



# CRITICAL TIMES PRACTICAL MEASURES

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## **Pilot Social Impact Study of changes in water availability below Lock 1 in South Australia**

**Informant Report**

July 2010

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## Acronyms

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## Part 1 - Background

### *The Water Planning Tools Project*

In 2008, Griffith University and CSIRO brought together a small multi-disciplinary team to work on water planning projects with government agencies and other stakeholders throughout Australia. The primary aims of the Water Planning Tools (WPT) project are to help communities and governments meet the challenges of water planning by building knowledge and skills in government agencies, and informing policy making at national and state levels. The WPT project is working with communities and planning agencies in Queensland, South Australia and the Northern Territory to develop ‘water planning tools’ that can be adapted to suit local conditions, and that will enable better planning and management of Australia’s water resources.

The South Australian case study has been undertaken on the River Murray Prescribed Watercourse Planning area in collaboration with the South Australian Murray Darling Basin Natural Resource Management Board (SAMDBNRM Board). The objectives of the River Murray case study were to:

- support water allocation planning in the SA River Murray prescribed watercourse to comply with the principles of the National Water Initiative and relevant provisions of the *Water Act, 2007* (Cwealth) and the *Natural Resources Act, 2004* (SA)
- collaborate with the Department of Water Land and Biodiversity Conservation and the South Australian Natural Resource Management Board in the design and delivery of the trial of tools and to conduct the case study in an open and transparent manner
- review the water plan and plan making process and identify gaps in which innovative deliberative tools could be trialled to enhance capacity within the agency
- trial tools that are tailored to the issues and are time and resource responsive
- use tools which build social learning and are engaging and participatory
- evaluate the tool trials and reflect on their usefulness and value in terms of water allocation planning broadly and the principles of the water planning tools project specifically

Three trial projects have been undertaken in this case study and they include:

- A deliberative investigation of social values in environmental prioritization using ‘Concept’ a participatory modeling tool and deliberative multi-criteria evaluation (DMCE).

- Trial of a methodology and a preliminary investigation of Indigenous Cultural Water Values at Sugar Shack, SA.
- A pilot social impact study of changes in water availability below Lock 1.

This Report is the Informant Report which provides the results of the pilot social impact study of changes in water availability below Lock 1.

### ***The need for socio-economic assessment in water planning***

Commonwealth policy and legislation and SA State legislation have requirements to include social and economic considerations in water planning. The need for socio-economic assessment has been identified by the National Water Initiative (NWI) (Sch 6) which provides that planning processes should include the application of socio-economic analyses ‘consistent with the level of knowledge and resource use’.

The Commonwealth *Water Act 2007* provides the framework for water planning at the Basin scale. The Murray Darling Authority is required to prepare a Basin Plan and in preparing that plan the Authority is required to act on the basis of the best available science and socio-economic analysis. In commenting on the draft Basin Plan the Ministerial Council must take account of the likely socio-economic implications of any reduction in the proposed long-term average sustainable diversion limit. The important role played by socio-economic analysis was confirmed in the recent Concept Statement for the Basin Plan. It is envisaged that the analysis will be used in at least two ways by the MDA: (1) to inform how, where and when water can be delivered to meet environmental requirements and (2) to assess the implications of any reductions in the long term average sustainable diversion limits. (MDA 2009, 11). A description of the socio-economic context for the Basin plan has been prepared as part of the Basin planning process (ABS/ABARE/BRS 2009)

Water Resource plans prepared by the Basin States are required to comply with the Basin Plan by 2014. A plan eligible for accreditation by the MDA must comply with the relevant provisions of the legislation. Further in general terms there is a requirement to consider the social and economic impact of water plans and to incorporate social and economic values into water planning under the provisions of the *SA Natural Resources Management Act 2004*.

In natural resource planning the practice has been to equate stakeholder consultation with social impact assessment and a determination of economic benefit with economic impact assessment. In short, water planning has not had a strong tradition of high quality socio-economic assessment. Hamstead et al (2007: 171) identified this as an area warranting improvement, stating that where assessments were done they were ‘highly variable in quality’. There were perceptions that socio-economic assessment is completed at late stages more for compliance purposes than for input into the decision process. Case studies of socio-economic assessment in planning by Baldwin et al (n.d.) found that work that was done in this area tended to provide mainly profiles not impact of options, there was little rigorous analysis and the focus tended to be on the economic rather than social issues. Tan et al (2008) have identified the need to better incorporate social values into water planning. A profile of baseline conditions, and each alternative scenario of water sharing and the alternative strategies for

achieving outcomes should be assessed (Bowmer et al, 2007). Ideally this should be carried out early in the planning process, preferably with community input in order to build trust in the data and ownership of the findings of the assessment.

Recent legislative changes at the Commonwealth level have reinforced the State legislative requirements to incorporate social and economic information into water planning process. However, there is a poor track record of social and economic impact assessment in water planning.

### ***Socio-economic assessment for the SA Water Allocation Plan***

A Water Allocation Plan (WAP) in SA is a statutory document prepared according to the provisions of the *Natural Resources Management Act 2004*, that sets out the rules on how water resources will be managed in a particular area. The *Water Allocation Plan for the River Murray Prescribed Watercourse* (River Murray Catchment Water Management Board 2002) determines how much water will be provided for the environment and how much will be allocated to consumptive uses. In addition, the WAP provides rules in relation to water allocation, use and transfer. The River Murray Watercourse has had a WAP since 2002 it was reviewed (SAMDBNRM June 2007) and a decision to redraft the WAP was taken in 2007.

The first phase in developing a WAP is the preparation of a Concept Statement. The Concept Statement sets out the proposed content of a draft water allocation plan, the issues to be investigated and the consultations that will be undertaken in developing the draft plan.

The *Water Allocation Plan for the River Murray Prescribed Watercourse Concept Statement August 2008* (SAMDBNRM August 2008) detailed the proposed content of the water allocation plan, potential risks to the resource and the assessments to be undertaken for the development of the draft plan. The importance to the SAMDBNRM Board of involving the community in water planning is underscored, by the commitment in the Concept Statement to going well beyond the minimum Statutory public consultation requirement (SAMDBNRM July 2008).

The Concept Statement identified a number of potential risks to the water resource. It noted that while some risks could be managed through the water allocation plan, others could not. None-the-less even risks that could not be managed through the plan, needed to be acknowledged in developing the plan. A number of the identified risks, such as climate change, decreased water availability in SA, upstream taking and use of the resources (outside SA), declining water quality (particularly due to reduced flows) and changing knowledge about system requirements and environmental requirements, would potentially have the same impact i.e. *reducing the amount of water available for extractive use*. The Concept Statement proposed that some of these risks could be managed within the parameters of the water allocation plan, by the setting of trigger points and management responses.

The Concept Statement identified a number of assessments that needed to be undertaken during the development of the draft plan. Several socio-economic assessments were identified and these were to determine areas of Indigenous cultural significance; and, the impacts of changing water security. Alongside these assessments, the Concept Statement identified the need to undertake assessments of

the risks to the resource due to climate change and the capacity of the resource to meet current and future needs.

### ***Pilot study of social impacts of changes in water availability***

The need for social and economic assessment is a requirement of legislation but also an important part of a comprehensive approach to water allocation planning. The SAMDBNRM Board has recognised this and made a commitment to include social and economic assessments into its deliberations for the new water allocation plan. The Concept Statement outlined this commitment however social and economic assessment is challenging for water planning agencies more familiar with biophysical and hydrological assessments. The gap analysis for the WPT project identified social assessment as an area warranting further attention and an agreement was reached with the Board that this was an area in which the project could contribute. As a consequence it was agreed that a pilot social impact study would be conducted by the WPT project.

### **Study location**

After detailed consultation with the project partners it was decided that the focus of the pilot study should be the area below Lock 1 often referred to as the Murraylands. The location was selected for several reasons. Firstly, studies were being undertaken in the Riverland and the Lower Lakes and Coorong as part of the Murray Futures Program. Secondly, adjustment support in various forms was being directed to both of these regions. Thirdly, the area though relatively small is diverse and includes primary and secondary industry, other manufacturing, a regional centre and tourism. Finally, the area was experiencing the effects of three different issues – drought i.e. a rainfall deficit, reduced water allocations and very low flows (1.4m below pool level, .7m below sea level in early 2010).

Not only was there a gap in this area but there was an opportunity, owing to the nature of the area, to explore the range of impacts that might arise from changes in water availability.

### **Study questions**

Project objectives and the specific questions were developed in collaboration with the DLWBC and SAMDBNRM Board. The two questions that were identified as being important to water allocation planning were:

1. What are the key socio-economic impacts of different levels of water availability?

The impacts on communities along the river, industries and employment will be identified. Three scenarios are an optimum for assessment and the proposed that levels are:

- (a) the current drought scenario which provides a base-line at 18% of current WAP allocation;
- (b) a long term 'new-normal' defined by the CSIRO Sustainable Yields Project (2008) and other modelling which is estimated at 60% of current WAP allocation and
- (c) an interim scenario such as 30% of current WAP allocation.

## 2. Are there critical thresholds for different water users, communities and industries?

The SIA examined in detail the first question of the direct and indirect impact of change on communities, industries and employment. The second question concerned critical thresholds proved to be a more complex one and influenced by a wide range of factors both general and specific to an industry, a community and a place in time. A definition of critical thresholds was not developed however a range of issues relevant to its understanding in the pilot study area were drawn out. This issue is discussed in Part 3.

## Methods

The objective of the project was to undertake a pilot study of the social impacts of changes in water availability below Lock 1. Formal social impact assessment usually has five steps i.e. scoping, profiling, assessment, mitigation and monitoring. The pilot focused on scoping, profiling and preliminary assessment of the probable impacts of changed availability of water for extraction.

One of the challenges of this study is that the content of the Water Allocation Plan (WAP) is determined by legislation and broadly speaking it can only determine rules in relation to water allocation, access, use and trade. However, change that the new WAP may introduce has the potential to have far reaching impacts on industries and the businesses and communities which rely on water in or from the prescribed Murray. It is not within the power of the WAP or the SAMDBNRM Board to mitigate these impacts to any great extent. However a study such as this can provide important information relevant to the implementation options and timing factors that can influence the impact of change. In addition, it can be useful to water planning agencies in seeking whole-of-government responses to mitigate the impacts of change, if necessary.

This was a participatory and qualitative study. The study was undertaken with the guidance of a community Reference Group. It was qualitative in nature to the extent that it involved the use of qualitative data collection techniques in addition to the use of a range of secondary quantitative data sources. This study has drawn heavily upon the methodology developed in 2003, by a group made up of Hassall and Associates, Professor Helen Ross from the University of Queensland assisted by Mary Maher and Associates and the conceptual framework for undertaking social impact assessment of water recovery developed by EBC Consulting for the Living Murray.

Four important conceptual frames underpin this study.

1. It has a broad focus to reflect the fact that the social and economic values of the River Murray below Lock 1 derive from water both in-stream and that taken for extractive uses.
2. The impact of change is transmitted through a system and flow-on effects need to be identified.
3. Change takes place within a context and analysis of the impact of change needs to incorporate an understanding of the cumulative factors affecting rural communities and industries, particularly agriculture.
4. The way a community responds to and experiences change is a function of its vulnerability or resilience.

### ***Living Murray Social Impact Studies***

The pilot study being undertaken by the Water Planning Tools Project for the SAMDBNRM Board of the region below Lock 1 is based on the methods developed for the Living Murray in 2003. Two significant studies were commissioned by the Murray Darling Basin Commission to examine the social impacts of potential changes in water availability arising from the commitment to provide more water for the

environment through the Living Murray program. EBC Consulting developed a conceptual framework for undertaking social impact assessment of water recovery in the context of the Living Murray. The approach was then trialled in the Murray Irrigation Area of NSW. Also in 2003, a group made up of Hassall and Associates, Professor Helen Ross from the University of Queensland assisted by Mary Maher and Associates were commissioned by the Murray Darling Basin Authority to conduct a scoping study into the potential social effects of the possible return of water to the River Murray System associated with three environmental flow reference points. This group developed another conceptual methodology for their study.

The scoping study developed for the Living Murray by Hassall et al (2003) forms the basis for the method used in the pilot study of the possible social and economic impacts of changes brought about through potential amendments to the SA River Murray WAP. However, important elements of the conceptual approach developed by EBC have been incorporated into the approach, particularly in the assessment phase of the study.

This study has drawn on the profile descriptors, the conceptual framework for understanding the flow-on effects of change (influence pathway) and ideas about a dynamic baseline developed by Hassall et al (2003). The scoping study undertaken by Hassall did not proceed to a full SIA but it did highlight industries and regions that were more vulnerable to the impacts of change and that they warranted closer examination.

The work undertaken by EBC Consulting for the Living Murray was not a comprehensive SIA but a preliminary assessment of the social impacts of recovery of water for the environment. The EBC study concluded that there were likely to be a number of social impacts of change and that the manner in which decisions about change was made impacts on the acceptability of the impacts that arise. The importance of perceptions of procedural fairness is discussed later in this report.

It should be noted that a key factor differentiates the conditions under which the social impact assessments undertaken by Hassall and EBC Consulting in 2003 for the Living Murray and this study. In both cases there was an expectation that a reduction in water allocation for irrigation would lead to benefit for the environment and industries dependent on water in-stream. The current situation of drought and over-allocation across the Basin means that for the area below Lock 1 even a significant reduction in allocation to extractive uses will not necessarily lead to a major benefit to either the environment or industries such as boating and recreation.

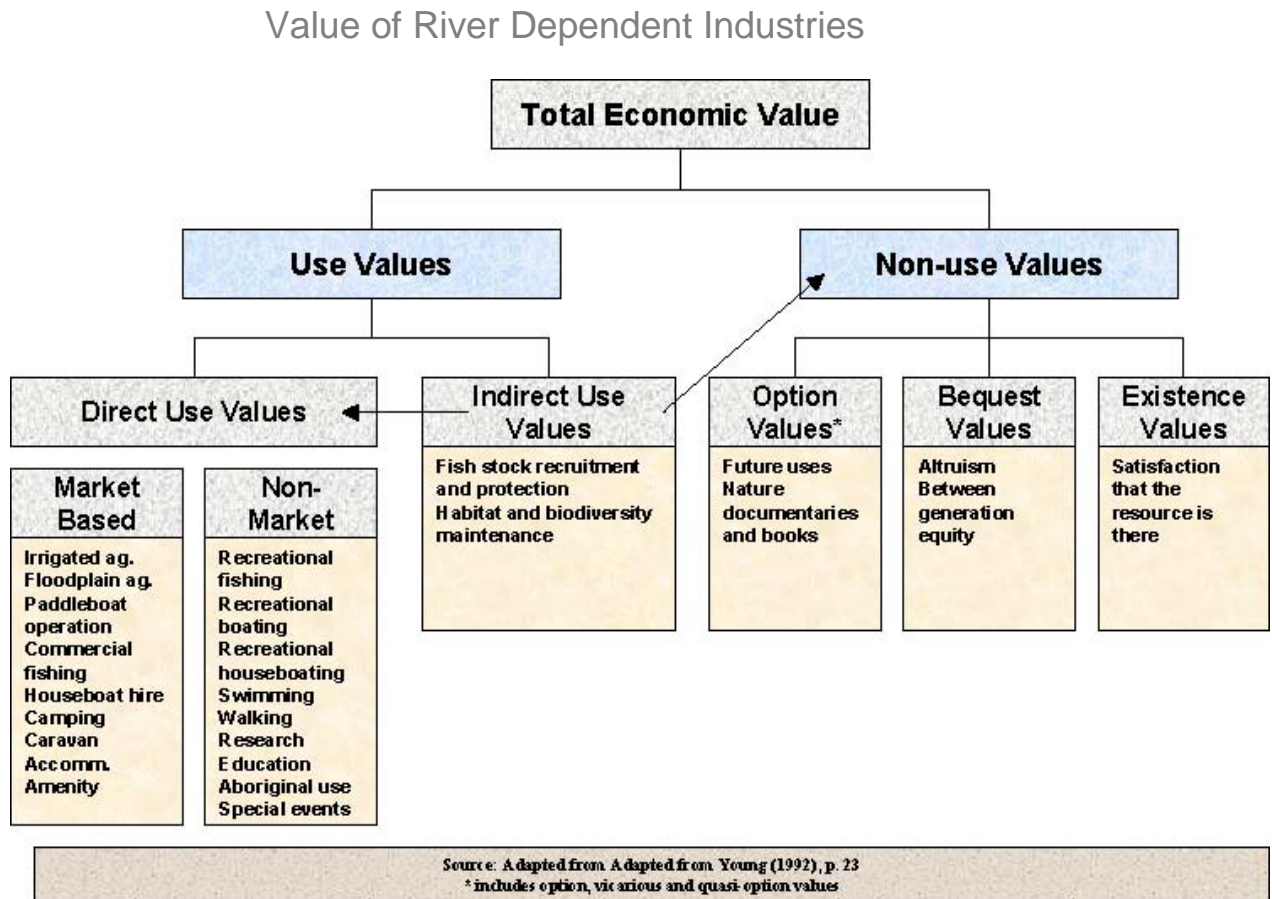
## ***Conceptual frames***

### **Total value of the River**

The total value of the water resources of the River Murray is made up of both use and non-use values (see Figure 1 below). As depicted by Young (1992) the total economic value of the River is made up of use and non-use values. The non-use values include option, bequest and existence values. The use values include direct use values and indirect use values, which more recently are framed as ecosystem service values. The direct use values include market and non-market values. This study will identify and described a set of direct use values as well as a sub-set of very specific

