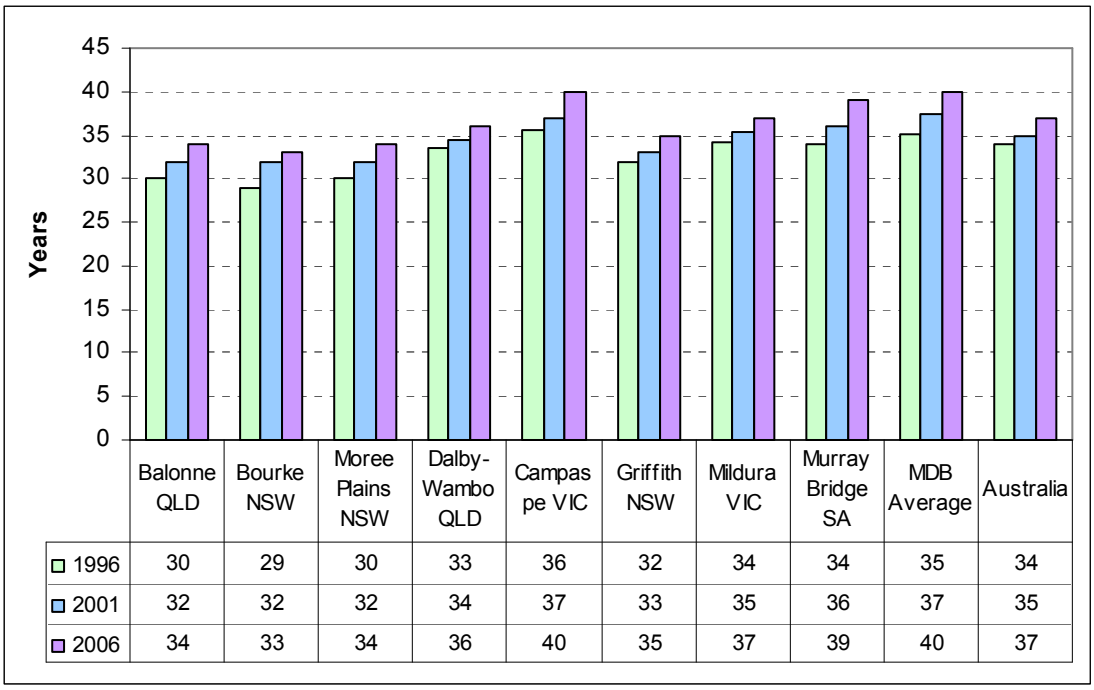


Figure 38: Median Age – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1996	30	29	30	33	36	32	34	34	35	34
2001	32	32	32	34	37	33	35	36	37	35
2006	34	33	34	36	40	35	37	39	40	37

Figure 39: Median Age – Time Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

12.16 Skills Base

- On average SLAs in the MDB have a low proportion of persons who hold certificates or higher qualifications compared with the rate for Australia on the whole (20% lower in 2006).
- In 2006, areas with particularly low proportions of persons holding certificates of higher qualifications were Murray Bridge (18% lower than the MDB average of areas), Balonne (11% lower), and Dalby-Wambo and Bourke (both 10% lower). The other case study areas had a rate that was similar to the average rate of areas in the MDB.
- Each of the case study areas, as well as the MDB average and Australia on the whole, had an increase in the proportion of persons holding certificates or higher qualifications between 1996 and 2006. The largest increase was seen in Bourke (49%), followed by Murray Bridge (45%), Dalby-Wambo and Balonne (both 40%), Mildura (39%), Campaspe (38%), Griffith (33%) and finally Moree Plains (29%). The average increase in areas in the MDB was 39%, and in Australia overall there was a 32% increase.

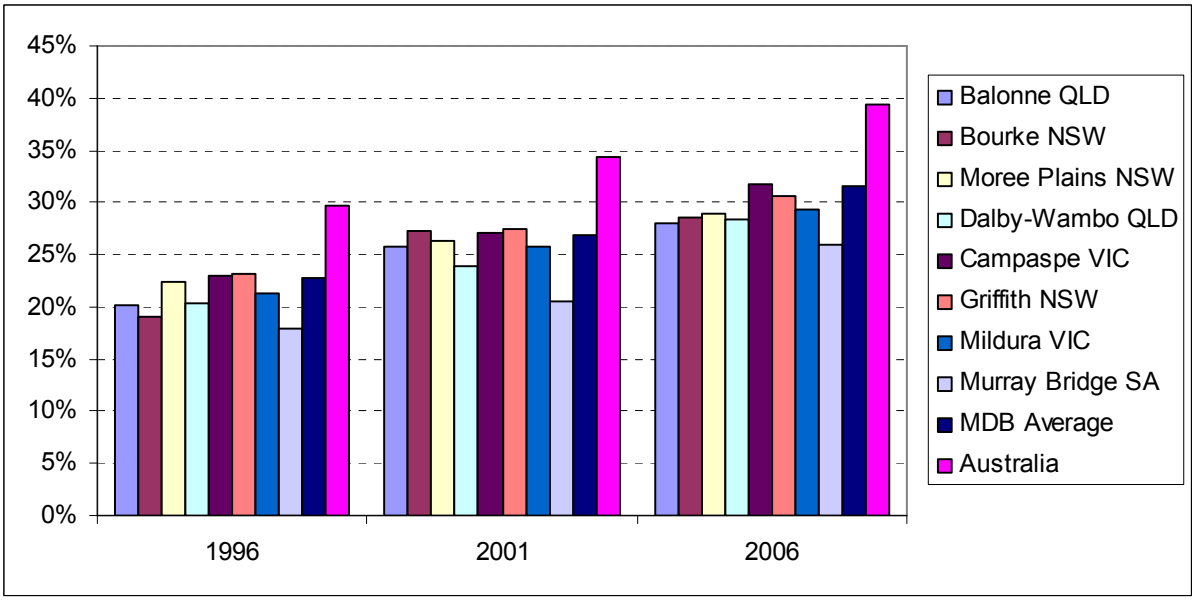
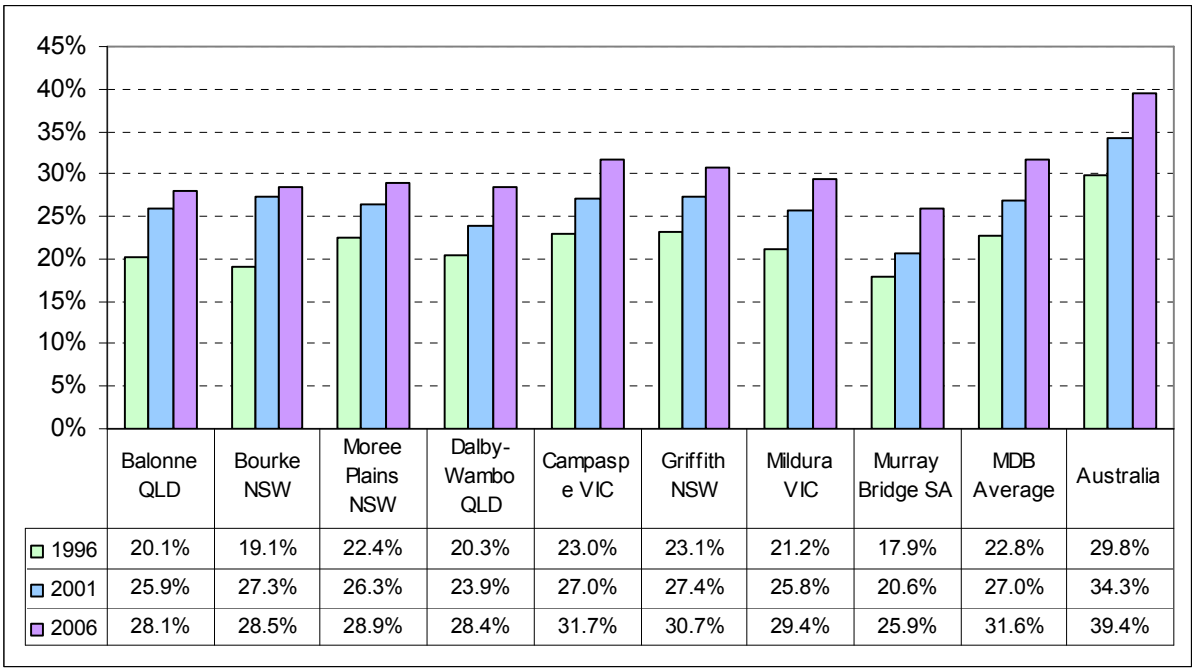


Figure 40: % Population 15+ yrs with Trade or Higher Qualifications – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1996	20.1%	19.1%	22.4%	20.3%	23.0%	23.1%	21.2%	17.9%	22.8%	29.8%
2001	25.9%	27.3%	26.3%	23.9%	27.0%	27.4%	25.8%	20.6%	27.0%	34.3%
2006	28.1%	28.5%	28.9%	28.4%	31.7%	30.7%	29.4%	25.9%	31.6%	39.4%

Figure 41: % Population 15+ yrs with Trade or Higher Qualifications – Time Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

12.17 Participation in Secondary Education at Age 16

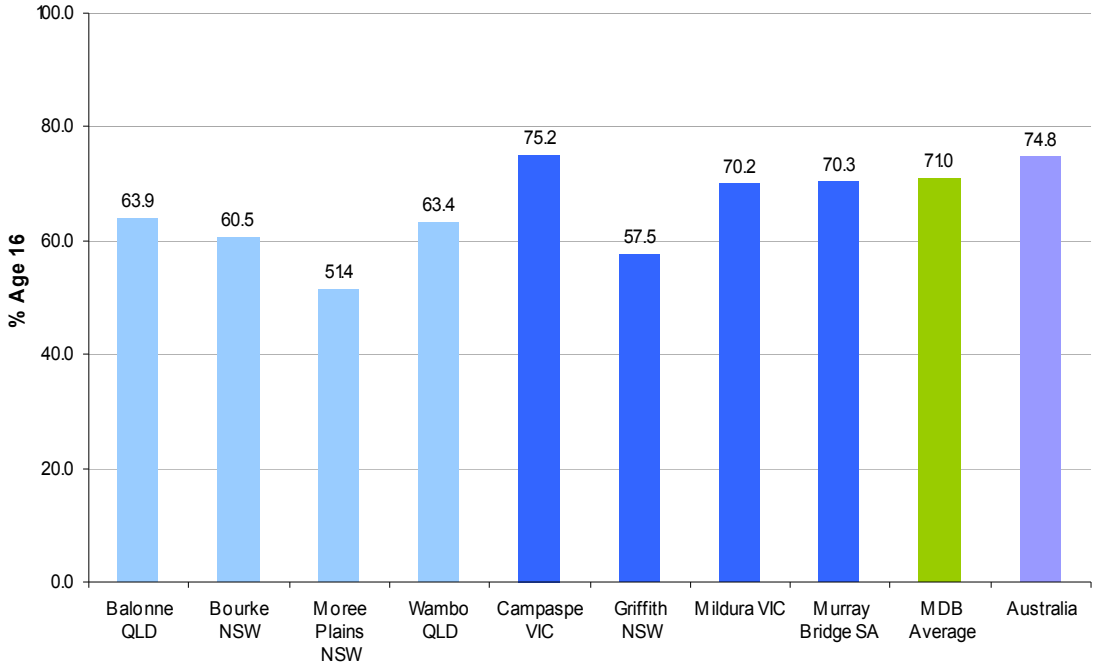


Figure 42: Secondary Education Participation Rate at Age 16

Source: PHIDU (2008), JSA (2009)

