Building resilience to a changing climate

A climate change adaptation plan for the South Australian Murray-Darling Basin

A Community Summary

The South Australian Murray-Darling Basin region will be impacted by climate change through a warmer and most likely, drier climate with increased risk of bushfires, reduced flows down the River Murray, and rising sea levels along the Coorong with higher temperatures and lower pH of marine waters.

Further information on how the region can adapt and the sources of information on which the Plan and this summary are based can be found at:
http://www.naturalresources.sa.gov.au/samurraydarlingbasin/projects/all-projects-map/adapting-to-climate-change

How was the Plan developed?

The project was undertaken in three main stages: (1) values mapping and key decision timeline analysis to identify priority indicators for a vulnerability assessment; (2) an integrated vulnerability assessment which was used to identify key areas of decision making; and (3) identification and prioritisation of adaptation actions within and between sectors.

Step 1

Values and key decisions

- Stakeholder interviews (October 2013)
- Workshop - Murray Bridge (31 October 2013)
- Workshop - Loxton (1 November 2013)

Step 2

Integrated Vulnerability Assessment

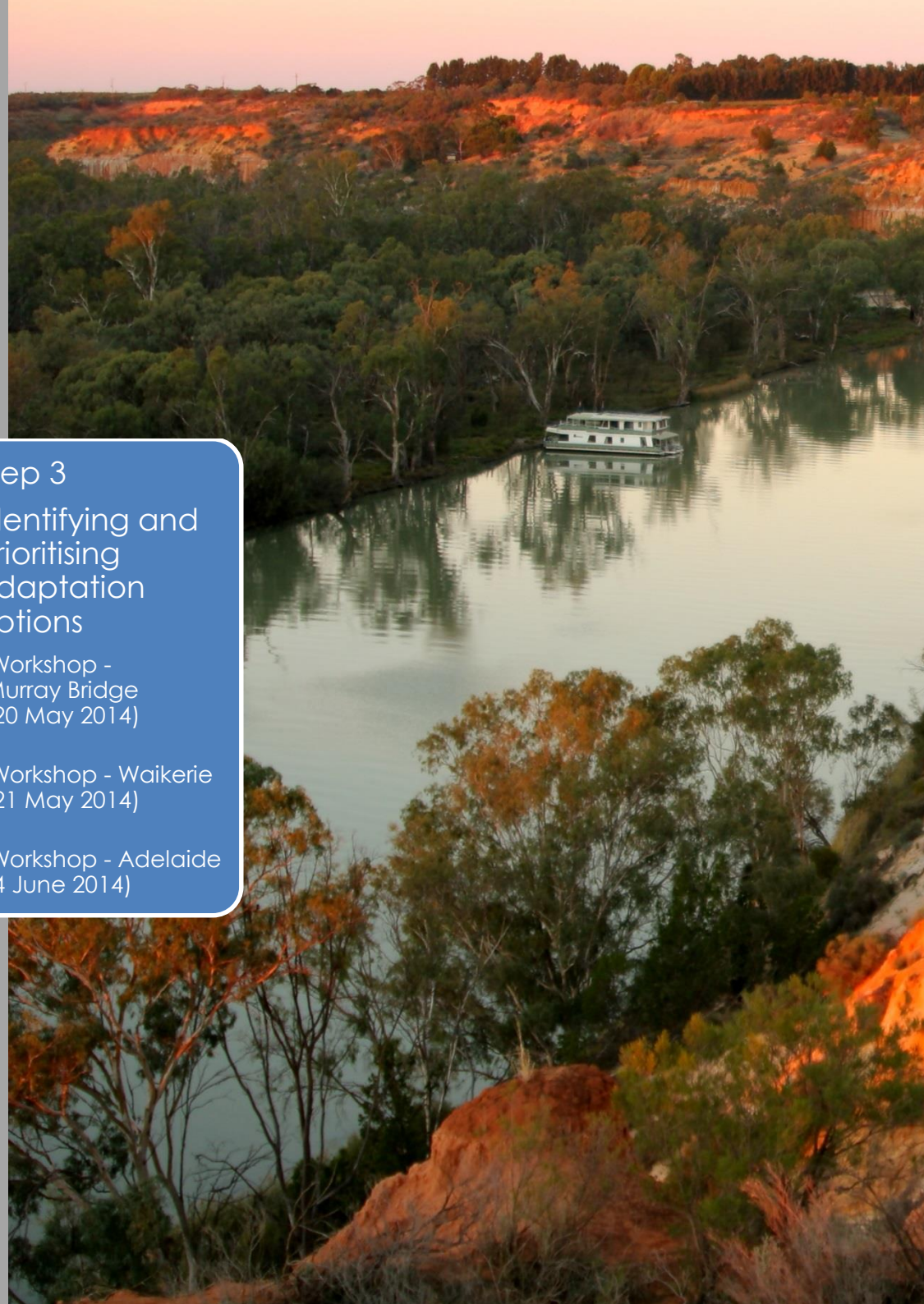
- Workshop - Murray Bridge (27 February 2014)
- Workshop - Loxton (28 February 2014)