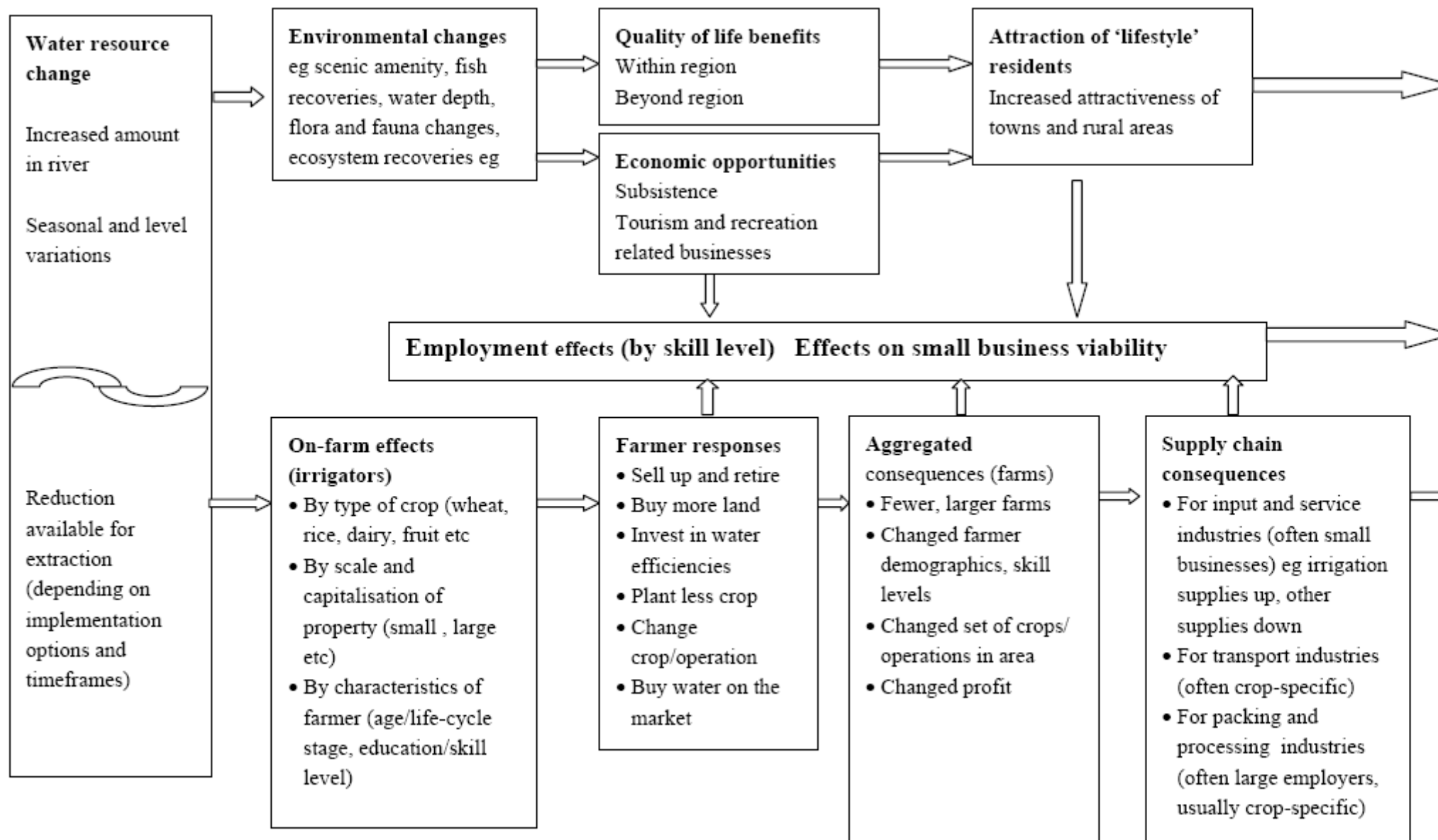
(to the pilot study area) indirect use values. The set of direct use values are those that the preliminary scoping with informants and the Reference Group identified as being most affecting by change. There is a tendency in water planning to undertake assessment of only the impacts one extractive uses of water (see for example Cooper Creek SIA). The risk with this approach is that decision making can be influenced by information on the negative effect of change on one use of the system without an understanding of the broader context and the extent to which benefit might flow to other parts of the system.

Figure 1 Components of Total Economic Value –Use and Non-Use Values



### Influence pathway

Hassall et al (2003:iv) developed a tool called an ‘influence pathway’ to trace where and how specific changes in water allocation would transmit through the economy and social systems. The Figure 2 below represents the conceptualisation of how change flows through the system. Changes in viability of particular industries are likely to transmit through their ‘supply chains’ i.e. affecting businesses that provide inputs, transport, packaging and processing. It also impacts on the towns and communities that are dependent on the industries and businesses. The pilot study documented as far as possible the social and **economic flow on effects**. A range of secondary data sources were utilized along with information collected through key informant interviews.



## **Cumulative change**

There can be considerable difficulty in distinguishing the effects of change from the background of issues that are affecting rural communities more broadly and agriculture specifically. In addition, there are specific factors which impact on communities and industries at a more local scale. This was described by Hassall (2003) as the dynamic baseline. This study has attempted to deal with the issues of cumulative change in two ways. Firstly, those factors that are relevant to the particular area and industry that is the focus of the study, have been identified as part of the profile. Secondly, the discussion of impacts is situated in the literature to the extent necessarily to reveal cumulative change factors with the potential to mitigate or intensify the effect of the change in water availability below lock 1.

## **Resilience and vulnerability**

Resilience in the biophysical sciences is a term which refers to the capacity of a system to return to equilibrium in response to change (Begon et al 1990). This term is increasingly used in the social sciences to represent the capacity of the social system to respond to change, but not necessarily to return to a state of equilibrium. Cork (2008) for example raises the question of the resilience of what to whom? The idea of social resilience has been used as a conceptual tool to explore how people and communities interact with change in light of processes of social and economic adjustment and resource depletion (Herreria et al 2008). There have been a number of attempts to define social resilience. Social resilience is the capacity of a community to cope with disturbances or changes and to maintain adaptive behaviour (Maguire 2008). Social resilience takes into account the economic, institutional and social dimensions of a community. The conceptual partners of resilience are vulnerability and adaptive capacity.

The Hassall study (2003) incorporated the idea of dependence on water, as a factor in understanding vulnerability to change in its availability. While this logic is self-evident Herreria et al (2008) warn against an over simplification of the notion of resource dependence. They suggest that the way in which a community or individual responds to change is mediated by a suite of social variables. Vulnerability is influenced by a range of factors. These include the frequency of the frequency or intensity of the event and underlying community factors such as income and employment (Maguire 2008).

Adaptation describes adjustments made to changed environmental circumstances that take place within biological and social systems (Adger et al 2009). The capacity to adapt is influence by a wide range of factors which include attitudes to risk, knowledge, capacity, values and environmental conditions (see Adger et al 2009). For Nelson et al (2009) adaptive capacity is influenced by the state of human, social, natural, physical and financial capital. It is argued for example, that farm households with a greater diversity of assets and activities are likely to have greater adaptive capacity because of a greater capacity to substitute between alternative livelihood strategies in times of stress (Nelson et al 2009).

A fulsome exploration of these concepts is well beyond the scope of this study however they have been used to inform the method and discussion of impacts. The vulnerability or resilience of a community to change is influenced by the dependency

on the resource and in broad terms by the store of resources that exist at the time of change. For this reason the study has used descriptors which reveal *dependence* and incorporated *cumulative* factors likely to influence the outcomes of change, in the profile. These factors impact upon the *capacity to adapt* and the *potential severity of impacts*. A resilience approach to social assessment incorporates complexity, recognises that response to change is dynamic and provides a way of assessing the resources and adaptive capacities of a community rather than just its vulnerabilities (Maguire et al 2008).

### ***Profile descriptors***

The profiling phase of the SIA provides a baseline assessment of the social environment. The descriptors developed by Hassall et al (2003) for the profile of the social environment were designed to address three core objectives, which were:

1. To provide a descriptive overview of the population and the social characteristics of the community within the affected area,
2. Where possible to develop social profiles which address issues raised by key informants in the scoping phase of the assessment.
3. To develop social profiles which provide an indication of the resilience (vulnerability or robustness) of the community to adapt, manage or adjust to any future changes.

The pilot study undertaken for this project replicates the profile that was developed by Hassall et al (2003). The descriptors, include, among others:

- assessment of dependence on water by irrigated agriculture as well as non-agricultural industries such as tourism, recreation and fishing
- community well-being and services
- cultural heritage (sites of Aboriginal, non-Aboriginal and natural heritage)
- cumulative change and community response.

The role of the baseline is to provide a context against which to measure change. However, the context is not static because of the breadth of factors which are already affecting agriculture more broadly (global financial crisis) as well as those specific to particular industries (National Foods decision to reduce the price paid for milk) or regions (new road). For this reason the Hassall et al Study including not only traditional profile indicators (population, income etc) but also a literature based description of the other important factors likely to influence the cumulative impacts of change and the capacity of an industry, community or business to adapt.

The role of scoping study is to distinguish the ‘most significant potential impacts’ of a proposed change. These are defined as those that will make most difference to a decision or require most mitigation. The challenging aspect of the task is to distinguish the potential impacts of change from the noise of the dynamic context within which change is to take place. EBC (2003) took a positive approach to this and incorporated a process of surfacing past events and using them to assist with the prediction of the impacts of change.

### ***Reference Group***

A community Reference Group was formed and four meetings were held between September 2009 and April 2010. The role of the Reference Group was to provide

advice and input on appropriateness of the indicators in the profile, the scope of impacts, factors that are likely to add to the cumulative impact of change and/or likely to mitigate the impact, sources of information and studies and to review the draft social impact assessment study, as appropriate, and provide feedback.

The Reference group was asked the following questions:

1. Understanding the region – what changes have shaped the study region over the last 10 years?
2. From your knowledge of this region and understanding the changes that have already taken place what do you think will happen if the water level below lock 1 remains as it is now – with a water allocation of about 30%?
3. Are there particular places in the study area that might be more affected than others? What factors mediate the impact of change in the places less likely to be most affected?
4. What are the strengths and weaknesses of the study area?
5. What does the future look like under the three scenarios?

## Part 2 – Description of the pilot study area

The pilot study area is known as the Murraylands region. This region encompasses the Local Government Areas (LGAs) of Karoonda East Murray DC, Mid Murray DC, Rural City of Murray Bridge, Southern Mallee DC and the Coorong DC. The impacts of change described in this Report however are specifically relevant to the Mid-Murray Region which includes the LGAs of Murray Bridge, Mid-Murray and Karoonda East Murray.

This study area is not directly comparable to the Hassall et al (2003) ‘Murraylands’ study area because it included the LGAs of Alexandrina Coastal and Strathalbyn. The Murrayland region is used by the Regional Development Board, the Employment and Skills formation region and is therefore a useful scale at which to undertake the analysis.

Land use in the study area is diverse and includes grazing, cropping, irrigated horticulture, viticulture, irrigated pastures, dairying, conservation areas, national parks and urban areas. Two important cultural heritage areas are Ngaut, Ngaut Aboriginal site, near Nildotte, and Ngarkat Conservation Park.

Irrigation below Lock 1 at Blanchetown includes irrigation areas at Mypolonga and the Lower Murray Swamps as well as direct off take in the mid section of the River. Annual vegetable crops such as onions and potatoes are important as well as fruit and almond trees. Irrigated dairy and horticulture takes place in the lower Murray Swamps although its extent has been much reduced over the recent drought. Viticulture has expanded in parts of the case study area in recent years.

Two recent large studies provide an important broad context for the pilot study. In 2008 the ABS produced an extensive report *Water and the Murray-Darling Basin. A Statistical Profile 2000-2001 and 2005-2006*. In addition to this a social and economic profile of the Murray region is provided in the Report *Socio-Economic Context for the Murray-Darling Basin* (ABS et al 2009). The Murray Region as reported here is the largest of 18 regions in the Murray Darling Basin and 20 million ha or 19.7% of the Basin crossing three states (NSW, Victoria and South Australia) (ABS et al 2009:8). It includes the study region – the Murraylands and the area known as the ‘Riverland’. Both these Report provides valuable overview of the social and economic profile of the Basin and has been drawn on to provide a context for this pilot study.

A critical challenge in bringing together this profile includes the issues of the scale of data collection, the relevance of data collection to the issues of concern and the timeliness of data. The later is undoubtedly the most significant issue because the currently available census data does not cover the period in which change was taking place. For this reason a certain reliance on anecdotal evidence is necessary.

The profile provided in the three sections which include an overview of the water resources of the study area, a social description including population, employment,

income and other relevant factors and finally an overview of water dependent activities in the pilot study area.

## Water resources

The River Murray in South Australia is highly regulated with the volume of water received by the State controlled by arrangements under the Murray-Darling Basin Agreement. Under the Agreement, South Australia is entitled to a minimum annual flow (commonly known as the entitlement flow) of 1850GL.

The parameters for water allocations in the SA River Murray are set by the MDB Agreement entitlement flow, the MDB Cap on water diversions which limits the amount of water that can be allocated from the SA River Murray and the specific objectives established for water planning by the NRM Act.

The River Murray Water Allocation Plan defines how water is allocated between the different users in a normal year (see Figure 2 Water allocations per water-use-year for the River Murray Prescribed Watercourse).

Figure 2 Water allocations per water-use-year for the River Murray Prescribed Watercourse

Use	Allocation
Metropolitan Adelaide	130 GL
Irrigation, industrial, stock and domestic purposes in irrigation zones other than the Lower Murray Irrigation Management Zone	522.1 GL
Irrigation purposes in the Lower Murray Irrigation Management Zone	67.3 GL
Water Supply country towns	50 GL
Water for irrigating highland parcels associated with the lower Murray but within the River Murray Irrigation Management Zone	9.3 GL
Environmental land management purposes in the Lower Murray Irrigation Management Zone	22.2 GL
Wetland Management	200 GL

Source: Adapted from Explanatory Guide Understanding the Water Allocation Plan for the River Murray, River Murray Catchment Water Management Board, Government of SA.

Adelaide and much of rural South Australia and the Iron Triangle towns of Port Pirie, Port Augusta and Whyalla, although not within the MDB rely on the River Murray for water supplies. Adelaide and other metropolitan centres in South Australia draw their water partly from the Murray and also from the Adelaide Hills and the Adelaide Plains. In a normal year, about half the water is extracted from the Murray and the other half from the Adelaide Hills and its catchments around it. In dry years, the city draws up to 90% of its water supply from the Murray River.

Inflows into South Australia are currently well below the average (Figure 3 Murray System Inflows (excluding Snowy and Menindee inflows). The average for the 10 years since 1999 is significantly below the long term average which is a clear indication of a long term dry cycle.

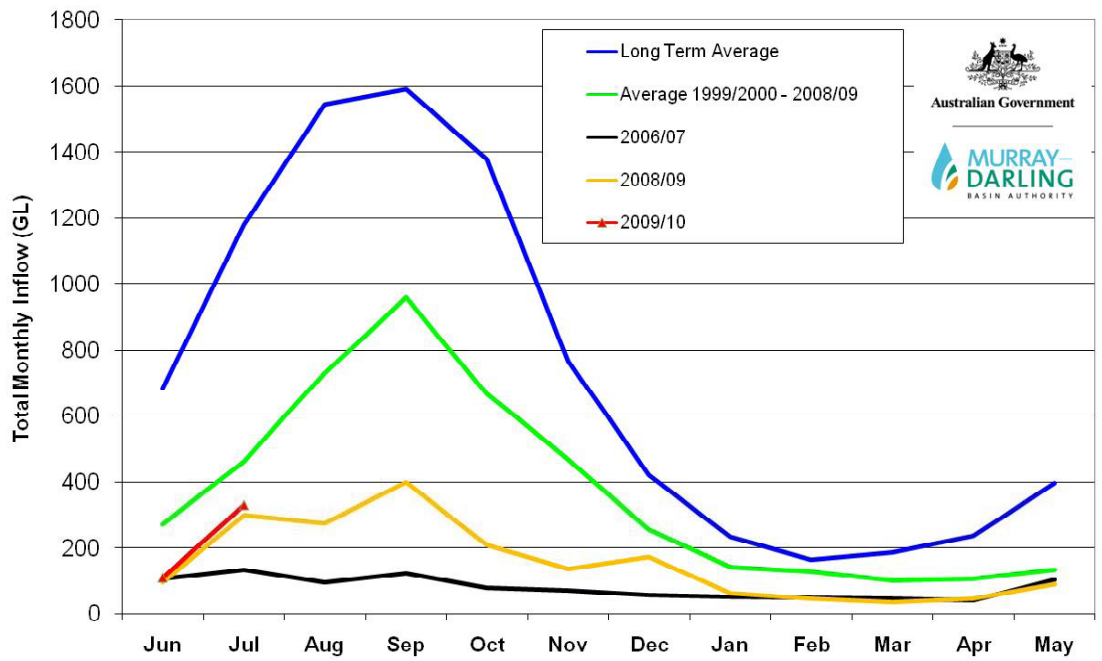


Figure 3 Murray System Inflows (excluding Snowy and Menindee inflows)

The quantity of water available for extractive uses in South Australia is a feature largely of storage upstream. Only a small percentage of water in the SA River Murray comes from local rainfall events. Figure 4 MDBA Active Storage July 1996, July 2009 below shows the level of storage between July 1996 and July 1999. It is clear that storage is well below the long term average.