12.18 Participation in Secondary Education

- The average rate of participation in secondary education of areas in the MDB is slightly (about two percentage points) lower than the rate for Australia as a whole. This rate has dropped slightly (by 1.6 percentage points or 2.1%) in the MDB between 1996 and 2006, while in Australia it has dropped by 2.2 percentage points (2.8%) over the same period.
- In 2006, the case study areas with the lowest rate of secondary school participation were Moree Plains (60%), Balonne (62%), Bourke and Dalby-Wambo (both 63%). Case study areas with the highest secondary school participation rates were Campaspe (80%) and Mildura (78%). This is compared with an average rate of areas in the MDB of 75% and 77% for Australia as a whole.
- Moree Plains experienced a drop of ten percentage points (14%) in the rate of secondary school participation between 1996 and 2006, and Dalby-Wambo, Campaspe, Griffith and Mildura each experienced a drop of five to six percentage points (6-8%) over the same period. Murray Bridge, on the other hand, experienced an increase in the secondary school participation rate of seven percentage points (11%) over the same period.

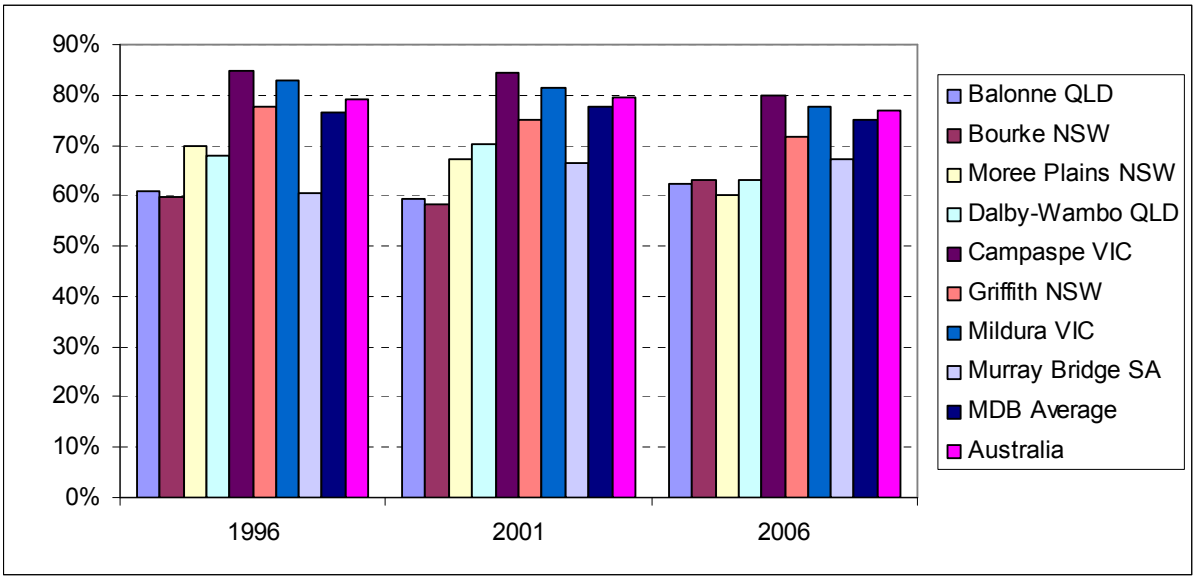
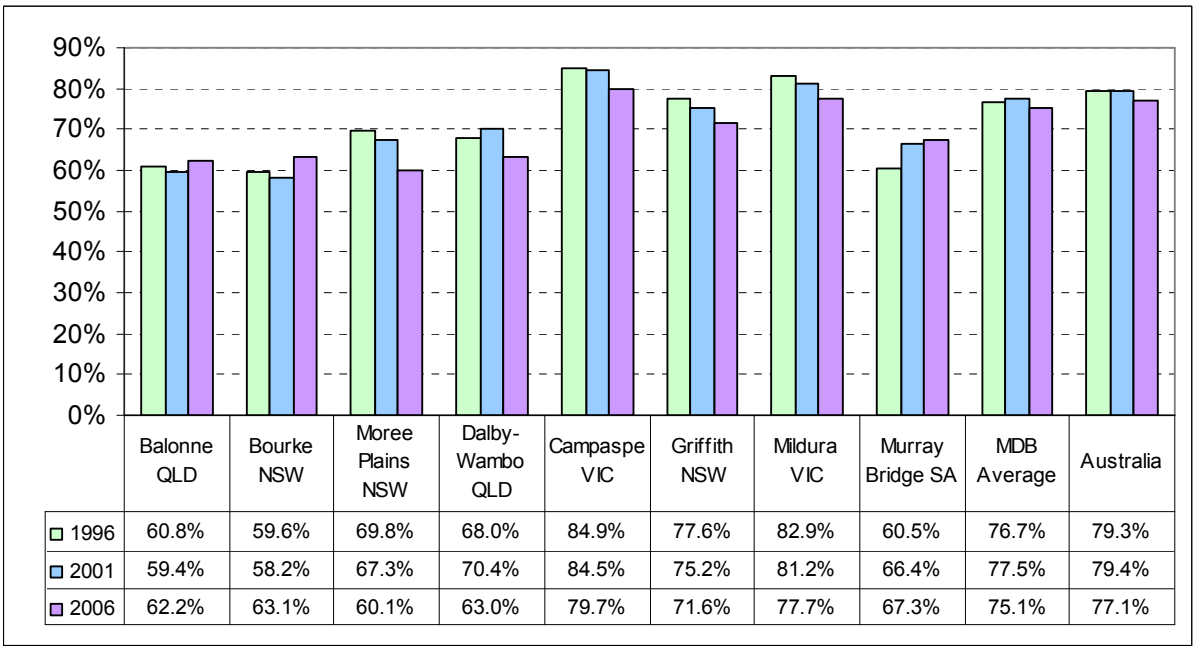


Figure 43: Secondary Education Participation Rate – Area Comparison[61]

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

[61] Note: Secondary Education Participation Rate has been calculated by dividing the total number of persons attending secondary school by the total number of persons aged between 12 and 17 years of age inclusive.



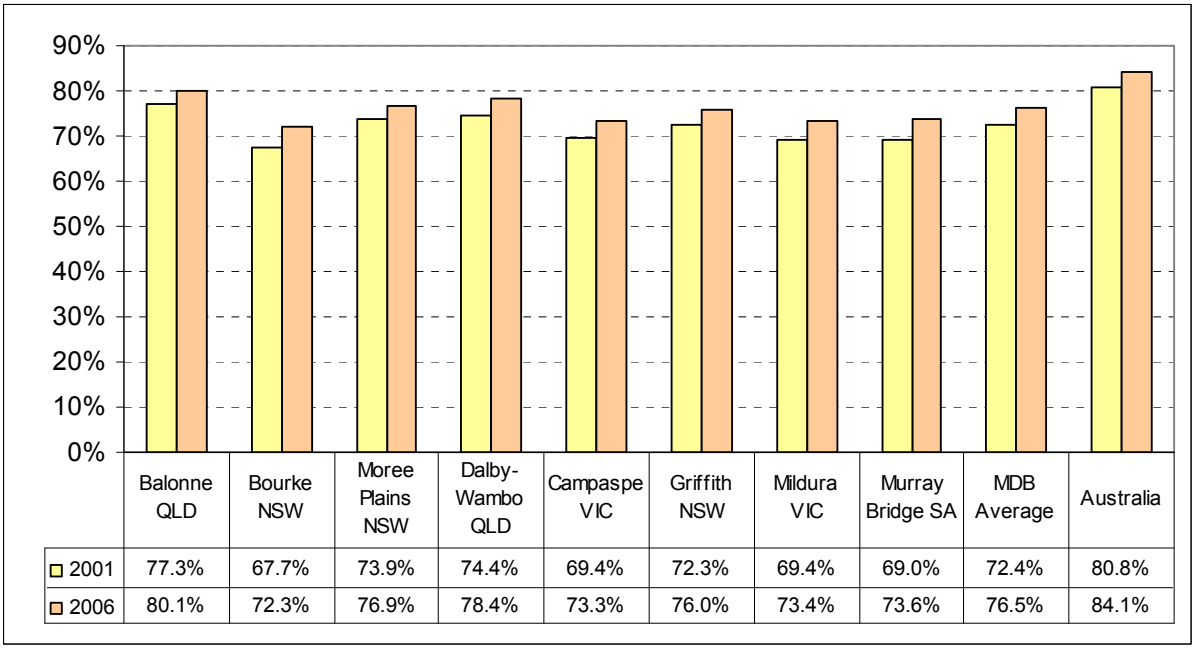
	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1996	60.8%	59.6%	69.8%	68.0%	84.9%	77.6%	82.9%	60.5%	76.7%	79.3%
2001	59.4%	58.2%	67.3%	70.4%	84.5%	75.2%	81.2%	66.4%	77.5%	79.4%
2006	62.2%	63.1%	60.1%	63.0%	79.7%	71.6%	77.7%	67.3%	75.1%	77.1%

Figure 44: Secondary Education Participation Rate – Time Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

12.19 Highest Level of Schooling Completed

- The average Year 10 completion rate of areas in the MDB in 2006 (76.5%) was about eight percentage points (9%) lower than the rate for Australia (84.1%).
- The Year 10 completion rate of each of the case study areas is within five percentage points (7%) of the MDB average rate, with the highest rates in 2006 being in Balonne (80.1%) and Dalby-Wambo (78.4%), and the lowest being in Bourke (72.3%), Campaspe (73.3%), Mildura (73.4%) and Murray Bridge (73.6%).
- Each of the case study areas, as well as the MDB average of areas and Australia as a whole, had an increase in its Year 10 completion rate of three to five percentage points (4% to 7%) between 2001 and 2006. The smallest increases were in Balonne (3.6%) and Moree Plains (4.1%), while the largest increases were in Bourke (6.8%) and Murray Bridge (6.7%), compared with an average increase of 5.7% for areas within the MDB, and 4.1% for Australia.