Step 3

Identifying and prioritising adaptation options

- Workshop - Murray Bridge (20 May 2014)
- Workshop - Waikerie (21 May 2014)
- Workshop - Adelaide (4 June 2014)

The region has a strong history of working to better understand potential climate change impacts and so the Plan has drawn strongly on past studies and reports. Development of the Plan has also been informed by the experience and local knowledge of stakeholders from across all major sectors, with over 150 people participating in interviews, workshops and information and feedback sessions.



Why develop a Climate Change Adaptation Plan?

The South Australian Murray-Darling Basin's community, economy and environment are well adapted to a variable climate. They have shown great resilience and an ability to withstand severe droughts. But climate change will result in a long-term shift in the region's climate. The region can expect conditions to be warmer and drier, the risk of bushfires greater and sea levels higher.

Recognising the challenge that future climate change presents, the South Australian Murray-Darling Basin Natural Resources Management Board, Regional Development Australia (Murraylands and Riverland), the Murray & Mallee Zone Emergency Management Committee, Murray Mallee Local Government Association and the Department of Environment, Water and Natural Resources agreed to work together to develop a climate change adaptation plan.

The aim of the Plan is to show how the region can build resilience to the impacts of climate change and make sure the region is adaptive and sustainable and continues to be a place where people want to live, visit, invest- and conduct business. The plan also addresses the requirements of the Climate Change Adaptation Framework for South Australia to develop a regional adaptation plan.

The Regional Climate Change Adaptation Plan needs to be periodically reviewed, in the spirit of adaptive management, every 2-3 years to consider new information on climate change projections and impacts and to account for changes in adaptive capacity.

How will climate change affect the region?

Climate change is a consequence of the release of greenhouse gases like carbon dioxide, methane and nitrous oxide into the Earth's atmosphere. Greenhouse gases trap the sun's energy in the Earth's atmosphere leading to changes in the global climate. Changes in the Australian climate have already been observed over the past 100 years; the nation's annual average surface air temperature has increased by about 0.2°C per decade since 1950, while rainfall has shown a variable but gradual decline.

Climate change projections for six towns in the region are presented in Figures 1-4. General trends for the region include[1]:

- *Temperatures in the region will rise* – Temperatures will rise by up to 1.0°C by 2030 and up to 2.5°C by 2070.
- *Heatwave frequency will increase* - Three consecutive days exceeding 40°C occurred 2-3 times every 10 years under baseline conditions for Lameroo and Loxton, but is projected to occur 7 years in 10 by 2050 (low emissions scenario) and at least once per year by 2070 (high emissions scenario).

What is the evidence that the Earth's climate is changing? (IPCC 2013)

In 2013, the Intergovernmental Panel on Climate Change (IPCC), the world's leading international body for the assessment of climate change, said that:

- warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia;
- each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850 when detailed temperature records began;
- continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system; and
- limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.