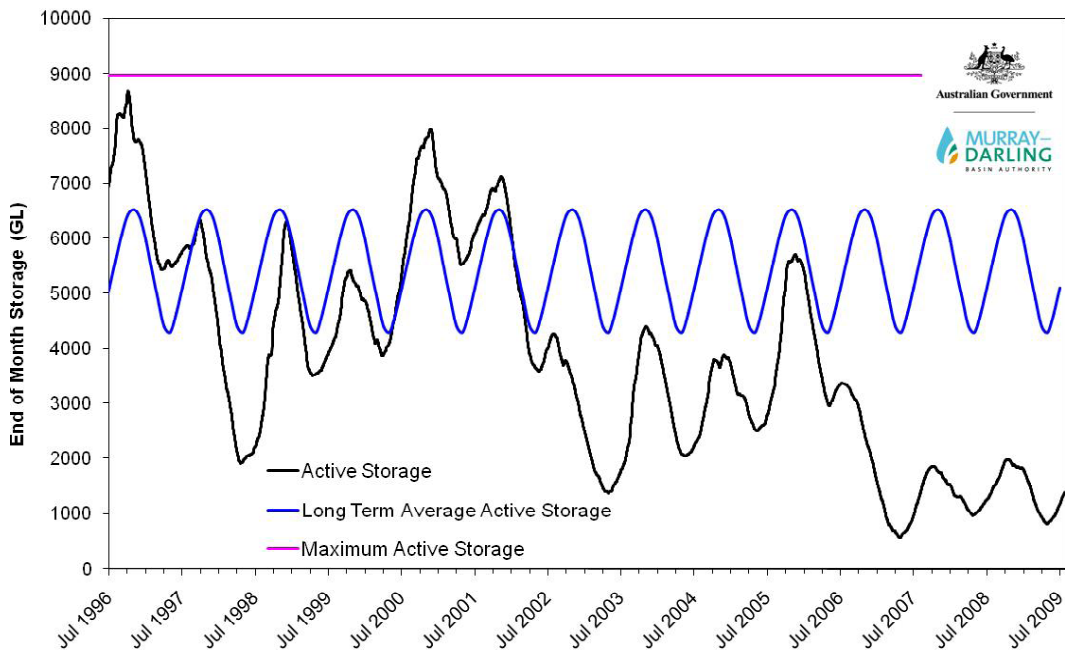


Figure 4 MDBA Active Storage July 1996, July 2009

## ***Environmental impacts of water management***

It is impossible in this Report to describe the environmental conditions in the pilot study area in anything but a cursory fashion. The natural environment in the case study area has been materially altered by some 70 or so years of river regulation. River regulation has impacted on flows within the stream, the variability and seasonality of flows, water quality and temperature, floodplain health and wetland condition. ‘Over-allocation of water and progressively reduced river flows, along with rising saline groundwater and poor land management practices along the river corridor all contributed to the declining health of the river.’ (DWLBC October 2005:11).

Considerable public focus centres on the icon site – the Lower Lakes and Coorong - within the study area however there are over 500 wetlands and floodplains that are impacted by river regulation and extraction. These smaller wetlands and floodplains are of importance not only to the healthy function of the system but are also of cultural and social value to communities along the River. The environmental impact of the drying of the Lower Murray Swamps is significant and questions about its capacity to recover in the long-term are raised.

The impacts of regulation and over-allocation have been intensified by the recent drought in the case study area. Riparian and floodplain vegetation health, already affected by the lack of flooding, has been significantly worsened by the lack of local rain. The drawdown of groundwater as a consequence of lower river levels and interception to compensate for shortage of surface water has also played a role in this worsening of vegetation condition.

The Lower Lakes and Coorong would normally have experienced drought one year in 20 however under the regulated river conditions the frequency has increased to one year in two (Wentworth Group of Concerned Scientists – Austin 2003). Drought conditions over the last four years have meant that little water has flowed from the main channel into the Lower Lakes and Coorong putting them at risk of hyper-salinisation and acidification.

Native fish populations are at 10% of their pre-European settlement levels and 16 of the Basins’ 35 native fish species are now listed as threatened. The causes are considered to include the cumulative impacts of land clearing, agricultural and urban development, river regulation and irrigation.

## ***Water allocation and restrictions***

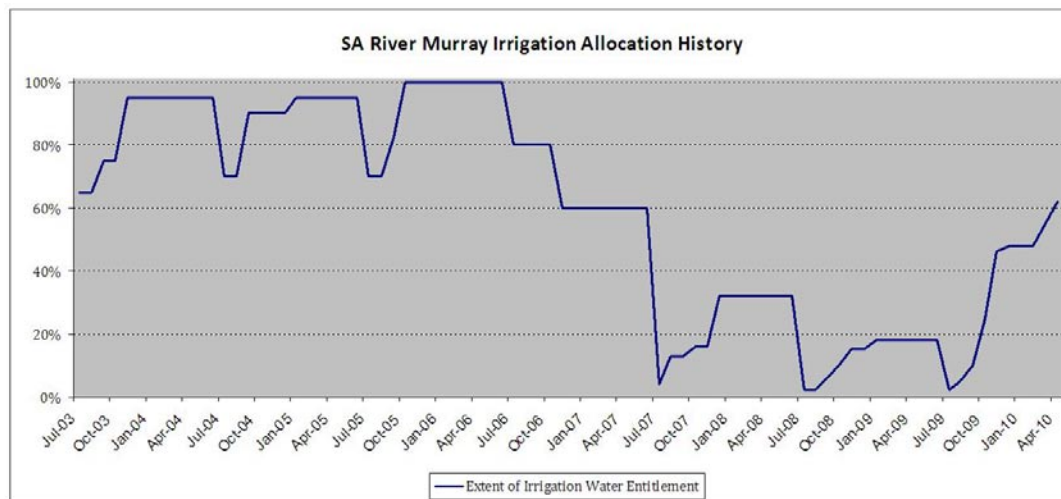
Conditions in the Murray Darling Basin and within SA arising from the low inflows into the State mean that the water allocations described in the 2002 RM WAP are not currently available for water users. Traditionally, in this highly regulated system, SA has received 100% of its entitlement flow. Until 4 years ago it had never received less than 1800 GL. Modelling by the MDBC had indicated that the lowest flow SA would ever receive was 1,500 GL (pers.comm. P Harvey).

In the water year 2006/07 SA received only 1,500 GL of its entitlement flow and this has continued to be reduced. South Australia is guaranteed a minimum regulated flow of 897 GL during 2009-10 to maintain water quality below an upper limit of not more than 1400 EC at Murray Bridge (DWLBC 2009). The minimum flow consists of 696 GL dilution flow and 201 GL critical human needs. The reduction in entitlement flow to only 1,100 GL over the last 3 years has had a significant impact on water users who are dependent on the SA Murray.

When the 2002 RM WAP was made, a reduction of entitlement flow was not envisaged and provision was not made for decision making about water allocations in the event of below entitlement flow. As a consequence decision making about water allocation has taken place outside the WAP for the last four years. A ‘Drought Allocation Policy’ prepared by DWLBC in 2006 (revised 2009) has provided the framework for the management of the water resources of the River Murray. The Policy provides a drought allocation decision sequence to guide decision making about water as it becomes available in SA. It provides a framework to ‘equitably distribute shares of water across all water users (except the environment), ensure that the best available information is accessible to decision makers likely to be affected by reduced availability of water and ensure a clear and transparent decision-making process for the establishment of water restrictions during periods of drought or poor water quality’.

Irrigation allocations have been restricted since 2003-04. The lowest allocation was 4% in July 2007 although it increased to a maximum of 32% in the irrigation year (see Figure below). Allocations are currently 62% (DWLBC 2010).

Figure 5 SA River Murray Irrigation Allocation History



There are no immediate prospects that the drought conditions in the Murray-Darling Basin will be relieved. In terms of inflows into the Murray there has been some relief provided by rain in the upper catchment (MDBA 26 May 2010). However, BOM forecasts for winter 2010 are for a ‘drier than normal season. The chances of exceeding median rainfall for winter are below 40% for South Australia (BOM 2010).

## ***Drought measures***

There have been a range of policies and programs introduced to respond to the drought. These include the State Drought Response and Exceptional Circumstances measures; the \$610 Murray Futures program, and the Commonwealth Governments irrigator exit package. The Murray-Darling Basin Small Block Irrigators Exit Grant Packages target small-block irrigators who may wish to stay on their land but are willing to sell their water entitlements to the Commonwealth (DEWHA 2009). Recipients are entitled to \$150,000 exit grant on condition that they remove all perennial plantings and infrastructure.

While these restrictions apply across the board special provisions have been made to provide water for permanent plantings in the Riverlands above Lock 1. In September 2008, the South Australian Government announced that it would underwrite the critical water needs of permanent plantings by purchasing water on the open market at a cost of up to \$67 million, should water availability not improve by June 2009 (NWC 2009). Around 1500 irrigators were granted water for essential permanent plantings under the Critical Water Package. The government bought 60 GL of water allocation for this program, mostly from interstate. The Irrigated Industry Support Program replaced this scheme for 2009-10 and will provide viable farm businesses a reimbursement grant of up to \$260 ML for water allocations purchased specifically to ensure the survival of permanent plantings (PIRSA 2009).

## ***Water Trade***

The trade of water in the SA River Murray is an important part of the contemporary arrangements for water management. The *Australian Water Markets Report 2008-2009* (NWC 2009) provided detailed information on the movement of water within SA and between SA and the other Basin States. This information is not available at a sub-regional scale however inference about trade below Lock 1 can be drawn.

Key points for the period 2008-2009 from the NWC Report:

- 339,902 ML of temporary water allocation was traded into the River Murray PWC, 98% came from NSW.
- 3,639ML of temporary water allocation was traded out of SA.
- The volume of permanent water allocations traded almost trebled from the previous year although the number of trades only increased by about one quarter.
- SA continued to be a net importer of interstate water allocations (+336GL), an increase of 25% from 2007-08.
- The average price for temporary water allocation trades in SA was \$346 ML down from \$679 ML in 2007-2008.
- Prices for water licences ranged from \$2170/ML to \$2384/ML over the 2008-2009 water year. The average prices for water licences were similar to the previous year.
- The gross value of water trade in the River Murray Prescribed watercourse was \$149.1 million.

## River level below Lock 1

The implications of low inflows into South Australia and decision making about the use of that water are significant for a number of reasons. For the area below lock 1 it has meant that the River level has dropped significantly.

When the River is at its normal managed level ('pool level') it is generally about 0.7m above sea level (AHD). At its worst, during periods in 2008 and 2009, the River level below Lock 1 fell to 2.1 metres below pool level. In March 2010 (due to improved flows accruing from rain events in NSW and Queensland during the Christmas New Year period 2009/2010) the River level below Lock 1 improved to around 1.47m below the normal managed level of the River. This level is about 0.75m below sea level. Figure 6 Murray River storage levels and flow data graphically demonstrates the impact on water levels below lock 1. Low water levels have been experienced throughout the Lower Lakes and Coorong.

Murray River storage levels and flow data: South Australian border to Lower Lakes  
Last updated: 15:03 21/05/2010

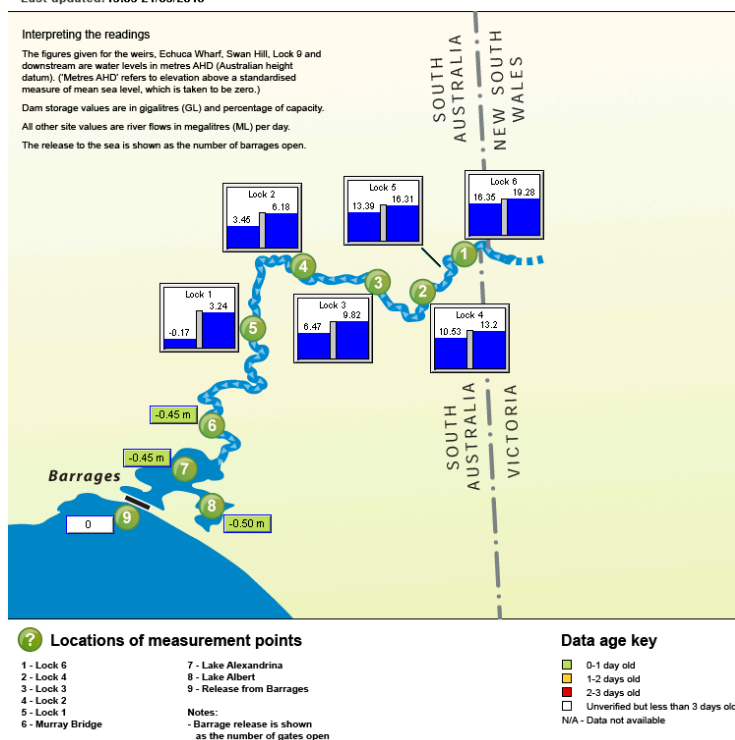


Figure 6 Murray River storage levels and flow data (MDA 2010)

## Sustainable yield and long term climate change

The Murray Darling Basin Sustainable Yields Project assessment commenced in 2007 and has since produced a series of reports examining the likely water yield of surface and groundwater catchments in the MDB based on current and future climate and possible development changes. The Sustainable Yields Project (CSIRO July 2008) found that current surface water use in the Murray Region (SA and Vic) was high at 36% of the average surface water available. The modelling for surface water under the current development and 1997-2006 climate scenario found:

- Average annual rainfall and modelled runoff for recent climate in the Murray region were 8% and 21% lower than the long-term averages;
- Under a long-term continuation of the recent climate and current water sharing arrangements, average surface water availability in the MDB would fall by 27%;
- For the Murray Region:
  - ❖ Average surface water availability would fall by 30%;
  - ❖ End of system flows at the barrages would decrease by 50%
  - ❖ Total diversions would fall by 13%
  - ❖ SA irrigation diversions would reduce by 12%.

The new Sustainable Diversion Limits (SDL) to be determined by the MDA are to be released later in 2010. However, it is probable that the SDL for SA will be reduced.

Rainfall in the Murray Bridge LGA is on average 350mm per annum. The Figure **Error! Reference source not found.** shows that there has been below average rainfall in 3 of the last 9 years in Murray Bridge.

## Social Description

### *Population size and change*

The population of the Murraylands was 36,312 in June 2007. The population has steadily increased over the last few years but at a rate slightly lower than the State average. Ninety per cent of the regions' population live in Murray Bridge, Mid Murray and the Coorong. Murray Bridge LGA has a population of 18,633, 51.3% of the regions total population grew most strongly. While 23.1% of the regions' population live in Mid Murray it has experienced a net loss of population of recent years.

The Murraylands region has a significant Aboriginal population (1,209 people) constituting 3.5% of the total population. The State average is 1.7%. The Aboriginal population is also growing with an 8.5% increase between the 2001 and 2006 Censuses (Workforce 2009). About 60% of the Aboriginal population live in Murray Bridge and 25.9% live in the Coorong LGA.

The population projections to 2021 for the Murray Lands Statistical Division (which includes the Riverlands) include the following:

- An average annual growth rate of between -0.12 and 0.32%
- An increase in the median age to over 43 years
- A decrease in the working age population of 4.7% in the medium projections (Planning SA 2007).

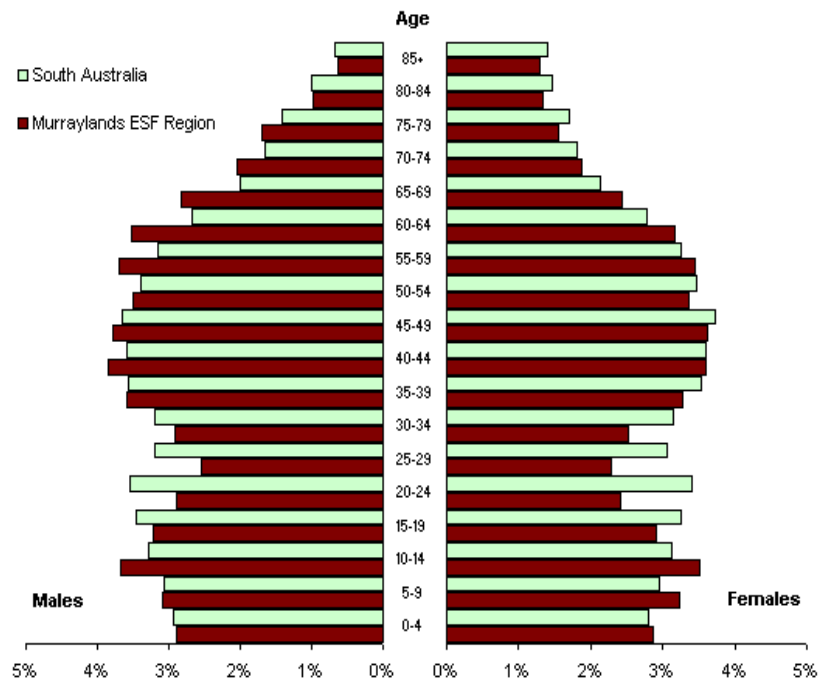
### *Age distribution*

Compared with the whole State the Murraylands has an above average populations of young people (i.e. below 15) and older people (i.e. 65years+). However, it has a significantly below average population of younger people in the age group 15-35 years.