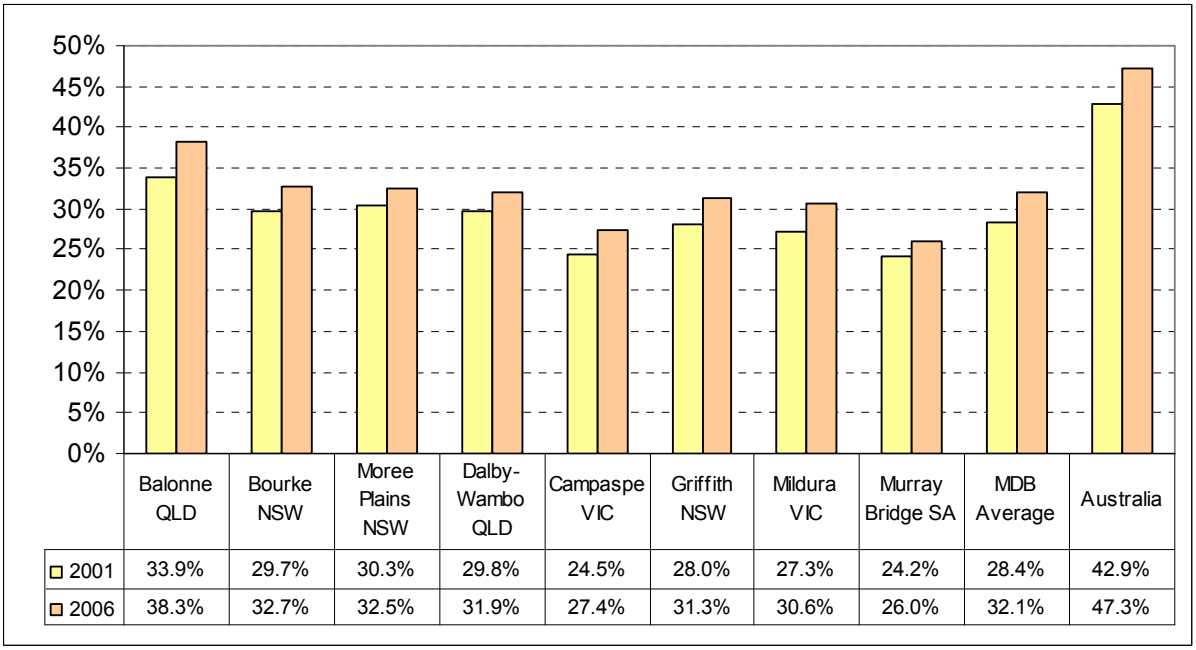


	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
2001	77.3%	67.7%	73.9%	74.4%	69.4%	72.3%	69.4%	69.0%	72.4%	80.8%
2006	80.1%	72.3%	76.9%	78.4%	73.3%	76.0%	73.4%	73.6%	76.5%	84.1%

Figure 45: Proportion of Persons Completed Year 10 or above

Source: JSA (2011), derived from ABS (2001, 2006) Census of Population and Housing

- On average, the Year 12 completion rate of SLAs in the MDB in 2006 was 32.1%, around two-thirds the rate for Australia as a whole. (In 2006 the Year 12 completion rate for Australia was 47.3%).
- At 26.0%, the Year 12 completion rate for Murray Bridge in 2006 was the lowest of the eight case study areas, followed by Campaspe at 27.4%.
- Balonne Shire had the highest Year 12 completion rate in 2006 at 38.3%.
- The Year 12 completion rates of the other five case study areas are within two percentage points (10%) of the MDB average rate.
- The Year 12 completion rates of the eight case study areas, as well as the MBD average and Australian rates, increased by two to five percentage points (7-13%) between 2001 and 2006. The largest increases were in Balonne (13%) and Mildura (12%), and the smallest were in Dalby-Wambo, Moree Plains and Murray Bridge (7% in each), compared with an average increase of 13% for areas in the MDB and 10% for Australia.



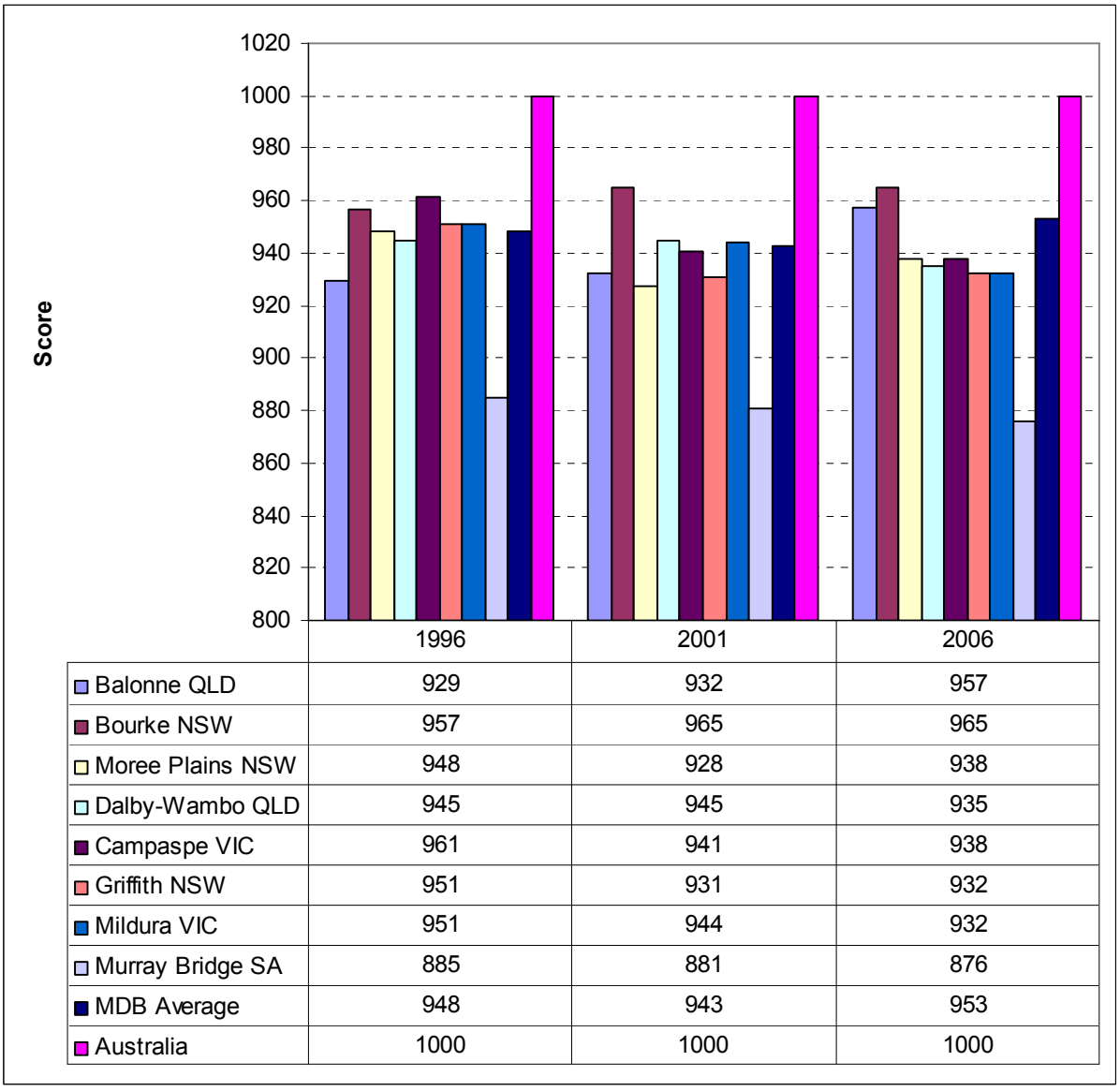
	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
2001	33.9%	29.7%	30.3%	29.8%	24.5%	28.0%	27.3%	24.2%	28.4%	42.9%
2006	38.3%	32.7%	32.5%	31.9%	27.4%	31.3%	30.6%	26.0%	32.1%	47.3%

Figure 46: Proportion of Persons Completed Year 12

Source: JSA (2011), derived from ABS (2001, 2006) Census of Population and Housing

12.20 SEIFA Education and Occupation

- As with the SEIFA Scores for Disadvantage and Economic Resources, Murray Bridge consistently scored very lowly in terms of Education and Occupation between 1996 and 2006, by far the lowest of the case study areas, and much lower than the MDB average and national scores.
- The scores of the other case study areas were more similar to the MDB average score, though still substantially lower than the national score, over the ten year period.



	1996	2001	2006
Balonne QLD	929	932	957
Bourke NSW	957	965	965
Moree Plains NSW	948	928	938
Dalby-Wambo QLD	945	945	935
Campaspe VIC	961	941	938
Griffith NSW	951	931	932
Mildura VIC	951	944	932
Murray Bridge SA	885	881	876
MDB Average	948	943	953
Australia	1000	1000	1000

Figure 47: SEIFA Index of Education and Occupation – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006)

12.21 Polarisation (Gini Coefficient)

- The Gini coefficient is used in order to measure the equality of the distribution of income across a population, and varies from zero to one, with a lower value representing greater income equality.
- In 2006, on average areas within the MDB had a Gini coefficient of 0.39, as did Australia, as well as Campaspe, Griffith, Mildura and Murray Bridge. Balonne and Dalby-Wambo had slightly lower scores (0.37 and 0.38 respectively), indicating greater income equality, while Moree Plains and Bourke had higher scores (0.40 and 0.42 respectively), indicating greater inequality.
- In each case study area apart from Balonne Shire, as well as in areas in the MDB on average, the Gini coefficient increased by 0.02 to 0.04 between 1996 and 2006, meaning that they have become less equal. Balonne Shire, as well as Australia as a whole, had the same score in 1996 and 2006, though the score dropped temporarily in 2001.