The age dependency ratio represents the number of children and older people relative to the working age population. Because the Murraylands has a high number of children and older people its age dependency ratio is quite high.

It is notable that there are more men than women in the adult age ranges.

Figure 7 Age and Sex, June 2007



Source: Australian Bureau of Statistics, Estimated Resident Population June 2007, Workforce (2009)

The age distribution of the general population of the Murraylands contrasts with that of the Aboriginal population which is much more youthfull. In particular, there are proportionally twice as many Aboriginal children and youth as the general population. There are half as many Aboriginal people in the 45-64 age group as in the general population.

Table 1 Aboriginal Population 2006

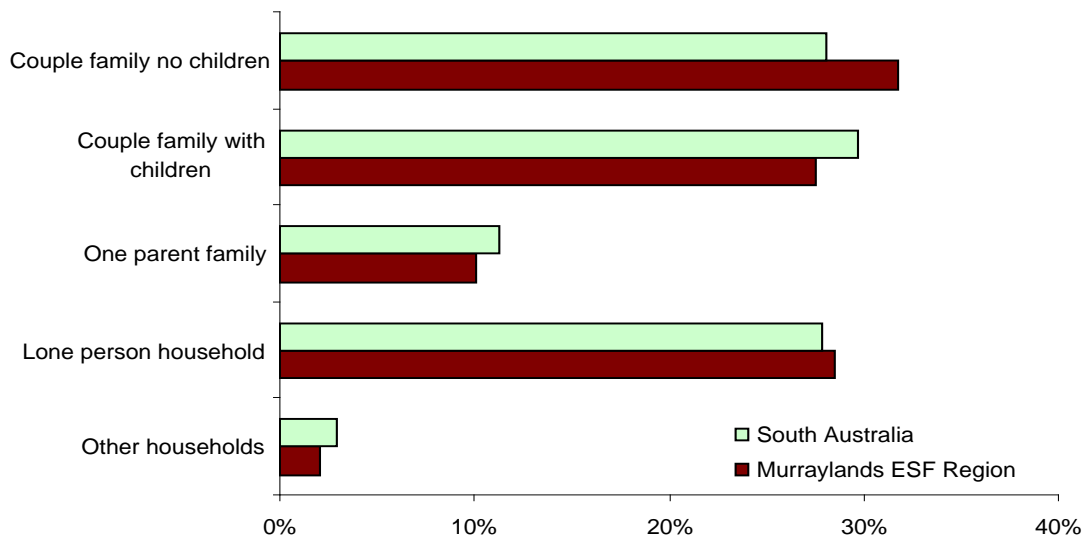
	Murraylands Region		
	Aboriginal		Non-Aboriginal
Age	Population	%	%
0-14	467	38.6%	19.0%
15-24	207	17.1%	10.7%
25-44	308	25.5%	24.7%
45-64	178	14.7%	28.8%
65 and	49	4.1%	16.8%
<b>Total</b>	<b>1,209</b>	<b>100.0</b>	<b>100.0%</b>

Source: Australian Bureau of Statistics, Population Census 2006, Workforce (2009)

The population in the Murraylands aged slightly during the census periods. The population in the Murraylands was on average 38 in 2001 and 40 in 2006.

### Family types

The Murraylands appears to have a higher than State average number of couples with no children and lone person households. However, there are less one parent families than the State.



**Source:** Australian Bureau of Statistics, Population Census 2006, Workforce (2009)

Figure 8 Household types, 2006

### ***Regional centre – Murray Bridge***

The major regional centre in the pilot study area is Murray Bridge. It is well connected to Adelaide with a highway. The region is well services with several major transport routes. The proximity to Adelaide and access to natural resources such as water and land are important factors in the location of manufacturing industry in Murray Bridge.

The majority of commercial and administrative activity in the study area is located in Murray Bridge. People travel from across the area to Murray Bridge for the majority of goods and services. Some people especially from around Mannum travel to Mount Barker for some shopping. The purchase of specialist industrial or commercial equipment is largely undertaken outside the pilot study area. Many people travel to Adelaide for the purchase of domestic white goods and the like.

The character of Murray Bridge has changed over the last 10+ years from being an ‘agriculture town’ with high levels of economic and social disadvantage to one with a more diversified underpinning. Unemployment rates have halved attributable in part to public policy efforts on the part of the Economic Development Board and Local Government to support development and economic diversification. A number of factors have contributed to the changes in Murray Bridge. These include decreased travel time to Adelaide because of the Heysen Tunnels, relatively affordable housing, planned economic diversification, employment demand and a good quality health system.

There has also been considerable demographic change in this period with in-migration of people seeking affordable housing within commuting distance to Adelaide, as well

as lifestyle change. These changes have off-set to some extent the effects of the drought on the rural community even through there has been impacts on some specifically agriculture dependent small businesses. Murray Bridge is no longer essentially rural – its character has fundamentally changed. Its future is quite hopeful because there are services to support farmers who are exiting the land and other opportunities for young people.

The picture of urban areas is not consistent across the pilot study area. Mannum just south of Murray Bridge is estimated to be 60% dependent on the grain, agriculture, horticulture and tourism sectors. It was reported that business is down by about 20% (pers.com). Other smaller less diversified centres appear to be more strongly affected by the low flows in the River, reduced allocations and drought.

## ***Employment***

Overall there was a growth in the number of jobs in the Murraylands between 2001 and 2006. Manufacturing, health and community services and the retail trade had a significant growth however it was off-set in part by the significant loss of jobs in Agriculture, forestry and fishing as well as the less significant loss of employment in the wholesale and cultural and recreational services sector.

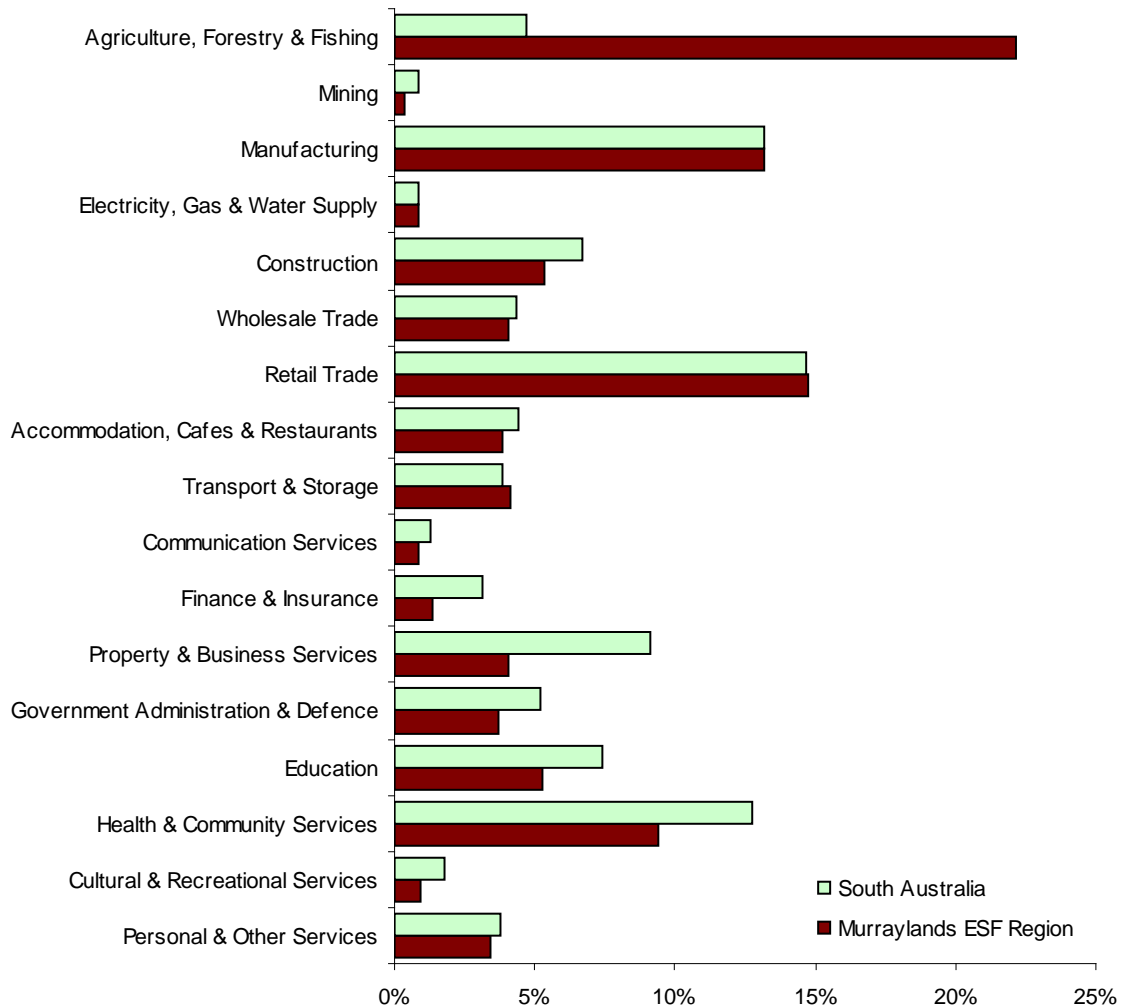
Table 2 Industry of employment, 2006

Industry Sector	2006	Change since 2001		Percentage 2006	
	No	No.	%	Murraylands Region	South Australia
Agriculture, Forestry & Mining	3,281	-674	-	22.1%	4.7%
Manufacturing	1,950	388	24.8%	13.1%	13.2%
Electricity, Gas & Construction	131	37	39.4%	0.9%	0.8%
Wholesale Trade	790	114	16.9%	5.3%	6.7%
Retail Trade	601	-138	-	4.1%	4.3%
Accommodation, Cafes	2,188	361	19.8%	14.8%	14.7%
Transport & Storage	570	17	3.1%	3.8%	4.4%
Communication	612	49	8.7%	4.1%	3.9%
Finance & Insurance	132	-28	-	0.9%	1.3%
Property & Business	196	45	29.8%	1.3%	3.2%
Government	606	81	15.4%	4.1%	9.1%
Education	547	47	9.4%	3.7%	5.2%
Health & Community	777	33	4.4%	5.2%	7.4%
Cultural & Recreational	1,393	368	35.9%	9.4%	12.7%
Personal & Other	138	-73	-	0.9%	1.8%
<b>Total</b>	<b>14,829</b>	<b>771</b>	<b>5.5%</b>	<b>100.0%</b>	<b>100.0%</b>

Source: Australian Bureau of Statistics, Population Census 2006, Workforce 2009

Agriculture, forestry and fishing is the largest employment sector in the Murraylands with 22.1% of people being employed in it. There was a significant decline in employment in this sector between 2001 and 2006 (Workforce 2009). The second largest employment sector is the retail trade (14.8%) followed by manufacturing (13.1%). The manufacturing is significantly associated with processing meat and milk products. The combination of high levels of employment in agriculture, forestry

and fishing and in manufacturing associated processing primary produce indicates a high level of dependence on one sector.



Source: Australian Bureau of Statistics, Population Census 2006, Workforce 2009

Figure 9 Industry of employment, 2006

### Unemployment

Unemployment rates have been relatively stable for several years in the Murraylands at around 5.5%. There are some differences between local government areas with Murray Bridge having the highest rate at 7.7% and Karoonda East Murray and the Southern Mallee the lowest at 2.0%.

	Unemployment %
Karoonda East Murray	2.0%
Mid-Murray	4.4%
Murray Bridge	7.3%
Southern Mallee	2.0%
The Coorong	4.4%
Murraylands	5.5%

Table 3 Unemployment Murraylands, 2008

Source: Department of Education, Employment and Workplace Relations June 2008

### ***Employment by occupation***

Figure 10 Murraylands occupations, 2006 below shows that the Murraylands has a large proportion of the population employed as labourers and related workers and managers and administrators. Relative to the State there are fewer people employed as professionals and intermediate clerical, sales and service workers. According to Workforce (2009) the managers and administrators group are primarily farmers or farm managers.

Figure 10 Murraylands occupations, 2006

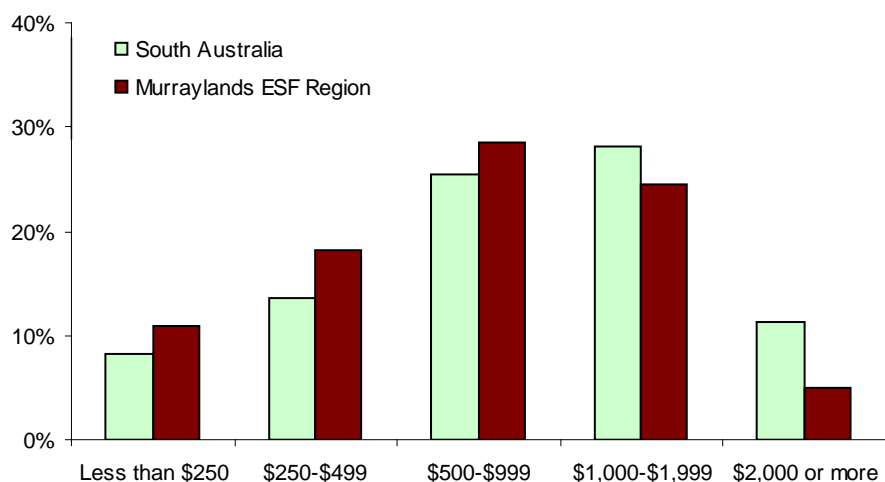


Source: Australian Bureau of Statistics, Population Census 2006

### ***Household income***

The figures below show that median incomes in the Murraylands are low relative to the State. Median individual and household incomes are well below the State average. It shows further that there are a large number of households with low to medium incomes.

Figure 11 Household Incomes, 2006



Source: Australian Bureau of Statistics, Population Census 2000

	Median Individual Income	Median Household Income
Karoonda East Murray	\$327	\$634
Mid Murray (DC)	\$326	\$616
Murrav Bridge (RC)	\$369	\$672
Southern Mallee (DC)	\$408	\$746
The Coorong (DC)	\$368	\$643
<b>South Australia</b>	<b>\$433</b>	<b>\$887</b>

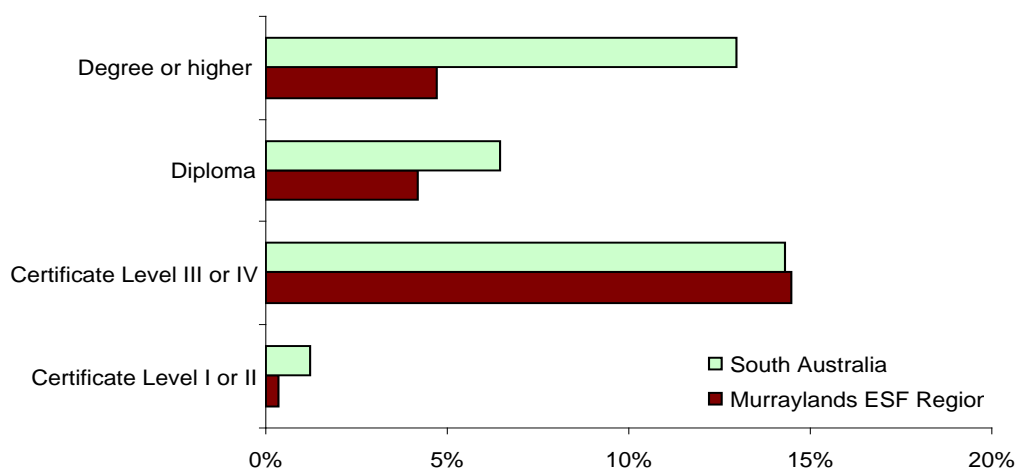
Source: Australian Bureau of Statistics, Population Census 2006, Workforce 2009

Table 4 Median Gross Incomes, 2006

### *Education and Qualifications*

The population of the Murraylands has a generally lower level of education than the State. There is a significantly lower proportion of people with degree or higher qualifications than the State average. There were above average proportions of people with Certificate Level III and IV qualifications in the region. This is consistent with the higher than average proportions of Tradespersons and people employed in Agriculture and manufacturing.

Figure 12 Highest Non-school Qualification, 2006



Source: Australian Bureau of Statistics, Population Census 2006, Workforce 2009

### Community wellbeing

The ARIA score – Remoteness and Accessibility conveys a measure of relative accessibility to goods, services and opportunities for interaction. The SLAs in the pilot study area have an ARIA score of between 1.4 and 3.0.

ARIA index	ARIA score
‘highly accessible’ – with relatively unrestricted accessibility to a wide range of goods, services and opportunities for social interaction	Murray Bridge 1.42 Mannum – Mid Murray 1.43 Truro – Mid Murray 1.69 Tailem Bend – Murray Bridge 1.63, Wellington – Coorong 1.69
‘accessible’ – with some restriction on accessibility to some goods, services and opportunities for social interaction	Peake- Mid Murray 2.89, Meningie – the Coorong 2.8 Karoonda East Murray 3.03.

Source: Department of Health and Aging [www9.health.gov.au/aria](http://www9.health.gov.au/aria)

Figure 13 ARIA score

There has been very little change in the ARIA score since 2003 with the exception of a slight improvement in accessibility in Karoonda East Murray and the Coorong.

## Water dependent activity below Lock 1

The economic value of river dependent activities includes a range of use and non-use values (see Figure 1). Only a portion of water dependent activity that sustains communities and industries is readily quantifiable. The section of the report draws on the approach of Hassall et al (2003) to conceptualise economic and social activity in terms of its dependence on water. This is dependence both for extractive uses and non-extractive uses. This approach means that a more comprehensive understanding of the contribution of the River can be developed.

Considerable socio-economic activity and employment is generated through extractive uses of water. These uses include water for irrigation of agriculture and for industrial uses in particular manufacturing. The dependence of the manufacturing on irrigated agriculture because of the nature the sector i.e. processing primary produce and producing in-puts and equipment for agricultural activity is particularly important to note.

Another aspect of socio-economic activity and employment in the pilot study area is generated through non-extractive uses of water. In the Murraylands tourism and recreation are important industries. These depend on a certain quantity and quality of water being in the River.

The community is also dependent on the River Murray through the provision of a suite of ecosystem services. The importance of ecosystem services to the long term functioning of the River and dependent communities has long been recognised (see Cork et al 2001, Bryan et al 2009). There has been no attempt to detail these services but their importance is recognised. However, a range of ecosystem services have been adversely affected by changes in water availability and the way in which this has impacted on dependent communities is are documented in Part 3 of this Report.

### ***Dependence on water – including irrigated agriculture***

A significant section of the economy of the Murraylands is based on irrigated agriculture. Not only does it provide over one fifth of local employment its gross value to the region is over \$1 billion annually. The relative importance of this sector however declined between 2001 and 2006 with net negative growth in winegraps, vegetables and grains (Econsearch November 2008). It is of importance to the State economy and the large economy of the Murray-Darling Basin.

Table 5 Value of agriculture SA and Murraylands

	South Australia		Murray Lands	
	Gross value	Local value	Gross value	Local value
<b>Agriculture - total value (\$)</b>	3,674,464,146	3,425,540,440	1,089,716,006	1,012,020,631
<b>Crops - total value (\$)</b>	2,232,338,514	2,085,831,110	823,967,605	764,936,264
<b>Pasture and cereal and other crops cut for hay -</b>	116,964,141	116,964,141	15,159,604	15,159,604

<b>total value (\$)</b>				
<b>Crops (excluding hay) - total value</b>	2,115,374,373	1,968,866,969	808,808,001	749,776,660
<b>Nurseries, cut flowers and cultivated turf - total value (\$)</b>	75,172,118	70,620,933	7,964,375	7,446,119
<b>Vegetables - total value (\$)</b>	477,666,231	425,083,681	173,712,104	152,922,269
<b>Fruit - total value (\$)</b>	810,648,989	775,102,692	502,044,520	473,865,822
<b>Livestock slaughterings - total value (\$)</b>	894,992,314	816,255,398	172,239,813	157,033,305
<b>Livestock products - total value (\$)</b>	547,133,318	523,453,932	93,508,588	90,051,061

Source: Agricultural commodities small area data 2006-07

There are over 3,500 agricultural businesses in the Murraylands utilizing an area of 3.2 million hectares.

**Table 6 Area of Irrigated agriculture**

	South Australia		Murray Lands	
	Number of agricultural businesses	Estimate	Number of agricultural businesses	Estimate
<b>Area of holding</b>				
Area of holding - total area (ha)	15,835	50,064,634	3,681	3,271,603
Area of holding - land both owned and operated (ha)	14,877	19,914,051	3,475	2,914,879
Area of holding - crown land leased (ha)	837	26,239,154	177	173,019
Area of holding - other land leased or rented (ha)	2,286	3,939,660	328	167,673
Area of holding - n.e.c. (ha)	263	71,607	55	15,157
<b>Land use</b>				
Total crops (excluding pastures and grasses) - total area (ha)	11,496	4,449,549	3,188	991,134
Cereal broadacre crops - cereals for all purposes - total area (ha)	6,670	3,699,459	1,481	865,932
Non-cereal broadacre crops - total area (ha)	3,644	626,582	416	77,030
Horticultural crops - total area (ha)	5,066	123,507	1,831	48,171
Nurseries, cut flowers and cultivated turf - area (ha)	273	1,013	52	163
Vegetables for seed - total area (ha)	119	1,872	19	220
Vegetables for human consumption - total area (ha)	769	14,795	199	6,589
Fruit and nuts - fruit (excluding grapes) - total area (ha)	1,385	21,003	868	14,833

<b>Orchard fruit and nut trees (excluding plantation and berry fruit) - total area (ha)</b>	1,362	20,832	862	14,825
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Source: ABS Agricultural Commodities Small Area Data 2006-07

Over 64,000 ha of land was irrigated in 2007-08 and the volume applied to a variety of crops was almost 300,000ML.

**Table 7 Water use on farms 2007-08**

Statistical Division	Agricultural Businesses no.	Agricultural Businesses no.	Area of agricultural holdings (ha)	Area irrigated (ha)	Volume applied (ML)
Murraylands	3,372	1,967	3,136,812	64,518	299,313
Total – Lower Murray Darling Basin	25,898	11,039	21,559,012	564,970	1,987,857

Source: ABS Water Use on Australian Farms 2007-08 cited by Anon (2009a)

Food product manufacturing is important in the Murraylands. The key food product manufacturing activities are the processing of dairy, fruit and vegetable products and wine making.

	No. locations	Employment at end June no.	Wages and salaries \$m	Sales of goods and services \$m
Murraylands	52	1,998	93	883
Murray Darling Basin	592	18,648	1,079	8985

Source: ABS Manufacturing Industry, Australia 2006-07, cited by Anon (2009a)

There are 13 major dairy facilities in the Lower Murray Darling Basin, two of which are in the Murraylands. National Foods has processors at Jerois which makes cheese and milk powder and at Murray Bridge which makes cheese.

T&R Pastoral at Murray Bridge is an important Livestock processor (110,000 tonne annual output). Stock for processing is purchased from all over the State. T&R Pastoral (Murray Bridge) employs 1000 directly and is estimated by the Development Board to generate 2,500 jobs indirectly. Water restrictions have had an impact in particular on their ability to discharge waste water. There is more water used for cleaning than production therefore water restrictions can have significant hygiene and bio-security impacts. TNR has changed its operating process and now re-use/recycles water.

Stockfeed companies supply to dairies and feedlots. Ridley Agriproducts has manufacturing and distribution facilities at Murray Bridge. Stockfeed production and consumption has significant flow on to the transport sector.

The value of agriculture to a regional economy extends beyond the value of its produce to include input harvesters, contractors, chemical suppliers, service industries and so on. Large vegetable processors in the pilot study region include Big River Port and RivaPak have been impacted by the reduction in production.

There is a growth of poultry - chicken production in Murray Bridge. Industry operators do not appear to have been materially impacted by the changes in water availability. This is because industrial users of water have continued to be able to access 100% allocation although they do have to prepare water efficiency plans.

### **Lower Murray Swamps Irrigation**

The Lower Murray Irrigation area is unique in the context of MDB irrigation (Hassel et al 2003). The Lower Murray Irrigation Area is made up of 23 reclaimed swamps, 13 of which are used for dairying. Approximately 5000 ha was developed as flood irrigated pasture between late the 1800's and the 1950s. In 2005 irrigation water diversions were estimated to be in the range of 60 and 305 GL/year (Aucote 2005). The cap on diversions was 99 GL. The areas are below the level of the River and the form of irrigation is flood. It is used mainly for pasture and fodder production.

The dairy industry in the Lower Murray swamps has supported a major part of the SA dairy industry – particularly fresh milk supply to Adelaide. In 2003 the region was reported to produce 25% of the state's milk production with the Jervois Dairyfarmers factory also exporting to Japan (Hassel et al 2003).

Dairy farms directly purchase inputs such as feed, fertilizer and fuel and services including veterinarians, farm management consultants, nutritionists and contractors. Dairy farms produce milk which is processed but also livestock for slaughter and breeding. The dairy farm sector has a large multiplier effect including direct employment in trade, services, transport and other agriculture. The ABS estimate of dairy's regional economic multiplier is 2.5, generating \$2 billion in economic activity (based on a farmgate value of milk production of \$803 million) and underpinning the regional economies in those areas in the Lower Murray-Darling Basin where it operates (Anon 2009a)

Dairy farms in the Murray Darling Basin have had average rates of return on assets, including capital appreciation, of 6.0 per cent per annum over the nine years 1999-2000 to 2007-08 according to ABARE data (Anon 2009a). South Australia has performed better over this period than the regional average with a 7.4% rate of return (ABARE Farm Survey Data). Dairy Australia data shows that feed costs have increased over recent years and that total farm debt has increased. The debt increase has been in part a consequence of farm expansion or the need for increased working capital (Anon 2009a).

The dairy industry on the swamps has had positive economic and social impacts and negative environmental impacts. The Sustainable Rivers Audit "River Health Check" reports rated the river valleys in dairying areas of the Lower Murray-Darling Basin as being in either poor or very poor health. The Murray Lower was rated poor – ranked 5<sup>th</sup> of the 9 Valleys rated (Anon August 2009). Efforts have been made to address the negative environmental impacts of dairying in the Lower Murray Swamps.

Since 2000 a regional program of infrastructure works, including metering of diversions, rehabilitation of irrigation infrastructure and irrigator education to improve practices has been in progress (Aucote 2005). The program had two objectives which are to improve compliance with water allocations and to capture and reuse on farm all surface water runoff (RMCG 2009). The current drought and the drying of the Swamps has resulted in significant damage to the infrastructure built to better manage on farm irrigation and return flows. This has been a loss of both public and private investment. It will also mean that when water returns to the system the negative environmental impacts associated with return flows of surface water will likely reoccur.

Dairying in the Lower Murray Swamps has been of considerable importance economically and socially for many years however the industry has been contracting in recent years. The table below shows that the number of dairy cows has been in decline in the Murraylands for some time. The rate of decline has accelerated in the period 2006/07 to 2007/08. There has been a reduction in the number of dairy cattle across the Basin however it has been relatively more significant in the Murraylands. There has been an annual average change in dairy production in the Murraylands of -15.3% (Dairy Australia Data and Analysis in Anon 2009a).

Table 8 Trends in dairy cattle numbers 1993/94 to 2007/08

	Milk cattle – total number 1993/94	Milk cattle – total number 2006/07	Milk cattle – total number 2007/08	Change 1993/94 to 2007/08	Change 2006/07 to 2007/08
Murraylands	43,198	37,767	34,339	-20.5%	-9.1%
Total	699,430	695,640	601,774	-14.0%	-13.5%

Source : ABS Agricultural Commodities Australia, cited by Anon (2009a)

Hassall et al reported that dairy deregulation, drought and the rehabilitation of the Lower Murray Swamps were factors affecting the region in 2003. Dairy deregulation had resulted in structural adjustment of the industry in the five years prior to 2003 and the rehabilitation program was estimated by Lower Murray Irrigation to be likely to result in 46-50% of farmers leaving the area.

### ***Dependence on water (excluding irrigated agriculture)***

This sector plays an important role in the pilot study area. Tourism and recreation are important components of this sector. The sector includes visitors involved in fishing, boating, house-boating, visiting natural attractions, driving holidays, visiting wineries, and holidaying in holiday ‘shacks’ located along the river.

Key sectors within the Murraylands tourism include:

- Monarto Zoological Park
- Houseboat Industry
- Paddle wheeler and larger River craft fleet
- Accommodation sector
- Cultural tourism
- Ngarrindjeri Cultural sites.

Total tourism expenditure is estimated at \$122 m or 6.2% of the total Murraylands gross regional product. Tourism related employment is estimated to be 1,117 jobs (or 7%) of the workforce (Dynamic 2009). Tourism satellite account for 2003 showed that about 4% of employment in the Murraylands was dependent on tourism (Hassall et al 2003).

The Murraylands Regional Tourism profile 2008 (the reporting area does not include the Lower Lakes and Coorong or the Riverland):

- 273,000 domestic overnight visitors per annum
- 596,000 domestic day visitors per annum
- 58% of domestic visitors were from Adelaide and 21% from regional SA
- The proportion of visitors participating in water sports and activities (25%) and exercise/gym or swim in local river/lake (8%) was higher than any other region
- 6% of domestic holidays involved charter boat/cruise/ferry
- 6,500 international visitors per year
- 26% of international visitors stayed on a houseboat/boat
- \$5.45 million in accommodation takings in 2008 (Tourism SA 2008).

The proximity of the pilot study region to Adelaide has contributed to it having one of SA largest day trip visitation rates.

Tourism employment is spread across a wide range of sectors of the economy including retail trade, accommodation, food outlets, manufacturing, education, transport and services (Sustainable Tourism CRC 2009).

According to the Murraylands Integrated Regional Strategic Tourism Plan (2009:33) the tourism industry is heavily dependent on the natural environment. The River itself is 'a tourism icon', houseboats and river cruising are key assets and Aboriginal Cultural tourism is a developing product.

It was reported to be 600 private house boats with the majority concentrated around Murray Bridge and Mannum (Hassell et al 2003:298). The house boat industry was reported as being affected by low fish numbers in 2003. The houseboat industry includes about 100 boats in the Murraylands. There are major houseboat marinas and moorings at Mannum and Murray Bridge. The houseboats offer accommodation for between 8-12 berths and for a wide range of budgets.

At its height (approximately 10 years ago) there were 200 commercial river craft (which include commercial houseboats and cruisers, paddle steamers and other craft). There was an occupancy rate of 70% and it generated about \$70 million in hire fees and add-ons (pers.comm).

An unpublished review of valuation studies in the Murray Darling Basin by Hatton-MacDonald (2009) indicates that 'a loose aggregation of environmental values, amenity, tourism and recreation are at least half the value of irrigated agriculture'.

## ***Fishery***

Hassel et al reported on the commercial fishery that existed in the Coorong, Lower Lakes and River Murray which depended directly on the level of water in the system and the health of the riverine floodplain and wetlands. While at the time there were 28 commercial fishers between the NSW SA border and Wellington only 6 derive their income from fish sales. Fishery in the Coorong and Lower Lakes was worth \$5 million in 2003 – now nothing. The sector has been phased out over the last number of years.

The value of the River for recreational fishing is considered to be significant.

## ***Indigenous Cultural values***

‘Ngurunderi chased the giant pondie down the small stream that was the Murray River back then’. According to Matt Rigney (quoted by Weir 2008) this story

‘tells us how our country was created and what was the purpose of the creation – it was to sustain life, to give life, and to create an environment that sustains us in that way. Like the bird life, the animal life, the plant life.’

Indigenous people have lived in the area of the SA River Murray for at least 18,000 years (Anderson et al 1999). The region supported an estimated population of 3,000 people living in a semi-permanent village lifestyle (Anderson 2007). Comprehensive descriptions of the culture and history of the Ngarrindjeri are available (see for example Anderson 1997 and Anderson et al 1999). The Ngarrindjeri were probably the first people in SA to have contact with Europeans. The explorer Charles Sturt credits his success at reaching the Murray mouth in part to the guidance of a man from the Swan Reach area (Sturt 1833:142; Hemming 1982:36 cited by Anderson 1997:68).

The Murray Lower Darling Rivers indigenous Nations (MLDRIN) is an organisation formed of an alliance of ten traditional owner groups along the River Murray and its tributaries to, amongst other activities, advocate for Indigenous interests in natural resource management including water (Weir and Ross 2007). MLDRIN has had an important role in raising the profile of Indigenous interests in water and helped develop the Indigenous Response to the Living Murray Initiative. Part of the Response to the Living Murray involved documenting contemporary uses and customary obligations in water and these were described to include:

- Access to drinking water
- Fishing
- Collecting food, fibre, medicines and other sustenance
- The responsibility to pass on unpolluted water down stream
- The right to protect cultural knowledge
- To pass knowledge on and provide cultural education
- To protect and access particular sites and species and
- To maintain song lines and story lines along the River (Final Report, Attachment 1: Consolidated Community Responses 2003).

The protection of cultural values in the Murray Darling Rivers has been described by Rigney (2006:27) to include care for wetlands (nurseries), burial grounds and the maintenance of flows. Sea County planning (2007) has articulated the Ngarrindjeri rights and interests in the lands and waters and their importance to Ngarrindjeri existence.

A healthy river system is fundamental to the capacity for existence of other rights such as fishing rights and more general cultural and economic rights (Morgan et al 2004). Broadly, this concept of a cultural economy needs ‘sufficient environmental, social and economic water flows and volumes’ to sustain it (Morgan et al 2004:40).

### ***European Cultural Heritage***

The explorer Charles Sturt travelled down the River Murray in 1833 in a whale boat. Following Sturt were the ‘overlanders’ who brought cattle and then sheep into the new colony of SA. The town of Wellington was first settled in 1838. European settlement continued apace throughout the 19<sup>th</sup> century with the use of the River for trade, communication and irrigation. The paddlesteamer is a significant symbol of European history. Australia’s first paddle steamer the ‘Mary Ann’ was built at Mannum and launched in 1853. The PS Marion is docked at Mannum and is open to the public. Artefacts of European cultural heritage continue to be of significance and are an important part of the modern tourism industry in the pilot study area.