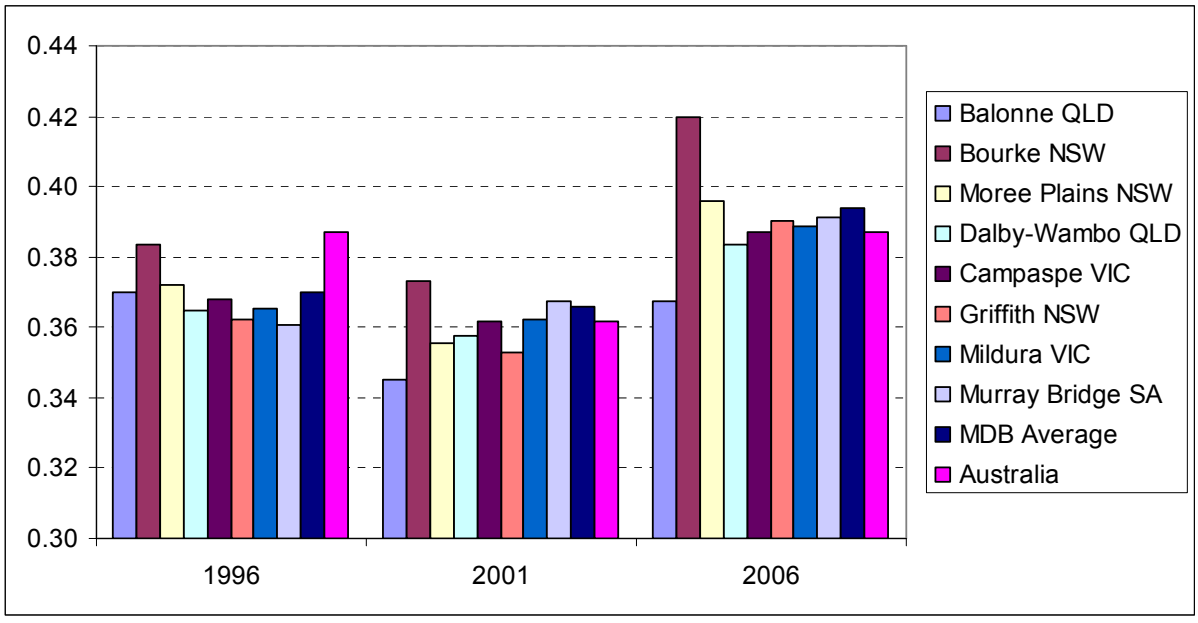
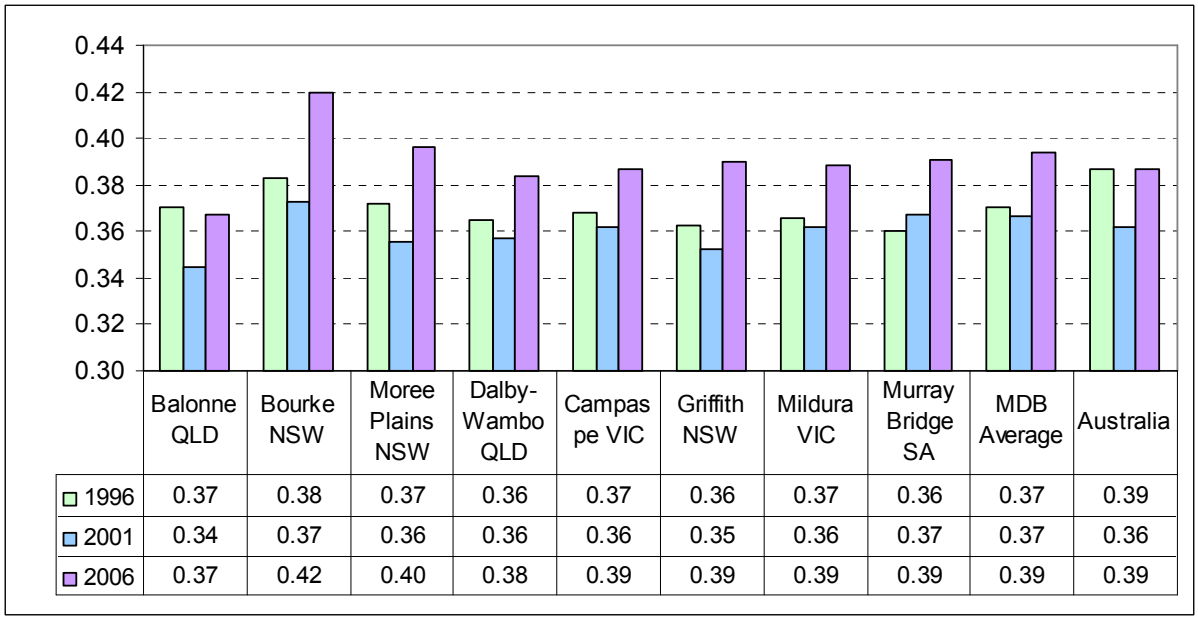


Figure 48: Polarisation (Gini Coefficient) – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1996	0.37	0.38	0.37	0.36	0.37	0.36	0.37	0.36	0.37	0.39
2001	0.34	0.37	0.36	0.36	0.36	0.35	0.36	0.37	0.37	0.36
2006	0.37	0.42	0.40	0.38	0.39	0.39	0.39	0.39	0.39	0.39

Figure 49: Polarisation (Gini Coefficient) – Time Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

12.22 Youth Unemployment

- The average youth unemployment rate in SLAs in the MDB is similar to the overall rate for Australia, and has dropped by 39% between 1996 and 2006, while in Australia youth unemployment dropped by 35% over the same period of time.
- In 2006, of the eight case study areas Bourke had the highest rate of youth unemployment at 16.9%, followed by Murray Bridge at 13.5% and Moree Plains at 13.1%. While the youth unemployment rates of Murray Bridge and Moree Plains dropped significantly between 1996 and 2006 (by 31% and 26% respectively), the 1996 and 2006 rates in Bourke were the same, despite having quite a low rate in 2001.
- Of the case study areas, the lowest 2006 youth unemployment rates were in Balonne Shire (6.8%), Griffith (8.3%) and Dalby-Wambo (8.7%). The youth unemployment rate in Balonne almost halved between 1996 and 2001, staying constant thereafter, and in Dalby-Wambo the rate fell by 31% between 1996 and 2006. The rate in Griffith stayed reasonably constant over the ten year period.
- The youth unemployment rates in Campaspe and Mildura are quite similar to the MDB average and national rates. In Campaspe the rate fell by 31% between 1996 and 2006, while in Mildura it fell by 27% over the same period.

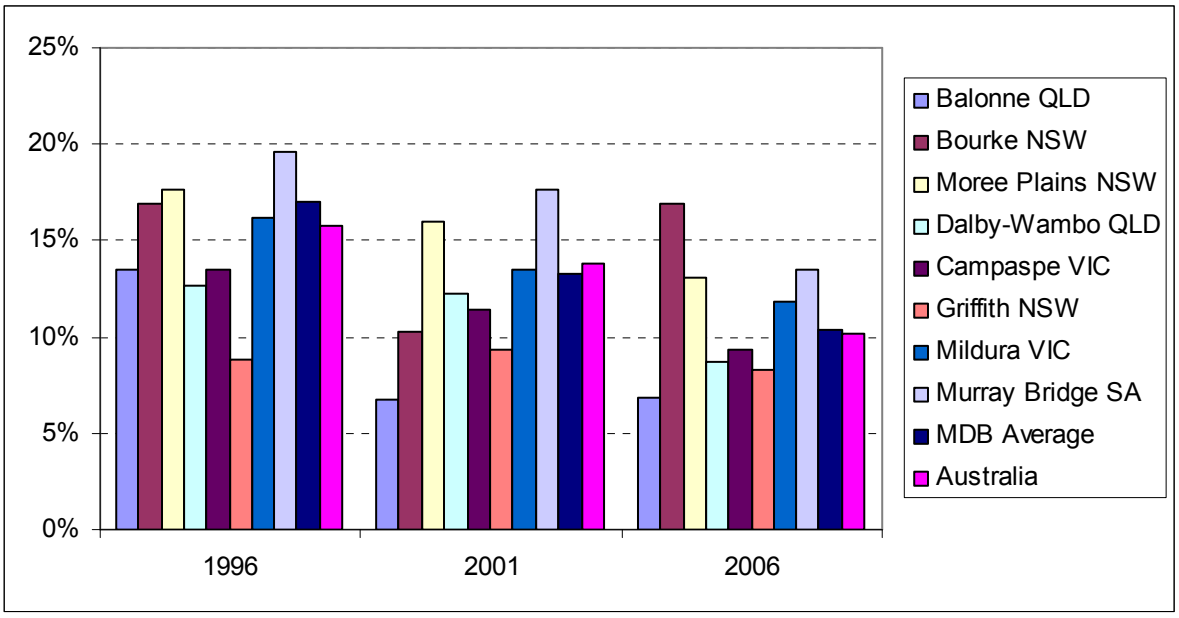
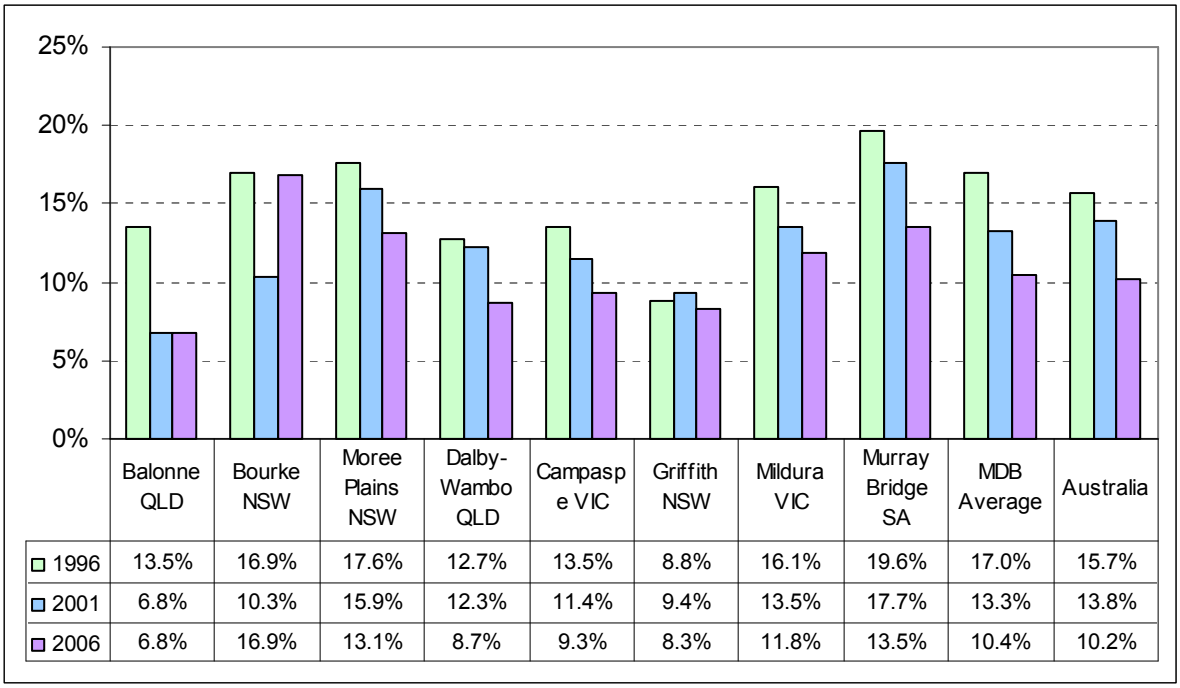