The Australian Heritage Places Inventory (accessed March 2010) lists a large number of heritage places in the pilot study area.

	No listed heritage places
Murray Bridge	67
Mid-Murray	35
The Coorong	23
Karoonda-East Murray	4
Total	129

Source Australian Heritage Places Inventory (March 2010)

Table 9 Listed heritage places

### ***Social Values in the environment***

There are a large number of social values in the environment. An exploration of the suite of values in wetlands was undertaken by the WPT project during 2009 (see Mooney et al 2009). An extensive suite of values was identified by participants in the project.

Water Allocation Planning Committee	Representative Group
Human Health	Aesthetics
Aesthetics	Recreational activities, such as swimming, camping, fishing, bird watching, skiing,

	canoeing, boating
Recreation Swimming, camping, fishing, bird watching	Water Quality, particularly turbidity and salinity
Water Quality	Ecological function, Habitat, Breeding grounds (fish, birds, plants), Connectedness
Habitat, Biomass - area of wetland available, red gums	Biodiversity includes fish, birds, bugs, flora
Biodiversity	Social well-being, Spiritual renewal, Sociological health, Community connectedness, Mental health
Social well-being	Regional economy, regional enhancement and contribution to local and regional economic value
Economic value both primary and secondary	Threatened species, including habitat refugia maintaining existence value
Significant sites, RAMSAR, Indigenous sites, European heritage	Indigenous Cultural value
Economy	

Table 10 Values of wetlands

## Part 3 – Regional Responses to Reduced Water

This section of the Report relates the issues that were raised by the Reference Group and informants about the impacts of reduced water availability, drought and low flows. The preliminary scoping indicated that the focus of the study should be on the agricultural sector and tourism and recreation. However, as the study progressed it became apparent that water issues were impacting significantly on what is broadly described here as infrastructure. Accordingly, in addition to a description of impacts on agriculture and tourism and recreation the impacts on infrastructure are described. It will be noted that these impacts cut across both sectors but also have significant and wide reaching community impacts. The fourth part of this section describes a number of issues that were raised about community well-being. Like infrastructure this is a broad aggregation of a number of issues including those of physical and social well being, fairness and equity.

### Agricultural industries

The two agricultural industries in the pilot study area that were described as having been impacted by the changed availability of water due to drought, low flows and low allocations were dairy and vegetable production. The implications of the reduction in water allocations for extractive use and the timing of those decisions are significant.

The loss of water for irrigation has had a devastating impact on parts of the pilot study area. In particular, the irrigation area at Mypolonga and the dairy industry on the Lower Murray Swamps were reported to have been heavily impacted. The combined effects of low flows, reduced allocations and drought have had a negative impact on production. In some cases the little water that has been available has not been able to be used because irrigation infrastructure has failed or groundwater is so depleted that the application of surface water is of little value. The impact of low flows on infrastructure is described in the relevant section. In this section the issues of allocation and timing are discussed.

It was reported that some reduction in water allocation can be tolerated or adapted to without loss of production for several reasons. Either irrigators didn't use their full allocation in the past or they have made adjustments to the production methods to become more water efficient. It was estimated by several informants that practice change and small infrastructure improvements could achieve about a 10% reduction – just watering differently.

Annual vegetables – in particular onion and potato growing has been affected by reduced water availability. Production in the pilot study area has been significantly reduced. Some landholders have stopped trying to grow at all and some have reduced the area of land in production. It has been feasible for some farmers to move annual production to other areas such as the Mallee and the South-East. However, there are costs associated with leasing land, purchasing water and moving production. In addition, packing sheds and other important infrastructure are not locally available and the produce has to be transported back to the Murraylands for processing. Therefore the profitability of these enterprises can be affected by increased costs.

However, the need to maintain long-term supply contracts makes this option worthwhile. While some farm business may continue, the impact of the loss of this production locally includes purchase of inputs, transport, handling, and casual employment.

An important issue that was raised was the timing of the announcement of availability of water. Annual crops are planned up to 12 months ahead. The procedure for notifying availability of water means that there is a lack of predictability. It is a *real gamble to plant a crop with a 2% allocation in the hope that more water will be available later in the season to finish it off*. The cost of trade in water can be high and is probably not viable in the longer term. Vegetables, pastures and seasonal crops need a forward allocation. To plan, an understanding of what water is available needs to be provided either at the end of the calendar year or March. For the planting of some crops, such as onion seed, the timing of water application is critical. It was suggested that there is more flexibility with other crops such as fruit and cherry trees.

In 2003 the Hassall study reported that there was a high-level intensive irrigation of fruit and vegetables adjoin a number of the reclaimed lands particularly at Mypolonga. However, the low levels in the River, reduced allocations and drought have had a profound effect upon agriculture in this area.

*Mypolonga has been decimated. Less than 10 years ago there were 40 full time orchards now there are only three or four. There used to be 20 dairy enterprises now there is only one (which is operating via feedlotting). The impact is not just on orchards and dairies. There had been conversion from orchard to vineyard and olives over the last 10 years as the citrus and stone fruit have become less profitable. This conversion process has taken considerable investment. The loss of water has meant that these operations have also failed.*

*There has been a private irrigation area in Mypolonga for 30-35 years. Due to the ever increasing incidence of large scale bank slumping (due to the lower than normal water levels) the pumps and their power supply systems fell into the River in February 2009. Water is now supplied temporally through the CIT pipeline until the infrastructure can be reinstated.*

The impact of reduced availability of water on the dairy industry was also raised as a key concern for the pilot study area. The dairy industry has been affected by long term structural change, shorter term changes arising from need to improve environmental performance and the short-term impacts of drought, low flows and low allocations.

The Region had 92 dairy farms in 2005 approximately 40 of which are located on the reclaimed swamps and river flats between Mannum and Wellington (Aucote 2005). The remainder are adjacent to the Lakes and on the Narrung Peninsula (Aucote 2005). In 2006/07 there were 78 dairy farms in the Murraylands (ABS Agricultural Commodities – Small Area Data 2006-07). In 2009 it was reported that there were 42 dairy farms in the Lower Murray Swamps (pers. Comm. Steve Rice August 2009 cited by RMCG 2009). In the Lower Lakes the 21 dairy farms that might normally irrigate are currently running as dryland operations (RMCG 2009).

‘The Murray Swamps are facing an economic and ecological disaster if water allocations and river levels typical of the last ten years continue’ (Beale et al 2009:14).

Water is obviously important to the agricultural industry below Lock 1. However, it was stated that the most important issue in survival overall, is commodity prices. If prices are high, water is affordable. For example, the wine grape growers managed through 06/07 and 07/08 because reasonable prices meant that they could afford to trade in water. However this changed with the drop in value of wine grapes in 2009/10.

The issue of water trade was a keen point of discussion in the pilot study area. Water trade was seen as something that could both mitigate the impact of change and intensify underlying structural changes.

*Water trade and the Commonwealth buy-back are having an impact on water prices. These policies are believed to be causing prices to increase and make it increasingly difficult for small irrigators to buy-in water.*

*The impact of trade on top of reduced allocations needs to be examined. An allocation of 25% isn't very useful so it is being traded. This might be good for the individual because they have some income – but for the community it is bad because there is no local production.*

*Water trading, in particular temporary leasing of water, has helped some people to survive. In some cases it has been the only income.*

According to some informants the nature of production in the area below Lock 1 has been changed by the drought. A major change has been a shift from permanent horticulture to annual crops, such as vegetables. It was felt by a number of informants that this change was likely to be permanent because of the costs and time involved in re-establishing these permanent plantings. Uncertainty about long term water security is another issue which was considered likely to play into this process of change.

The loss of water and reduced profitability has had an impact on farmers (and others dependent on water) long term future. In particular, in calling on financial reserves to survive, superannuation savings and other assets have been depleted. There has also been an increased debt load.

*There is a need for a long term plan – ‘everybody knows there will be less water’. The current approach means that communities are slowly dying.*

## **Recreation and tourism**

The recreation and tourism sectors have also been significantly impacted by the changes in water availability, in particular low flows. The impacts have been direct and indirect. An example of a direct impact is navigation issues and indirect impacts are perception issues. The perception of the River by the broader community was an issue of concern to a number of people in the pilot study area. While it is

acknowledged that amenity has been affected the perception that the River is dying has had an intensified the pressure on the industry.

Many house boats have moved away. The perception issue has a large impact as well as the practical problems arising because of the drought. These include navigational issues, access to moorings and slipways. In particular large boats (50-60 tonne which make up about one third of the fleet) are sitting very low in the water. This causes a number of serious issues for access for passengers and services. Significant business impacts of the decline in the tourist trade below Lock 1 include the loss of a very large paddle steamer the Murray River Queen. Flow on impacts from this will be significant.

There was a fall of 60% in occupancy of commercial rivercraft between 2007-09 (Dynamic 2009). Issues with the River are important however other factors may have contributed to this decline. Income of commercial river craft operators has dropped by about 50%. There are significant impacts beyond the direct impact and these flow on to the cleaners, mechanics, food suppliers and others.

House-boat Concepts – a nationally awarded and highly acclaimed boat builder near Mannum was forced to close in 2009. ‘Absolute’ a boat built by House-boat Concepts was awarded the ‘Boat of the Year’ title by the Australian Marine Industries Federation in 2008. This business used to employ 20 people and draw considerable business into the local area.

The houseboat open day has been a feature in Mannum for 27 years with up to 30 large commercial craft on display. This was reduced in 2009 with only nearly 20 craft moored for inspection. The houseboat open day will not be run in 2010 and therefore a major event, with ordinarily up to 10,000 people visiting, has been lost to the Mannum community.

Access issues are affecting the operation of other large commercial boats. For example, the Murray Princess and other craft of similar size cannot access slipways, for obligatory commercial survey inspections at Mannum, nor can they proceed through narrow and shallow channels to slipways above Lock 1. There is a proposal to construct a \$2million dry dock in the Lower Murray to overcome this problem.

The lowering level of the River has had a negative impact on marinas because craft are unable to enter or leave them. For those who departed their marina berths prior to the significant lowering of water levels, the SA Government has provided strings of “Emergency Moorings”.

The large house boats and paddle steamers bring people to major tourist sites such as Ngaut, Ngaut. The effect of loss of this trade has been felt by a number of tourism business along the River.

In March 2010 access to Ngaut Ngaut was closed because of concern about the impact of cracking and bank slumping which threatens the existence of Aboriginal rock carvings and other important artefacts at the site. A safety audit has recently been conducted and the site has been closed. The safety audit found that in addition to the issues of cracking and slumping falling rocks along the walkway were a concern. The

Ngaut Ngaut site is a co-managed cultural tourism site which is run by volunteers and generates a significant income for the local community. It is estimated that under normal operations about \$10,000 in fees would have been generated between March and May 2010.

There is a noticeable reduction in recreational activity for example jet skis, water skiing, wakeboarding, picnicking and other passive pursuits. Activity is on-going, but reducing (with the public apprehension about the impact of drought restrictions in the area), above lock 1 which means that some towns are now being by-passed as people drive further up the River for recreation.

The flow on effects from the downturn in recreational activity are felt by business along the River. For example, the viability of the Mypolonga General Store & Mypo Traders – has been significantly affected by the change in recreational activity because of the River level. Previously 1.5 people were employed on a Saturday to supply deli lines, ice, beer etc now there is almost no business. The General store no longer opens on a Saturday.

There are approximately 1,500 holiday homes below Lock 1 through to Wellington, many of which are equipped with motor boats. Many of these are used as weekends by residents of Adelaide and surrounding areas. The visitation rate, measures solely by diminished local sales of boat fuel is substantially down because recreational amenity has diminished.

Towns such as Mannum have expanded in recent years because of improved infrastructure (e.g. effluent disposal schemes) which has allowed the development of many more holiday homes along the River. It is estimated that only about 10% of shacks are for retirement living. The majority are holiday homes. There is some economic flow on effect from holiday homes but considerable new local business generated with the construction of these buildings.

There is considerable concern that the value of real estate, in particular holiday homes (shacks), marina and house boat prices have been considerably affected by the downturn in tourism and recreation in the pilot study area.

## **Infrastructure and ecosystem services**

A number of issues were raised by the Reference Group and other informants about the impact of low river levels below lock 1. These include river bank slumping and a range of impacts on the safety and efficiency of infrastructure.

River bank slumping is a real concern with over 200 km of river between Blanchtown and Wellington i.e. 400kms of river bank, at risk of slumping and cracking (Riverbank Collapse Hazard Program DWLBC). Bank slumping itself has major implications for the environment but it also impacts on infrastructure such as boat jetties and irrigation pumps.

The impact of bank slumping can be felt on all river dependent activities. A large marina, the Long Island Marina suffered an extensive bank slumping in early 2009

and marina walls, boarding platforms and several motor vehicles were lost into the River (vehicles have not been located or removed). Reconstruction costs are estimated to exceed \$1M. The pumps and power supply for the irrigation area in Mypolonga ‘fell into the River’ in February 2009 because of large scale river bank slumping. Water is now supplied temporarily through the CIT pipeline until the infrastructure can be reinstated.

Mid-Murray Council has spent \$300,000 (funding matched dollar for dollar from SA Government sources) on maintenance of boat ramps and other infrastructure as a consequence of low River levels and drought. Management of hazards such as tree collapse into the River has been an important issue for local government. The cost of the drought and low River levels to local government as a consequence of damage to infrastructure is being presently absorbed. Road cracking and slumping is an issue and it is estimated that 8% of roads in Murray Bridge are at risk of slumping. Other maintenance and capital works are being deferred as funds are directed to maintenance and hazard management of issues associated with the declining river levels and drought. The total cost to local government has not been calculated although there is a proposal to quantify it in the Murray Bridge Council.

Swanport Bridge, National Highway 1 and Murray Bridge rail and road bridges are all potentially affected by the river level and drought. Work was undertaken in late 2009 and 2010 to reinforce the Swanport Bridge and the Murray Bridge against the risks of slumping.

One of the two Mannum Ferries stopped running for a period in 2009 and operations were restored in 2010. It is estimated that this has impacted on spending in the town by 15 to 20%. The cost to the Department of Transport of extending the ferries to allow craft to moor further out from the bank, to accept vehicular traffic is estimated to be in excess of \$1M.

The lower level of the River below Lock 1 has had an impact on the infrastructure that supports river craft industry. There are 25 boat ramps in the length of the River between Blanchetown and Wellington. Nine are currently closed (2009) and there is concern that up to another 10 would need to be closed. Recent rising in river levels have meant that it is less likely that any more ramps will need to be closed. Some are only suitable for use by 4-wheel drive tilt trailer.

Infrastructure serving both the irrigation sector and the river craft is designed to operate at particular water levels – sewage and grey water pump outs, irrigation pumps and fuel lines for example. The low water levels affect the operational effectiveness of the infrastructure as well its efficiency. Irrigation pumps are designed with for a particular lift and they lose efficiency/run out of water as the River height goes down. There is a major effort going in to redesigning infrastructure such as floating boat ramps and the provision of lifts for boats to cope with the lower level of water in the River. For the irrigation sector there are two real issues – one is having a water allocation the other is being able to use it.

Mannum Council operates the historic/preserved paddle steamer Marion PS offers day and overnight trips. It is an historic steam powered vessel. The craft is overdue for vital maintenance which cannot be undertaken because of the access issue that the

River height has caused to local and regional slipways. It is likely that the craft will be removed from service due to Transport Department restrictions.

## Community wellbeing

Drought, low flows and reduced allocations have had a range of impacts on community well-being in the pilot study area. People along the River have made gradual adjustments to the change in water level and water availability but because the drought has gone *on and on and on* the capacity to adjust is reaching its limit. Psychological impacts on communities are evident and community leaders are reported to be exhausted. Vitality and well-being have been adversely affected by drought and this is eroding resilience. There are some evident health effects from the stress and work of coping with the situation.

It was reported that youth are leaving the region, particularly the more water dependent parts, because there is no longer employment. This trend has been evident for some time however; it has accelerated in the last 10 years because of the decline in the farming, leisure and tourism sector.

People are leaving agriculture and tertiary sectors not just because of the current lack of water but because of fear and uncertainty about the future. There are a complex set of reasons as to why people leave these industries. The pressure is not just water it is also commodity prices and input costs. Several informants suggested that the people pulling out of agriculture below Lock 1 are the ones on smaller holdings who were having trouble *making a go of it* even before the water crisis however others felt that even some large established irrigators are not able to cope in this environment.

There are many issues with farm exit. One issue is about identity *who are we if not farmers?* Other issues are more practical. Sometimes it is not so easy to achieve farm exit – this is because there are often complex family ownership issues. So while siblings might be happy for one person to farm the land and make a living this way they will want their share of the capital if the property is sold. This means that the exiting farmer may not really have much capital left to build a future with.

## ***Implications of special measures for drought relief***

Communities along the River have always had three quite distinct identities – the Lower Lakes and Coorong, the Murraylands and the Riverland. The drought and the impact of change flows in the River have been divisive. The different approaches to drought relief and management of the Lower Lakes have left many people below Lock 1 feeling as though they have been forgotten. There is lots of anger in the community and lots of blame.

Within SA the emphasis has been on provision of water for permanent planting. The area below lock 1 has permanent plantings and annual crops. However, the critical water allocations provided to the Riverland growers was not extended to this area. At one stage irrigators below Lock 1 were on 18% and above on the equivalent of 45%. It is argued that annual cropping can have aspects of permanence, such as long term supply contracts. Long term contracts are very important to this sector and

considerable work, such as the establishment of quality assurance systems, goes into winning them. For vegetable growers the failure to supply could void a contract.

Even within the region the pressure that is a consequence of low allocations and drought has intensified the competitiveness between people in already competitive industries.

Drought relief is not readily available to tourism operators or other small businesses affected by drought. To qualify for Centrelink drought support a business must demonstrate 70% dependence on agriculture. According to the Reference Group this has adversely affected a number of businesses who depend to various extents on the River.

### ***Fairness and equity***

Issues of fairness and equity were raised a number of times in interviews and by the Project Reference Group. Questions about fairness and equity were raised in relation to a number of issues.

- Water sharing across the whole Murray-Darling Basin *for the bottom of the system it is the most unfair 'we have to cop all the upstream greediness.*
- Water sharing between different uses within South Australia. *Adelaide gets what it wants, industrial uses get 100% and irrigators get what's left over.*
- The meaning of 'critical human need'. *It is not fair that Adelaide gets water for gardens and parks and below Lock 1 there isn't enough water for farming or wetlands'.*
- The distribution of water savings from past efforts by irrigators to improve efficiency. *Where has the water gone?*

The way decisions were made and who was involved in making them was an issue raised by the Reference Panel and some informants. It was pointed out that with so many players in water – the Department, the Authority, the Board – that it is hard to know where decisions are made and who is making them. To some it seems unfair that there is no real local input into decisions that affect livelihoods. The community feels disempowered because the management of water and the drought has become so politicised.

## Part 4 – Overview and Discussion

### The impact of changes in water availability below Lock 1, SA

The purpose of this study was to examine the impacts of potential changes in water availability. The conditions at the time of the study (drought, low flows and reduced allocations) provided important information on which to base an assessment of future impacts of changes in water availability. The pilot study area below Lock 1 in South Australia is highly dependent on water in and from the River Murray. The River level below Lock 1 is significantly below the normal 'pool' level. At its worst it was 2.1m below normal. Since 2003-04 there have been restrictions on irrigation allocations which have become increasingly stringent in more recent years. At their lowest allocations were 2% and are currently around 60%. The River Murray in SA has been drought declared for a number of years. The combination of low flows, drought and reduced irrigation allocations have significantly impacted on local communities and industries.

#### *Profile summary*

The population of the Murraylands is concentrated in the regional centre of Murray Bridge. The region is growing as a whole (0.5%) but less rapidly than the rest of the State (7.9%) (Econsearch Nov 2008), and less rapidly than the MDB which grew by 5.2% over 10 years from 1996-2006 (ABS 2008). The population of Murray Bridge has increased but Mid-Murray experienced a net loss of population in recent years. Population projections to 2021 are for a slight increase of between -0.12 and 0.32% (Planning SA 2007).

The trend towards urbanisation in the pilot region reflects a broader trend in rural Australia. In the MDB as a whole, remote and very remote population declined by 12.4% and 42.8% over five years from 2001-2006, whilst inner regional populations increased by 8.6% over the same period (ABS 2008). The risk is that smaller centres may reach critical levels such that there is a loss of essential services which exacerbates the population exit. The sustainability of rural communities relies in part on their capacity to retain population and maintain socio-economic functions (Jones and Tonts 1996:136-7).

Compared with the whole State the Murraylands has above average populations of young people (i.e. below 15) and older people (i.e. 65years+). However, it has a significantly below average population of younger people in the age group 15-35 years.

When combined with the ageing of the population the impact of youth out-migration from rural areas represents a significant demographic change in many communities (Gibson and Argent 2008). Out-migration has been going on for some time however according to Argent and Walmsley (2008) the rate has accelerated but is spatially

complex. It contributes to local skills shortages, loss of social capital, reduced economic viability and contributes to the sense of rural decline in some areas (Gibson and Argent 2008). Young women are more likely to move compared with young men and inland areas to have higher rates of out-migration than coastal areas.

The age dependency ratio represents the number of children and older people relative to the working age population. Because the Murraylands has a high number of children and older people its age dependency ratio is quite high. This has implications for the community support structures in the region such as family or volunteer network support, which in turn increases demand on government resources.

The Murraylands has a slightly higher than State average number of couples with no children and lone person households. However, there are less one parent families than the State.

Employment distribution across industries indicates the level of concentration of economic diversity in the Region. High concentration of employment in water dependent economic activities indicates a vulnerability to change in the availability of water. Low sector diversity indicates less adaptive capacity to respond to such changes.

In most industries of employment the pilot study region has a similar profile to the State. The most significant difference is in agriculture, which in 2006 made up 22.1% of employment compared with 4.7% across the State. Interestingly, this is also higher than the MDB which has about 10% of all employment in agriculture (ABS 2008). However, for both the Murraylands and the MDB more broadly, the period between 2001 and 2006 saw significant declines in the number of people employed in agriculture.

There are some significant differences between the Murraylands and the State in the tertiary sector for example, property and business 4.1 compared with 9.1, government 3.7 and 5.2, education 5.2 and 7.4 and health and community services 9.4 and 12.7. This is probably a common profile for a regional centre as compared with a capital or major service centre. Compared with the MDB employment in government, education health and community services is lower in the Murraylands. In aggregate the difference is quite significant i.e. 28.9% compared with 43.5 in the tertiary sector.

The manufacturing sector makes up roughly the same proportion of employment as the state average. Closer analysis of the manufacturing sector could reveal the extent of dependence on agriculture being processing of primary produce or producing inputs for agriculture. While the manufacturing sector in the Murraylands is quite diversified anecdotal evidence suggests that there is a significant link between manufacturing and agriculture.

The importance of tourism to this region has been reported by informants. However, employment in tertiary sectors commonly associated with tourism activity, especially 'accommodation and cafes' and 'cultural and recreational services', is below the State average. In part the figures may reflect the nature of tourism in the region which is reported to be low value self-catered nature and recreation based activity. Some tourism income may actually be reflected in retail (as in supermarket) rather than

restaurant turnover. Estimates by Workforce (2008) place employment in the tourism sector as 7% of total regional employment.

The results indicate that employment in the pilot study region is heavily reliant on agriculture, and hence highly water dependant, both directly and indirectly but that its importance has declined between 2001 and 2006. There is some anecdotal evidence that employment in agriculture has declined further since the last census. Transition industries in the region, such as tourism and manufacturing, are also heavily water dependant. Low levels of employees in the tertiary sector are indicative of a reduced adaptive capacity.

Unemployment is higher in Murray Bridge than the pilot study area as a whole, 7.3% compared with 5.5% (DEEWR 2008). This is a result of long-term structural factors in Murray Bridge. The unemployment rate in Murray Bridge has gone down over the last 10 years as a consequence of explicit policy aimed at improving the diversity of Murray Bridge and creating employment. This indicates that there is increasing resilience in Murray Bridge, but that it may be tied to public investment and government initiated programs.

The region has higher than state average employment as 'managers and administrators' and 'labourers and related workers'. The 'managers and administrators' are believed to be significantly constituted of farm managers. There is also a significantly higher than State average number of people employed as labourers and related workers. This type of occupational distribution can lead to social polarisation. Along with the lower than State average number of people employed as professionals this suggests that the population is not highly skilled and has a narrower range of employment options. It also suggests that certain core services may not be available within the region itself – particularly to support the high age-dependency of the region. As such, the region may be vulnerable to structural change which results in a reduction in agricultural and manufacturing employment.

Household income is an indication of the purchasing and saving power of a community. The household income in the study region is well below the median for the State, \$662 compared with \$887 (Workforce 2009). This suggests a level of economic disadvantage and a relative vulnerability to changes in employment. It suggests that the community would be affected by increases in living costs. Loss of local service provision is likely to add significantly to living costs.

The highest non-school qualification shows the level of education of people in the pilot study area. Relative to the State, the study region has a significantly lower number of degree or higher qualified people. There are above average proportions of people with Certificate Level III and IV qualifications in the Region. This is consistent with the higher than average proportion of tradespersons and people employed in agriculture and manufacturing.

As a composite the statistics on occupation, education and household income correlate with each other. They suggest that the population in the pilot study region is potentially less adaptable to changes in the industrial base of the study region and would have less financial reserve to manage through a period of transition. As such, the study region might be considered to have less potential to adapt than other areas.

The indicators of relative accessibility to goods, services and opportunities for interaction are high. This suggests that the region is well provided with goods and services.

Economic activity in the pilot study area below Lock 1 is highly dependent on the River Murray. Agriculture is the major employer in the region and irrigated agriculture dominates this sector. However, the relative importance of the sector declined between 2001-2006 it none-the-less accounts for 17% of employment. The tourism sector is also significant accounting for 7% or more of employment with much of the activity based around the River. The irrigated agriculture sector has been affected by reduced allocations of water and the tourism sector by low flows in the River.

The economic base of the regional centre Murray Bridge is reasonably diversified and supports a range of manufacturing activities. A significant part of this is activity relates to the processing of primary produce or the manufacture of inputs or equipment for the irrigation sector. This sector is not directly affected by water restrictions because industrial users have remained on 100% allocation. Some manufacturers have however been affected by loss of agricultural production and therefore input for manufacture or demand for outputs.

There has been growth in the tertiary sector. The position of Murray Bridge as a regional centre means that there is significant employment in both government administration and health. Growth in this sector was offset by contraction in the agricultural sector. The Murraylands Region grew by 0.5% compared with the State growth of 7.9% between 2001 and 2006 (Econsearch November 2008).

In recent times there has been in-migration into Murray Bridge with people taking advantage of the relative affordability of housing and proximity to Adelaide. This means that population and demand for community services such as education have increased in spite of the downturn in other sectors. Smaller, less diversified and more water dependent towns have not fared so well. Myponga and to a lesser extent Mannum have experienced economic downturn and population loss during the drought.

Population in the Murraylands has steadily increased in the last few years however parts of the region have experienced population loss. The projected annual growth rate is between -0.12 and 0.32%. The population is aging and there are more men than women living in the region.

The Murraylands is considered to be have relative levels of economic disadvantage. This is evidenced by below average incomes and high levels of income support. Relative to the State average there is an over-representation of people employed as labourers and related workers and below average numbers of people with degree or higher qualifications.

Strength	Weakness
Proximity of the River	The degree of water dependence of the

Proximity to Adelaide Potential to develop different industries because of natural resources, labour etc Quality of life – clear air, caring community House prices Growing diversification in the economic base Murray Bridge being a balanced centre with all tiers of economy active Good services including hospitals and health facilities Developing holiday destination and growth in the number of ‘shacks’ Good mix of agriculture and horticulture	local economy Water level in River and drought Lack of tertiary education facilities Local planning constraints Poor condition of the environment Risk that primary production won’t recover from current conditions
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Source : Project Reference Group

### ***Cumulative change***

Change in any system does not take place in a vacuum. A number of factors were identified in this study as having the potential to contribute to the impacts of change. These include:

- Drought since 2004
- MIS schemes and their demise
- Global Financial Crisis (GFC)
- Changes to environmental funding vis Natural Heritage Trust
- Milk price reductions
- Drought response – exit grant, underwriting critical water allocation, EC declaration
- Long term climate change
- A complex of environmental impacts arising from the low flows
- Other local factors such as local infrastructure etc.
- Commodity prices – specific impacts in study region include downturn in dairy prices and upturn in wine grapes followed by a more recent decline.
- Increase in fuel costs – which impact on transport and other inputs
- Reduced availability of water for extraction
- Water trading
- Aging farmer population – average 55-65
- Issue of farm succession – children are leaving the land and moving on and this means that the older farmers are hanging on.
- Cheap air fares effect on tourism.
- The mining boom – impact on wages and the number of people willing to work on farms.

Declining terms of trade have placed continual pressure on Australian farmers for a number of years (Roberts et al 2009). Intensification, better use of technology, expansion and acquisition of more land have been common means of off-setting the impact. However, this has reduced farm income and capacity to adapt to changing circumstances.

The current drought is seen as only one of a number of significant factors affecting rural communities and farming. Milne et al (2008) identified the other factors to include commodity price fluctuations, the strength of the Australian dollar, changes to water access and use, and a skills and labour shortage.

Actually differentiating these impacts is challenging. At times the Drought Policy Review Expert Social Panel (2008) Inquiry found it hard to separate the impact of dryness from the long-term socio-demographic trends contributing to the decline of some rural populations. They concluded that the existing effects of underlying structural changes are felt more acutely during dry times.

The range of factors impacting on agriculture and rural communities were defined by Stehlik (2003:15) as the ‘social consequences of climate variability, commodity differentiation, globalisation and restructuring’. The effects were unemployment, reduced access to education, increase in rural poverty, reduction in access to health and welfare, population decline, loss of social capital, loss of institutional capital, reduced agricultural workforces, stress in farm families and communities.

King et al (2009) study of South Australian farmers facing climate variation found that drought had a number of impacts including decrease in income, increase in workload, increase in stress and affected their capacity to be involved in off-farm activities. There was evidence that drought either exacerbated or caused health problems. Milne et al (2008) identified a range of factors as likely to influence adaptation which included attitudes and values, skills and knowledge of people, the social and organisation networks in which they were involved and financial and economic supports.

The key risks facing the dairy industry in the Lower Murray Darling Basin include climate change, international commodity prices and the strength of the Australian dollar (Beale et al 2009). However, while there is certainty about what the risks are there is uncertainty about how they will unfold into the future.

### ***Regional response to reduced water***

This section summarises the adaptive responses of the region to the recent periods of reduced water availability. Drought, low flows and reduced allocations have been experienced in the study region for over 4 years. The reportage below is an amalgamation of reported responses to these changes.

#### **What happened to the farm sector when there were low allocations?**

- Some growers introduced practice change and new irrigation technology, reduced water use and maintained production. According to the MDB profile (ABS 2008),

South Australian farmers had the highest rates of adoption of best-practice efficiencies.

- Some growers traded in water when commodity prices were high enough. SA was a net importer of interstate water allocations, importing 336 GL of water in 2008-09, a 25% increase from the previous year (NWC 2009).
- Some growers traded their water out and didn't produce anything. Relative to import of water from interstate, export of water out of the State was minor. There were 743 internal trades of water accounting for 84,204 ML in 2008-09 (NWC 2009). Prices for water licences ranged from \$2170/ML to \$2,384 ML over the 2008-09 year (NWC 2009).
- Some growers – particularly the onion growers with long term contracts – leased land in the Mallee and South East (groundwater area) and continued production.
- Some growers particularly those with permanent plantings especially oranges and almonds – ‘hung on’ – introduced a range of measure to ‘get by’ – pruned trees and let them senesce, pulled out mature trees and took the opportunity to renew their growing stock.
- Over time as allocations got very low some growers particularly those with permanent plantings couldn't maintain their trees which then died. Some traded their water and some used their water to produced annual crops.
- Dairy farming in the lower Murray swamps has been under considerable structural adjustment pressure for a number of years (Anon 2009a). The total number of milk cattle declined by 20.5% between 1993/94 and 2008/08 and the change between 2006/07 and 2007/08 was -9.1% (Anon 2009a). Clearly some dairy farmers ceased production.
- Dairy farmers who relied on irrigated pasture bought in feed.
- Over time as allocations got very low some dairy farmers were reported to have move into formal feedlot production (pers.comm).
- Increase in farm debt and decrease in farm profitability.

### **What happened to the tourism/recreation sector when the River levels got low?**

- Large rivercraft – especially paddlesteamers and commercial houseboats – have been unable to navigate the River or been confined in slipways because of low flows.
- Some large rivercraft have moved out of the Region to upstream above Lock 1 where water levels are higher.
- Daily use and maintenance of rivercraft has been affected by the problems of access to jetty's and effluent off-takes and fuel lines. Investments by local government and owners have helped overcome these operational issues.
- Occupancy rates of commercial houseboats have gone down because the amenity/aesthetic of the River has been affected and the public perception is that ‘things are bad on the River’.
- Private houseboats have not been able to access moorings however temporary moorings further in-stream have been provided by the State Government.
- Shack owners, day trippers from Adelaide and other recreational users including water skiers and others have stayed away from the River.

## Dependencies and flow-on effects

Three separate but inter-related water factors have driven change in the Murraylands over the last number of years. The three factors are drought, low flows and reduced water allocations. The dependence of different sectors on these different aspects is demonstrated in the Table below. The impact of reduced allocations, low flows and drought have different impacts on users of the River. The flow-on effects are difficult to quantify but the transmission through the economy and social system of these changes is also demonstrated.