Figure 50: Youth Unemployment Rate (15-24 yrs) – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1996	13.5%	16.9%	17.6%	12.7%	13.5%	8.8%	16.1%	19.6%	17.0%	15.7%
2001	6.8%	10.3%	15.9%	12.3%	11.4%	9.4%	13.5%	17.7%	13.3%	13.8%
2006	6.8%	16.9%	13.1%	8.7%	9.3%	8.3%	11.8%	13.5%	10.4%	10.2%

Figure 51: Youth Unemployment Rate (15-24 yrs) – Time Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

12.23 Unemployment

- On average, SLAs in the MDB have quite a low unemployment rate, about 30% lower than the national rate.
- In 2006, of the eight case study areas the highest unemployment rates were found in Bourke (7.9%), Murray Bridge (6.6%) and Moree Plains (6.3%), although apart from Bourke these areas were lower than the national rate (7.3%).
- The areas with the lowest rates were Balonne (3.3%) and Griffith (3.9%).
- The unemployment rates for Australia and the MDB average of areas, as well as for Moree Plains, Dalby-Wambo, Campaspe, Griffith, Mildura and Murray Bridge, peaked in 2001 and then by 2006 had fallen again to a rate similar to the rate in 1996.
- The rate in Balonne Shire decreased by 23% between 1996 and 2006, while in Bourke it rose by about 60%.

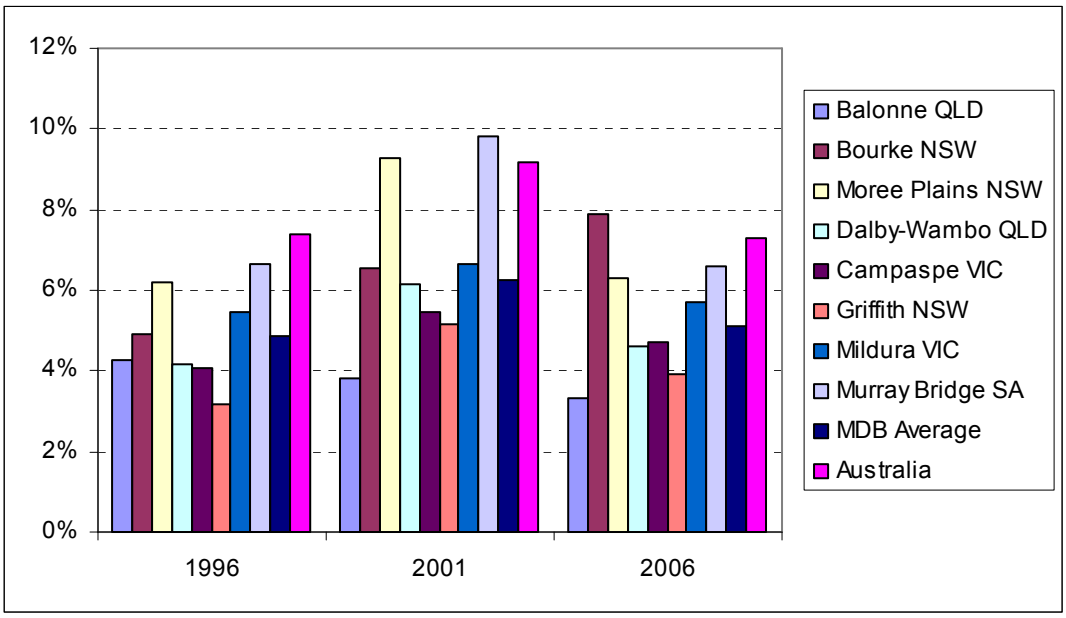
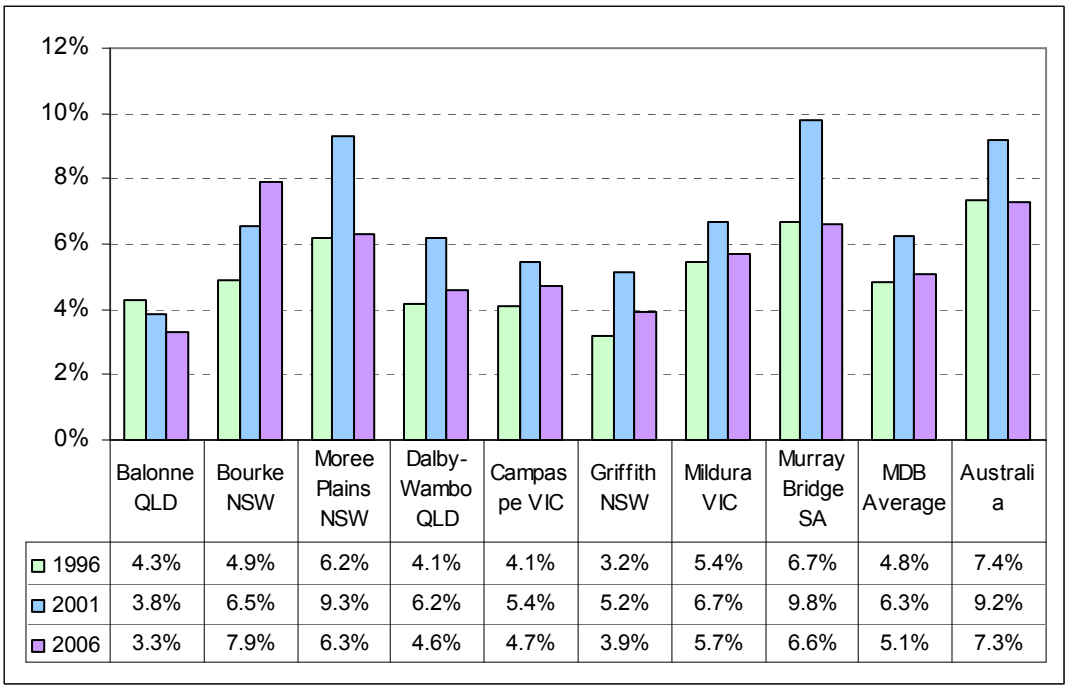


Figure 52: Unemployment Rate – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1996	4.3%	4.9%	6.2%	4.1%	4.1%	3.2%	5.4%	6.7%	4.8%	7.4%
2001	3.8%	6.5%	9.3%	6.2%	5.4%	5.2%	6.7%	9.8%	6.3%	9.2%
2006	3.3%	7.9%	6.3%	4.6%	4.7%	3.9%	5.7%	6.6%	5.1%	7.3%

Figure 53: Unemployment Rate – Time Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

12.24 Indigenous

- The case study area with by far the highest proportion of indigenous persons is Bourke, which has over twelve times the national rate and six times the MDB average rate.
- Moree Plains and Balonne also have high proportions of indigenous persons, eight and six times the national rate respectively, and four and three times the MDB average rate.
- The proportion of indigenous persons in the other five case study areas are generally similar to the MDB average and national rates. The areas with the lowest rates are Campaspe and Mildura, at 1.8% and 2.9% respectively.
- In each of the case study areas, as well as in all SLAs in the MDB on average and the nation, there was an increase in the proportion of the population identifying as indigenous, though in Bourke this increase was due to a decrease in the non-indigenous population rather than an increase in the indigenous population.
- The case study areas with the largest increase were Mildura and Dalby-Wambo, where the increases in the indigenous population were 650 and 300 (82% and 68%) respectively between 1996 and 2006. Campaspe also experienced a large increase of about 200 indigenous persons (42%).
- Comparatively, the average increase in areas in the MDB was 26%, while nationally it was 15%.

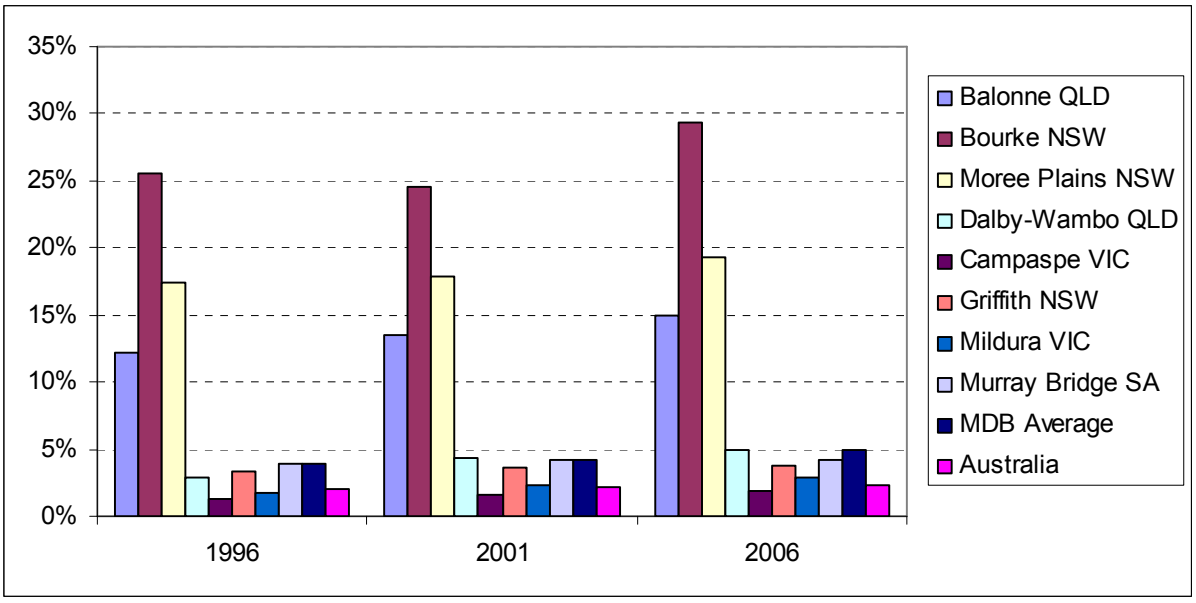
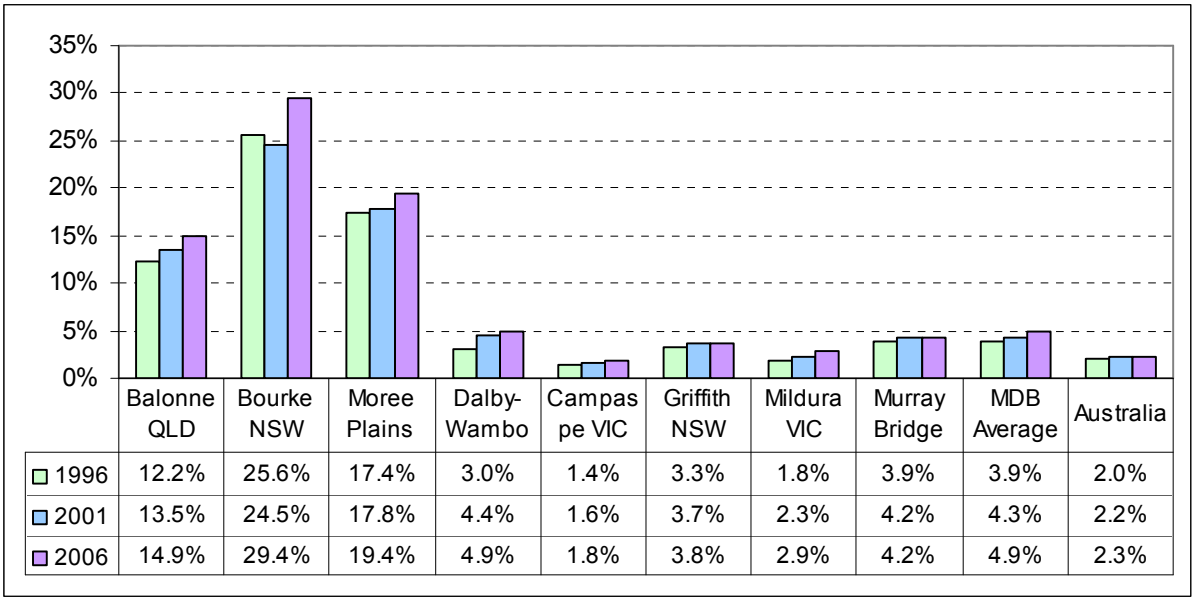


Figure 54: Proportion Indigenous – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains	Dalby-Wambo	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge	MDB Average	Australia
1996	12.2%	25.6%	17.4%	3.0%	1.4%	3.3%	1.8%	3.9%	3.9%	2.0%
2001	13.5%	24.5%	17.8%	4.4%	1.6%	3.7%	2.3%	4.2%	4.3%	2.2%
2006	14.9%	29.4%	19.4%	4.9%	1.8%	3.8%	2.9%	4.2%	4.9%	2.3%

Figure 55: Proportion Indigenous – Time Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

12.25 Change of SLA 5 Years Ago

- In 2006, residents of SLAs within the MDB, on average, were about 6% less likely to have moved from outside of the SLA within the last five years compared with the national rate. Neither the MDB average nor the national rate changed substantially between 1996 and 2006.
- Of the case study areas, Griffith has the lowest migration rate, with only 13.0% moving from outside of the SLA between 2001 and 2006, followed by Mildura at 15.9%, Moree Plains at 17.2%, and Murray Bridge at 19.3%.
- The highest rate of migration into an area between 2001 and 2006 was in Dalby-Wambo, where 30.0% of residents had moved from outside of their SLA of residence.
- The migration rates into Balonne, Bourke and Campaspe were similar to the average rate for areas in the MDB.

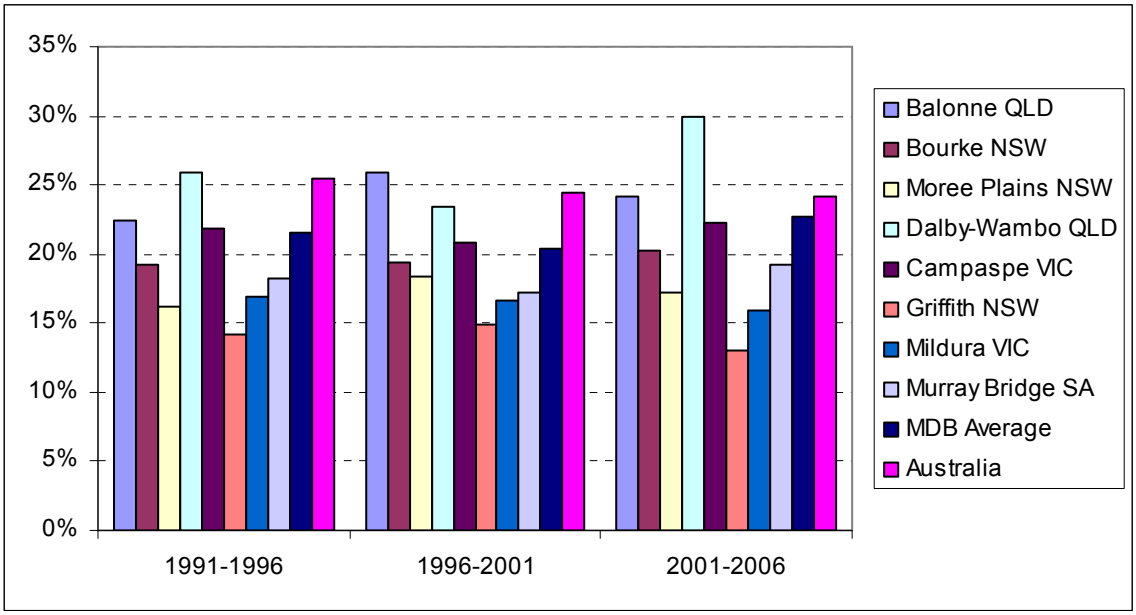
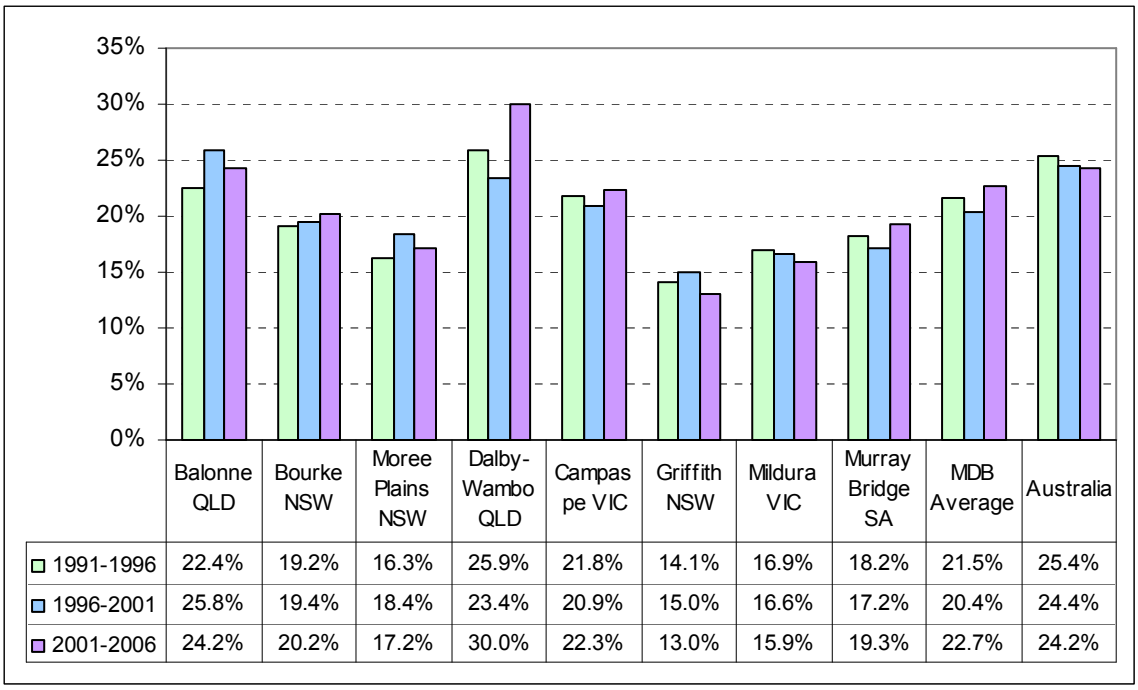


Figure 56: % of Resident Population that Lived in a Different SLA 5 Years Ago – Area Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing



	Balonne QLD	Bourke NSW	Moree Plains NSW	Dalby-Wambo QLD	Campaspe VIC	Griffith NSW	Mildura VIC	Murray Bridge SA	MDB Average	Australia
1991-1996	22.4%	19.2%	16.3%	25.9%	21.8%	14.1%	16.9%	18.2%	21.5%	25.4%
1996-2001	25.8%	19.4%	18.4%	23.4%	20.9%	15.0%	16.6%	17.2%	20.4%	24.4%
2001-2006	24.2%	20.2%	17.2%	30.0%	22.3%	13.0%	15.9%	19.3%	22.7%	24.2%

Figure 57: % of Resident Population that Lived in a Different SLA 5 Years Ago – Time Comparison

Source: JSA (2011), derived from ABS (1996, 2001, 2006) Census of Population and Housing

12.26 Voluntary Work

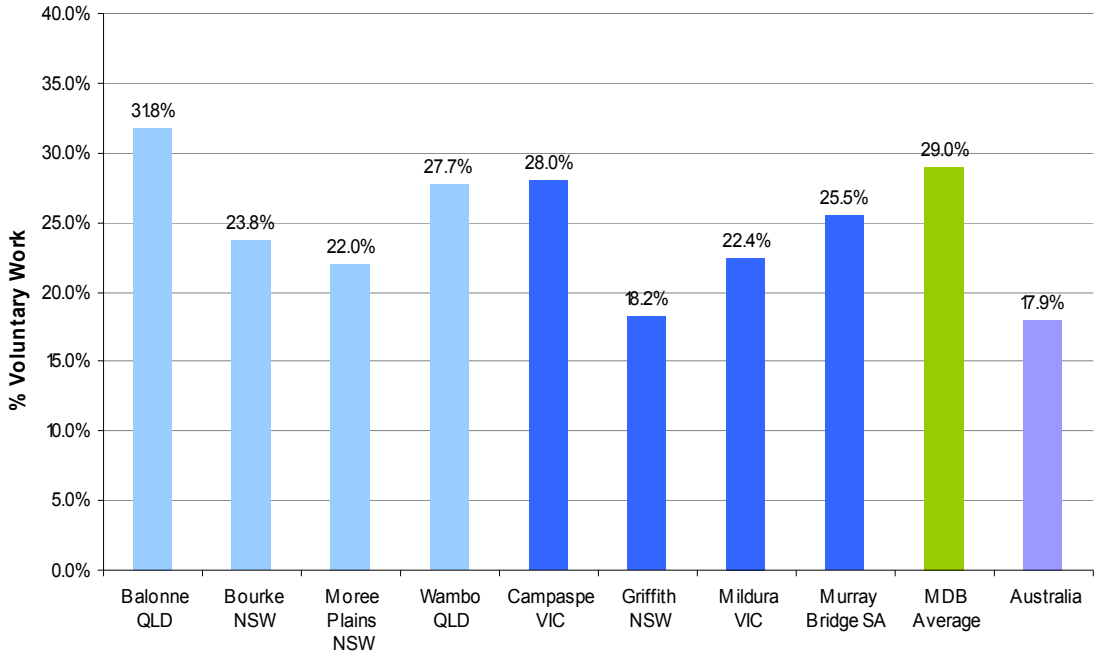


Figure 58: % Population 15+ Engaged in Voluntary Work for an Organisation

Source: ABS (2006) Census of Population and Housing, JSA (2009)