	<b>Drought</b>	<b>Low flows in the River</b>	<b>Reduced water allocation</b>
	Not enough rain falling from the sky	Not enough water coming down the system	Not enough water in the system to meet all needs
Dependence	Dryland farming Dairy Agriculture The environment	Boating Tourism Local Government Irrigated Agriculture The environment	Irrigated Agriculture The environment
Impacts	Reduced production/ loss of income	Infrastructure impacts – ferries, boat moorings and slipways, irrigation pumps etc Environmental impacts – bank stability, groundwater-surface water interaction, trees etc Navigational issues for water craft Reduced recreational fishing Water sports constrained etc	Reduced production, loss of income, loss of jobs, loss of population from small communities
Flow on	Input – chemicals, seeds etc Output- transport, packing etc	Boat builders, repairers, mechanics etc Motels, hotels, restaurants, other tourist attractions etc Local shops Reduction in funding to local services because \$ spent in repair and maintenance Long term damage to the environment including acid sulphate soils, tree death etc	Inputs – chemicals, seeds, irrigation equipment Outputs, transport, packing etc Manufacturing and processing dependent on this primary produce – milk processes etc

#Low flows in the River below Lock 1 are caused in part by decisions made about the operation of the River. They are a factor of the quantity of water falling in the catchments, the quantity intercepted and stored and the quantity released from storage and extracted. Impacts of different levels of water availability

#### Figure 14 Impacts of drought, low flows and reduced water allocations

Low flows in the River would appear to have a greater number and diversity of impacts than reductions in water allocations.

### ***What might happen in the future?***

Social resilience is the capacity of the community to cope with disturbance and to maintain adaptive behaviour. The resilience of the community may be influenced by the reserves they have in store to adapt to change. In this sense, the frequency and severity of disturbances will influence the resilience. It can be drawn out that the community below lock 1 has experienced a sustained disturbance that has continued over several years. It was asserted in interviews that this is affecting the community capacity to keep going and there is loss of social capital.

Equally, it might be drawn that certain industries will be less resilient to future changes than others because of the nature of impacts or disturbances they have experienced in the past. The dairy industry in the pilot study region stands out in this regard. Not only has the dairy industry in Australia experienced long term structural change but the local industry has had to adapt to new environmental performance requirements which have necessitated capital investment in infrastructure and practice change. The recent drought, low flows and reduced allocations have significantly impacted the local industry and its capacity to bounce back may well be impaired.

Fleming and Vanclay (2009) identified a set limits to adaptive capacity to include conceptual, practical and information barriers. Conceptual barriers mean simply an acceptance that long term change is taking place. Practical barriers relate to the potential solutions i.e. time, money and social infrastructure and so on. The third barrier is information, access, relevance and comprehensibility.

Milne et al (2008) in their study of 'Climate Risk and Industry Adaptation' found evidence to support the idea that people, farmers and small businesses who were flexible and able to diversify were the most adaptable. Diversification can take many forms and include on-farm and off-farm options. Irrigated farmers were considered the least adaptable because of their dependence on water. Transition to viable dryland farming is constrained by property size, since it relies on more extensive holdings than are common with irrigated agriculture.

General statements about the capacity of an industry to adapt to climate change do not reveal the issues that might influence individual behaviour or responses. The complex of factors that influence an individuals' capacity to adapt include a suite of factors including the characteristics of the required practice change, the characteristics of the individual and their business as well as broader structural factors (Cary et al 2002, Web 2004). About one third of farms in the Murray Region (including parts of SA

and Vic) were classified as having low income and low equity (Ashton et al 2009). Farms in this group are likely to be facing financial pressure often because of large farm debt and poor debt servicing ability. These farmers are probably more vulnerable to the change than others who have more financial capacity to adapt production or production methods.

The capacity of farmers to 'get by' in the face of climate variation was influenced by a number of factors which included pre-existing viability of the farm business; capacity to achieve income security through off-farm income, EC grants etc; the way risk was managed and the perception of themselves as farmers (King et al 2009). King et al (2009) conclude that the farmers that 'got by' were influenced by their personal philosophy or stance, the context in which they were making decisions and a range of processes which impact on their mental wellbeing and livelihood.

Water trade is one of the factors that is argued will mitigate the impacts of changes in water availability. Water trading in some cases is having a positive effect on the capacity of farm families to manage in drought ( Frontier Economics et al 2008, Edwards et al 2007). Water trading allows more flexible risk management farm decision making. The Frontier Economics study found :

- Temporary trade had helped the dairy industry fare better in the drought
- Permanent trade meant that those dairy farmers who left farming did so with more money than would otherwise have been the case
- Mixed farms had survived low seasonal allocations by selling water on the temporary market.

With respect to the dairy industry Beale et al (2009) also found that water trading had been a useful strategy for managing in the face of low milk prices and limited water availability.

ABARE research into the effect of the Australian Government plans to spend \$1.5 billion purchasing water entitlements examined the implications for the value of irrigated output, water use and land use by region and Industry (Hone et al 2010). The Buyback was translated to mean the purchase of 6% of surface water entitlements across the Basin which would result in a 2.4% decline in the gross value of irrigated agricultural production (GVIAP). The effect was not expected to be evenly distributed across the Basin and the study concluded that water use reduction in SA would be 4% for a range of factors. The ABARE study of the buyback scheme did find that it would have some impact on entitlement prices resulting in an increase of 18% in the southern Basin (Hone et al 2010). Hone et al (2010) concluded that the buyback would bring forward reductions in irrigated activity that would have occurred anyway as a result of the new sustainable diversion limits. They argue that the buybacks actually will 'smooth the transition'.

How the changes in water availability translate to the community level remains to be revealed. For farmers in the Kerang district of Victoria a key issue is the belief that 'thriving vibrant communities are underpinned by family-owned farms that are, frequently, smaller-scale operations than those owned by corporate farms' (Edwards et al 2008). There is potential for the changes in water availability brought about through either a reduction in the SDL or the impacts of water trade and buy-back will

impact on the structure of communities below lock 1. This is because of the possibility that population changes already in train will be intensified. The regional effects of the buyback will vary depending on the size and extent of dependency on irrigation activity. Larger towns with a broader economic base will be less affected but smaller towns more dependent on irrigation 'could be less resilient to a decline in irrigated agricultural production' (Hone et al 2010: 4). Net water exporting regions have experienced reduced populations and less local spending (Frontier Economics et al 2007).

Several studies have attempted to quantify the likely economic impacts of changes in water availability in the Murray-Darling Basin, in particular as a consequence of climate change and drought.

In 2007 Econsearch modelled the impact of three water scenarios on the Lower Murray regional economy. This analysis showed that a 60% water allocation would result in a loss of between 189 and 132 jobs in irrigated agriculture and between 91 and 83 jobs in tourism. In aggregate this represents between 1 and 1.4% of regional employment. It was estimated that between \$40m and \$46m in Gross Regional Product would be lost from the Murray economy in 2007/08 in response to the 60% allocation scenario. The impact of a 20% allocation scenario was much more significant estimated to result in the loss of between 768 and 587 jobs.

Connor et al (2008) have modelled the impact of reduced water availability on Lower Murray Irrigation. In summary, this study found that the short-run impacts were minimal at 30% reduction in water availability, had some impacts on productivity and profits at 60% but as allocations reach 80% reduction long term damage to profitability is experienced. In the longer term growers have more flexibility to adjust to changes in water availability than they do in the short term. Under a mild climate change scenario Connor et al (2008) predict that effects will be partially offset by investments in more efficient irrigation technology and reductions in water use. Mild climate change scenarios of 21% reduction in average water supply in SA would result in 14% reduction in sector income. A response to severe changes in water availability in SA would be a shift from horticultural and viticultural crops to annual cropping.

A study by Goesch et al in 2009 estimated the direct effect of reduced water availability on irrigators' incomes and land use. Under the median climate scenario and current development and water sharing arrangements it is estimated that surface water availability will fall by 11% and 4% across the Basin by 2030. ABARE estimated that this will lead to a 1% decline in irrigators' income in the SA Murray (Goesch et al 2009). A rebalancing of water sharing arrangements more equally with the environment would result in a 3% reduction in irrigators' incomes.

More recently the Wentworth Group (2010) have modelled the impact of 30% and 40% reductions in allocation on annual net returns. For the Murray (which includes parts of NSW, Vic and SA) there would be an 11.5% and 14.3% reduction in net returns annually.

There is no doubt that changes in the availability of water for extraction and use in irrigated agriculture will result in reduced income for many enterprises. The effect of income changes on farm viability will be influenced by a number of factors including the current level of profitability and capacity to diversify and maintain income levels.

Industries dependent on non-extractive uses of water are affected by the level of water in the river as well as the quality of that water.

The Reference Group were unwilling to predict the impacts of specific reduction in water allocations. They were concerned that doing so could appear to be a concession to change. It is apparent that any long term reduction in available water for extraction will be resisted by sectors of the community below Lock 1. The way decisions are made about change will likely be influential on the acceptability of outcomes and perceptions about their fairness or otherwise.

#### *For agriculture at allocations of between 60-80%*

- Some farmers will not be affected and will continue production even with a reduced allocation because they will become more efficient. However, the scope for improvement in efficiency will impact on this in the longer term.
- Some farmers will become water traders and trade in and out water depending on the season and the market conditions. Inter and intra-regional trade has been critical for agriculture during the recent drought (NWC 2010).
- Some farmers who are in a more vulnerable position because of the drought with more farm debt will be less able to invest in irrigation infrastructure efficiencies and probably struggle to maintain production. About one third of farms in the Murray Region (including parts of SA and Vic) were classified as having low income and low equity (Ashton et al 2009). These farms are likely to be facing financial pressure often because of large farm debt and poor debt servicing ability. Total farm debt of dairy farms has increased over the last drought period (Anon 2009a).
- Permanent plantings of oranges and almonds that have died will probably not be replanted. Commodity prices are not high enough to warrant the 5-8 year wait for trees to reach productive maturity. Some of this land will be converted to annual production particularly of high value annuals when water is available.
- Some dairy farms will be lost from the region and will not come back into production even should water return. This is because there has been structural adjustment in the dairy industry generally and in the Lower Murray Swamps specifically for a number of years. Breeding stock that has been sold off will probably not be bought back.
- The land that is no longer used for dairy in the Lower Murray Swamps will convert either to beef cattle production or be sub-divided for larger rural living blocks.
- Some larger producers have continued production and converted to feedlot based approaches – will probably continue as now.
- The economic pressure will be sufficient to cause some growers to leave the industry but they were probably quite marginal even with full allocations.
- Vegetable growers will return from the Mallee and South East to produce on their properties near the River

- The timing of allocation announcements and decisions about carry over water and trade have the potential to mitigate the impacts of reduced water allocations.

***For tourism and recreation at 0.7 below pool level (or sea level)***

- There is a threshold River height which allows rivercraft to move. The threshold is probably below ‘pool level’ and infrastructure adjustments that have been made to date will be useful in building more operational flexibility for rivercraft. When this threshold is reached operational and navigational issues will be largely eliminated.
- Will the rivercraft that have left – return? Mostly, however it will take some time for confidence to be rebuilt in the management of the River. If it is apparent that there is a commitment to provide environmental flow it will be only a matter of time before rivercraft return.
- Loss of reputation for tourism sector? Probably recoverable. It is probable that with some exceptions the tourism sector will recover.
- Local recreation and tourist day trippers will probably return. Arguably with improved environmental quality arising from increased environmental flow riparian vegetation will recover and fish numbers recover therefore the appeal of the region could increase.

***For towns and communities***

- Murray Bridge has changed through the drought but survived and to some extent flourished. Its dependence of agriculture has lessened and its diversity both economically and demographically increased.
- The city is vulnerable to the extent that the population is relatively low skilled and relatively low paid. With a shift away from agriculture which flows into the manufacturing sector there is a risk that unemployment might increase. The capacity of the population to transition into other occupations may be constrained by levels of education, employment and occupational diversity. This is also limited by the high dependence on water for transition industries, such as tourism.
- Murray Bridge has affordable housing and is in commuting distance to Adelaide; these factors may counteract the vulnerability arising from skill levels.
- The character of Murray Bridge may continue to change as agricultural land is retired and transitioned to rural living and other activities. This may provide new opportunities for the retained agricultural lands, including off-farm income, increased land values and opportunities for boutique style agricultural markets.
- Murray Bridge has many attractions as a manufacturing centre including access to water for industrial uses, cheap land, cheap labour and is centred on a transport hub/cross roads.
- Murray Bridge is already a regional centre with good services in particular health and other support services. It may attract population leaving the smaller centres within the region as well as others seeking life style and affordable housing.
- Small highly agriculture dependent communities may continue to decline in the future. This decline is a consequence of long-term structural change in rural Australia intensified by the period of recent drought and low flows. The loss of population from the remoter communities may reach a critical threshold below which services are no longer viably provided and social infrastructure breaks down.

## ***Conclusion***

Hassall et al (2003) identified the factors which made industries more vulnerable to further decreases in their access to water as those industries that are affected by reliability or quantity of water; expense or difficulty of change to alternatives; and debt levels, in some cases related to recent restructuring and to drought.

The purpose of this study was to examine the social and economic impact of changes in water availability below Lock 1. The importance of the level of the River, in addition to the quantity of water available for extraction, to the region was only revealed during the study.

The economy of the regional centre is reasonably diversified. The largest sector of employment is agriculture and there is a significant manufacturing and tertiary sector. However, the manufacturing sector is dependent in part on the processing of primary produce and the availability of water and is therefore potentially vulnerable to changes in water availability. To date industrial users of water have not had restrictions placed on their allocations. It is clear that both the irrigation sector and the tourism sector are important economic activities in the pilot study region and that a downturn in both these sectors would flow through the local economy.

Understanding the impact of changes in water availability has also been supported by a growing literature on the effects of climate change, water trading and the Commonwealth buy back. There have been several studies that have quantified the economic impacts of changes in water availability

This study has been important in documenting the impacts of drought, low flows and water restrictions on a section of the River whose population feel they have been forgotten by policy makers.

The study has been unique in providing such a detailed and fine grained account of water dependency within a region and its vulnerability to future changes. Generally, social impact studies undertaken for water allocation planning focus on users of water who are dependent on extraction of water. There is often little emphasis on understanding the positive benefits to other sectors of leaving water in stream. In this case because the loss of flow allied with drought has meant that all water dependent sectors have been affected the benefits of leaving water in stream can be articulated. While there is reason for concern about the impacts on irrigated agriculture, the broader impacts on the tourism industry and the regional economy through loss of economic activity and increases in costs needs to be recognized. The loss of water in this case draws into focus some of the ecosystem services that are provided by water in-stream including simply holding the banks of the River up!

The study has also drawn out that there are likely to be intra-regional effects reflecting the level of dependence on water and the degree of diversification of the particular community. This means that the trend towards contraction of small highly agriculture dependent communities is likely to be intensified by changes brought about by drought, low flows and restricted water allocation. There is a real risk that some parts

of the study area will experience a slow probably painful decline. This points to the need for targeted policy responses to manage change and mitigate it. The opportunity for a planned response to intense contraction of economic activity in small highly water dependent parts of the Region could alleviate social hardship and improve environmental outcomes in the longer term. For example, geographically specific water buy-back targeting areas of high social disadvantage that have experienced loss of community infrastructure, with perhaps lower agricultural suitability and values that environmental restoration could recover.

In the context of water planning however the social impact study undertaken for this project has only limited relevance. A better understanding of the social and economic impacts of change will improve the quality of decision making. However, in the absence of other tools to mitigate impacts the risk is that concern about the social and economic impacts of change will be a factor in delaying action to improve provision for the environment. A water allocation plan is constrained by legislation and can only make rules about water sharing, access use and trade.

Overall, the method employed in the study proved to be robust at teasing out the range of non-extractive and extractive dependencies on water in the pilot study area. It has facilitated the documentation of the range of impacts of change and the suite of factors which influence the outcomes of change. It has not been possible to differentiate and quantify the specific impacts of change on particular sectors.

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## Appendix 1 - Informants

Name	Position	Organisation
Bjunlund, Henning		University SA
Cann, Julie		DWLBC
Davies, Gerry		
Detloft, Peter	Vegetable Grower, WAP member	Swan Reach
Edwards, Jane	Centre for Life and Work	University of SA
Franssen, Ingrid		DWLBC
Gollan, Dean		Mid-Murray Council
Goode, Judy		SAMDBNRM/DWLBC
Harvey, Paul	Consultant	
Hill, Heather		SAMDBNRM Board/ DWLBC
Hind, Steve		Mypolonga Traders
Hollis, Brad		SAMDBNRM
Jones, Glen		Boating Industry, Marina and Houseboat Associations
King, Deb		Flinders University
Lamott, Helen	Drought Team	PIRSA
Lewis, Bianca		SAMDBNRM
Mansen, Andrew		PIRSA
McMahon, Gavin		CIT
Mensforth, Lisa	Jurisdictional risk coordinator	DWLBC
Meyer, Wayne	Professor	Flinders University
Najar, Ray	General Manager	MDA
Owen, Peter		Wilderness Society
Poppleton, Laurie	Water Planning Coordinator	DWLBC
Ratcliffe, John		CSIRO
Repper, Jennifer	Positive Communities Consultant	Murray Mallee General Practice Network
Robinson, Guy	Centre for Rural Health and Community Development	University of SA

Rothe, Katheryn	LAP Project Manager	
Shanks, Paul	Community member	
Simes, Frances		DWLBC
Smart, Graham	Dairy farmer	Swamps
Sobels, Jonathan		Flinders University
Stokes, Ken	WAP Chairman	Independent
Stribley, Lisa		
Sumner, Gladys	Indigenous facilitator	SAMDBNRM Board
Tanner, Fred		DWLBC
Wachtel, Sharon		Department of Environment and Heritage (SA)
Webb, Daryl		Murraylands Development Board
Welsh, Cameron		
Whetstone, Tim	Irrigator	Renmark
White, Monique	Agricultural Consultant	
Young, Doug	Economist	PIRSA
Young, Mike		University of Adelaide