12.27 Selected Crime Rates (NSW Only)

- The average rate of non-domestic violence related assaults for SLAs in the NSW part of the MDB in 2006 was 34% higher than the rate in NSW as a whole. This rate has risen by about 10% between 1996 and 2006, while in the state it had risen by 16%.
- Of the three case study areas in NSW, Bourke has by far the highest rate of non-DV related assaults, over four times the average rate of areas in the NSW MDB, and over six times the rate for NSW. This rate decreased by about 4% between 1996 and 2006.
- Moree Plains also has quite a high rate of non-DV assault, over twice the average for the NSW MDB and about three times the rate for NSW. This rate increased by about 17% between 1996 and 2006.
- The rate of non-DV assault in Griffith is similar to the average rate for the NSW MDB (about 8% lower) and the NSW rate (22% higher). The rate in Griffith increased by about 29% between 1996 and 2006.

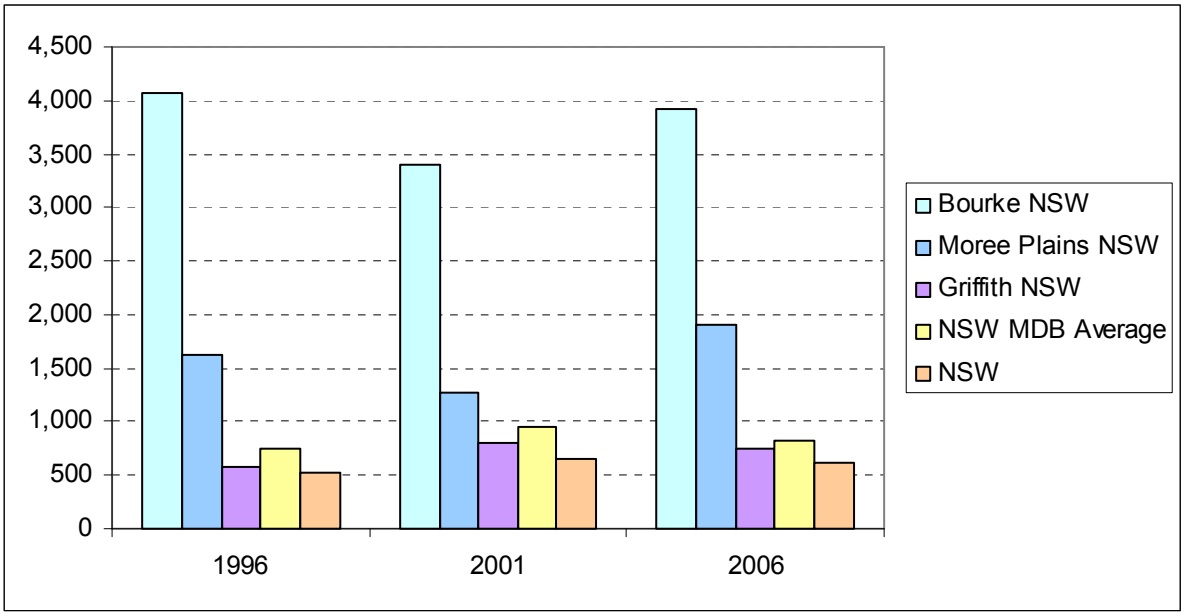
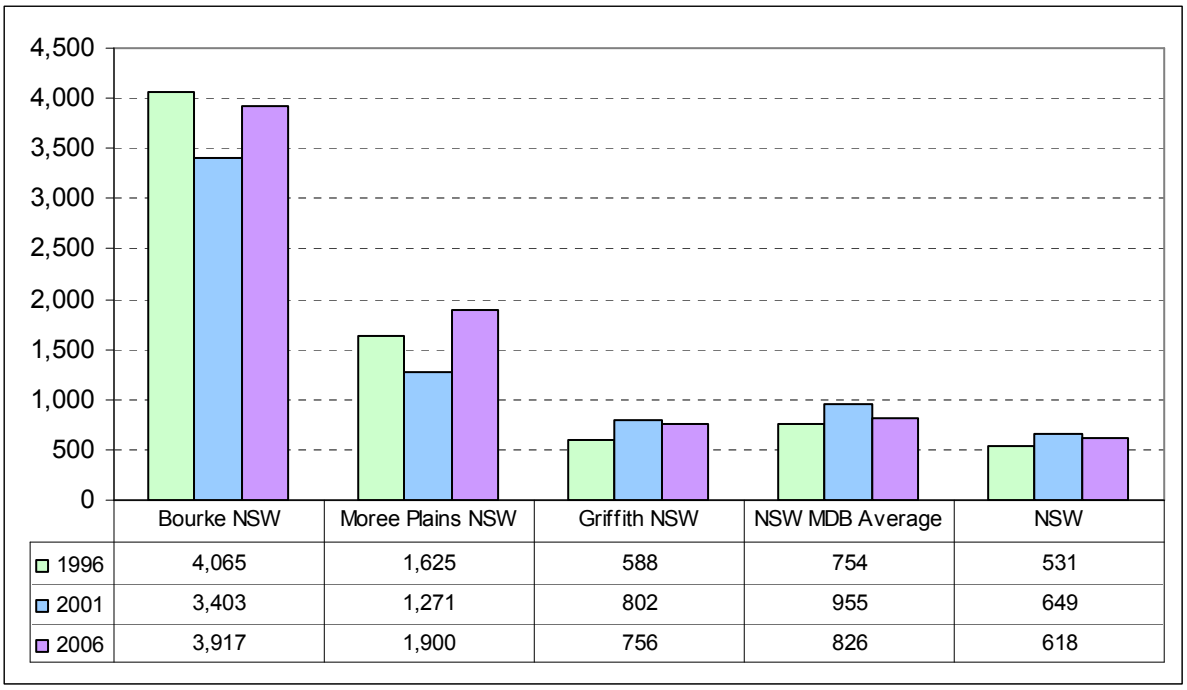


Figure 59: Non-DV related assault rate per 100,000 persons – Area Comparison

Source: JSA (2011), derived from NSW Bureau of Crime Statistics and Research (2010) Recorded Crime Statistics 1995-2009



	Bourke NSW	Moree Plains NSW	Griffith NSW	NSW MDB Average	NSW
1996	4,065	1,625	588	754	531
2001	3,403	1,271	802	955	649
2006	3,917	1,900	756	826	618

Figure 60: Non-DV related assault rate per 100,000 persons – Time Comparison

Source: JSA (2011), derived from NSW Bureau of Crime Statistics and Research (2010) Recorded Crime Statistics 1995-2009

- As with non-DV related assault, the average rate of domestic violence related assault in SLAs in the NSW part of the MDB is somewhat higher than the rate in NSW as a whole (about 64% higher in 2006). This rate increased by about 16% between 1996 and 2006, with a peak in 2001, compared with a much larger increase of 72% in the state.
- Again, Bourke had a very high rate of incidents; in 2006 over six times the rate of the average of areas in the NSW MDB, and about ten times the rate for NSW. The rate of domestic violence in Bourke increased by about 29% between 1996 and 2006.
- Moree Plains again also had a high incident rate, over twice the average rate of areas within the NSW MDB in 2006, and over three times the rate for NSW. The rate of DV related assault in Moree Plains increased by 67% between 1996 and 2006.
- The rate of DV related assault in Griffith is more similar to the rates for the NSW MDB average of areas and the state. In 2006, the rate of incidents was about 9% lower than the average rate of areas in the NSW MDB, and 48% higher than the rate for NSW. Between 1996 and 2006, the rate of DV related assault has increased by about 60%, with a peak in 2001.

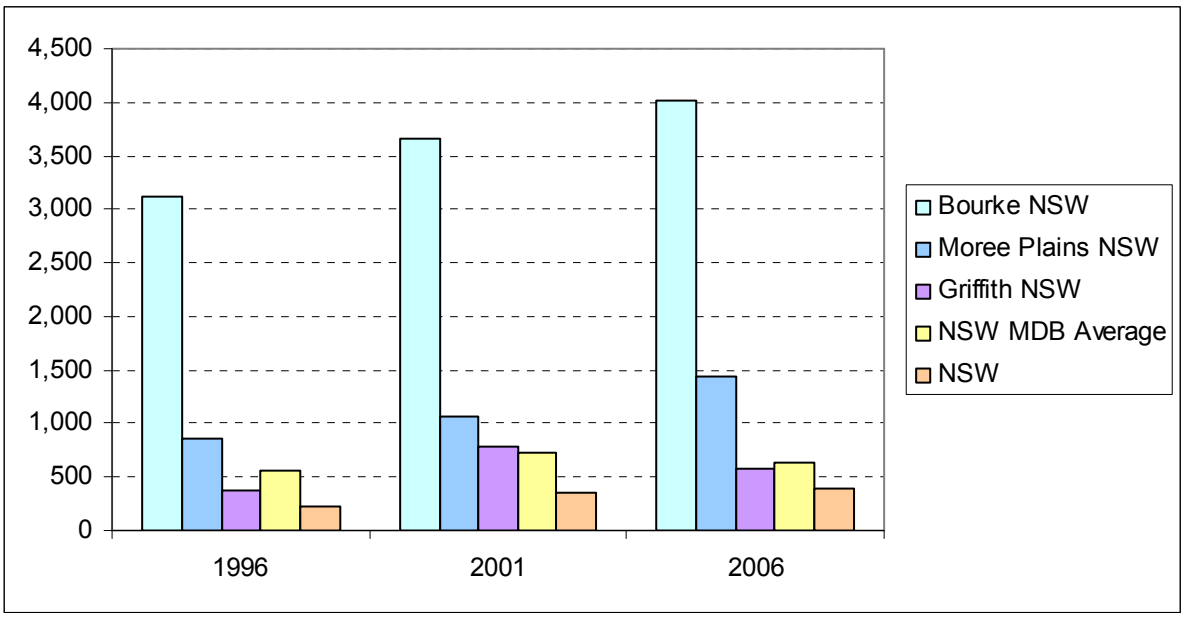
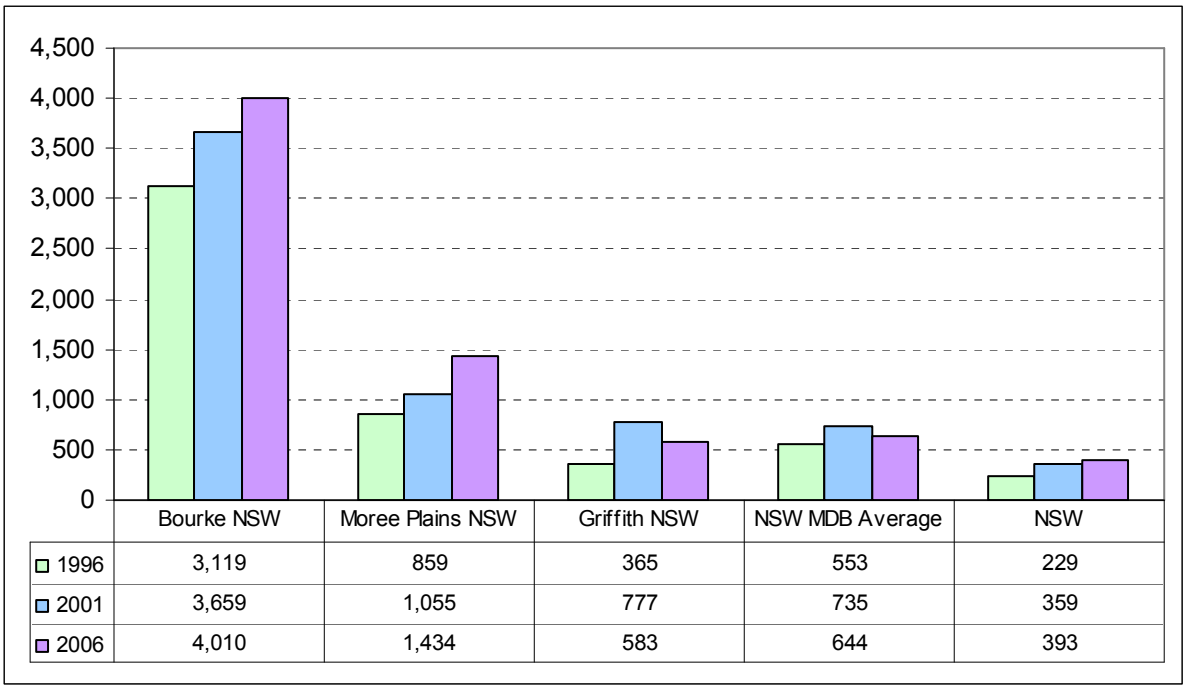


Figure 61: DV related assault rate per 100,000 persons – Area Comparison

Source: JSA (2011), derived from NSW Bureau of Crime Statistics and Research (2010) Recorded Crime Statistics 1995-2009



	Bourke NSW	Moree Plains NSW	Griffith NSW	NSW MDB Average	NSW
1996	3,119	859	365	553	229
2001	3,659	1,055	777	735	359
2006	4,010	1,434	583	644	393

Figure 62: DV related assault rate per 100,000 persons – Time Comparison

Source: JSA (2011), derived from NSW Bureau of Crime Statistics and Research (2010) Recorded Crime Statistics 1995-2009

- In 2006 the average number of property crimes in SLAs in the NSW MDB was about 5,000 per 100,000 persons, about 5% greater than the overall rate for NSW. While the NSW rate dropped by 22% between 1996 and 2006, the NSW MDB average rate was about the same in 1996 as it was in 2006, though it did peak at about 6,000 incidents per 100,000 in 2001.
- Again, Bourke has the highest incident rate of the three areas at about 22,000 incidents per 100,000 residents in 2006, over four times the rate for the state and NSW MDB average. The 2006 rate for Bourke is about 9% higher than it was in 1996.
- In 2006, the incident rate for Moree Plains was about 11,000 per 100,000 residents, over twice the rate for the state and NSW MDB average. The rate of property crime in Moree Plains fell by 20% between 1996 and 2006.
- Although Griffith had quite a low rate of property crime in 1996 (about 3,600 incidents per 100,000 residents, which is 28% fewer than the average rate of areas in the NSW MDB and 41% fewer than the NSW rate), by 2006 this rate had increased by 57% to 5,666 incidents per 100,000 persons, which was 13% more than the NSW MDB average rate and 19% more than the NSW rate.

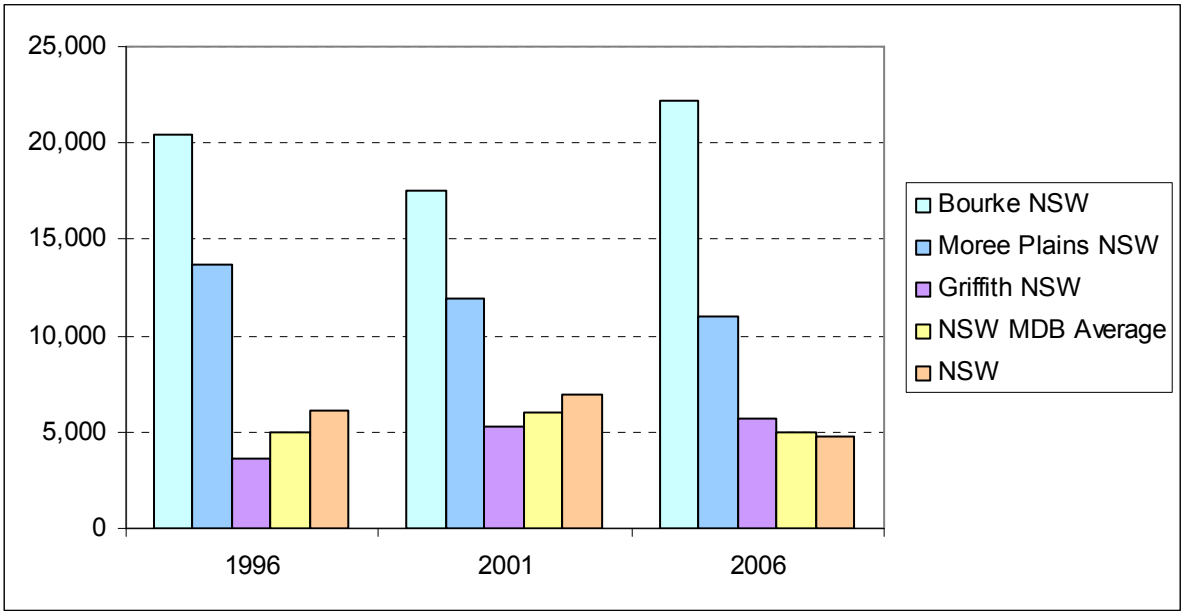
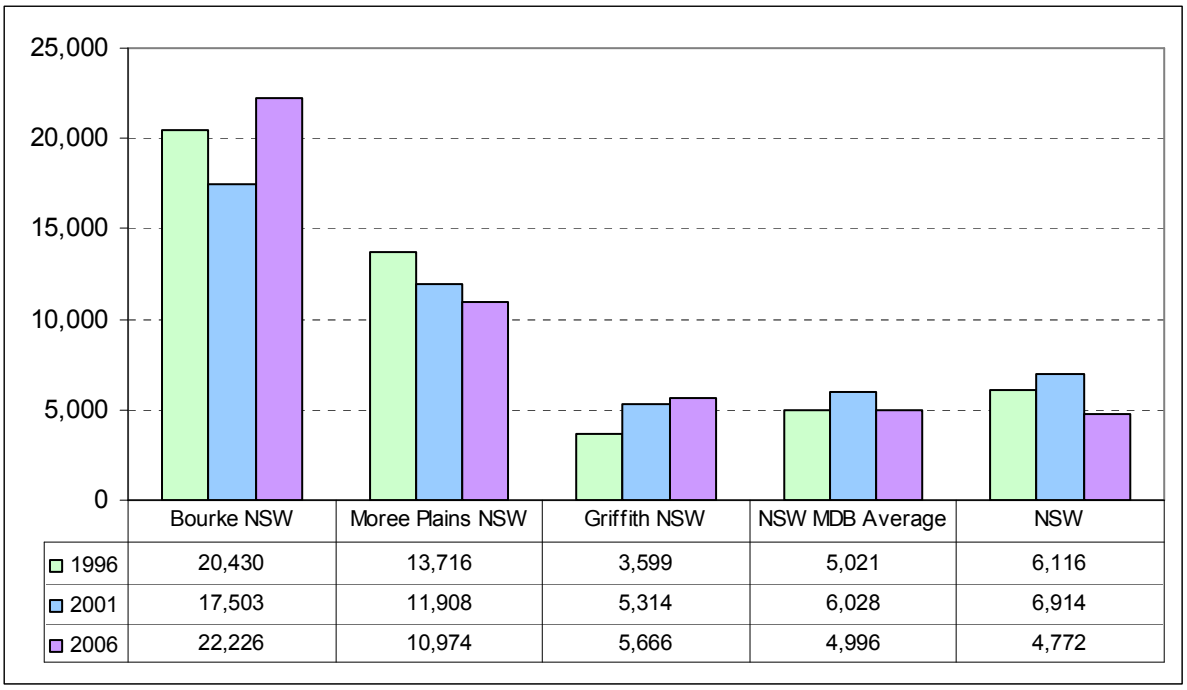


Figure 63: Aggregate property crime rate per 100,000 persons – Area Comparison

Source: JSA (2011), derived from NSW Bureau of Crime Statistics and Research (2010) Recorded Crime Statistics 1995-2009



	Bourke NSW	Moree Plains NSW	Griffith NSW	NSW MDB Average	NSW
1996	20,430	13,716	3,599	5,021	6,116
2001	17,503	11,908	5,314	6,028	6,914
2006	22,226	10,974	5,666	4,996	4,772

Figure 64: Aggregate property crime rate per 100,000 persons – Time Comparison

Source: JSA (2011), derived from NSW Bureau of Crime Statistics and Research (2010) Recorded Crime Statistics 1995-2009

"Aggregate property crime" is a total value of rates per 100,000 for the following:

- Break and enter dwelling
- Break and enter non-dwelling
- Incidents of motor vehicle theft
- Steal from motor vehicle
- Steal from retail store
- Steal from dwelling
- Steal from person
- Malicious damage to property