[1] *Unless stated otherwise, projections are based on a medium emissions scenario and baseline conditions refer to the period 1980-1999.*

- *Frost and freezing conditions to decline* - For example, at Murray Bridge, the incidence of frost is projected to decline from nearly 4 days per year historically to less than 1.5 days per year by 2070.

- *Rainfall likely to decline* - By 2070, the majority of climate models suggest a reduction in annual average rainfall. In winter and spring the most common estimate is for a 15% drying under a medium emissions scenario.

- *River Murray flows to decline* – There are various estimates of how much River Murray flow will decline because of climate change. Some estimates suggest a reduction within 50 years of 15% of average annual flow, whereas the worst case estimate is for a 50% reduction.

- *Fire risk will increase* - There will be an increase in the frequency and intensity of fire risk in many, but not all, parts of the region.

- *Sea levels will rise* - Sea levels rose across the globe by 21 cm from 1880 to 2009. Global mean sea level rise to 2046-2065 relative to 1986–2005 could be 26 cm.

- *The world's oceans will continue to warm and pH will decline further* - By 2046–2065 the ocean's temperatures could rise by about 1.4°C (under a medium emissions outlook) relative to 1986–2005 and the best estimate is for pH to decrease by a further 0.2 pH units, which compares with a 0.1 pH decline since the beginning of the industrial era.

Regional Projections

The summary above and graphs following are a snapshot of what the S.A. Murray-Darling Basin region can expect to see from future climate change impacts, and what we will need to manage for. Refer to the full report and the SKM climate change scenarios report (available on the Natural Resources S.A. Murray-Darling Basin website) for a more detailed explanation of temperature, rainfall, reduction in flows, bushfire and sea level rise.

Figure 1. Average annual rainfall under baseline (1980-1999) and future conditions at six locations in the South Australian Murray-Darling Basin. Low = low emissions scenario; High = high emissions scenario. Based on data from *SKM (2013).

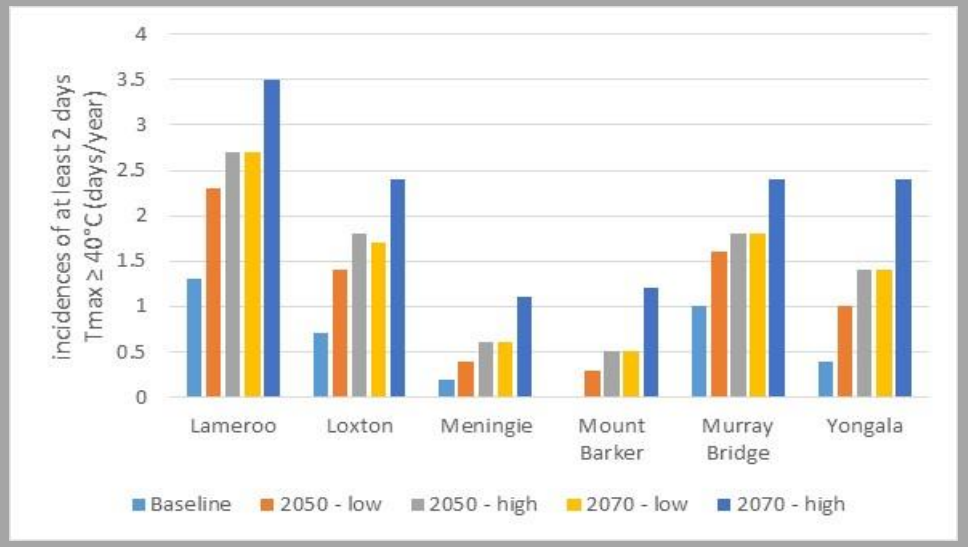


Figure 2. Average annual maximum temperature under baseline (1980-1999) and future conditions at six locations in the South Australian Murray-Darling Basin. Low = low emissions scenario; High = high emissions scenario*.

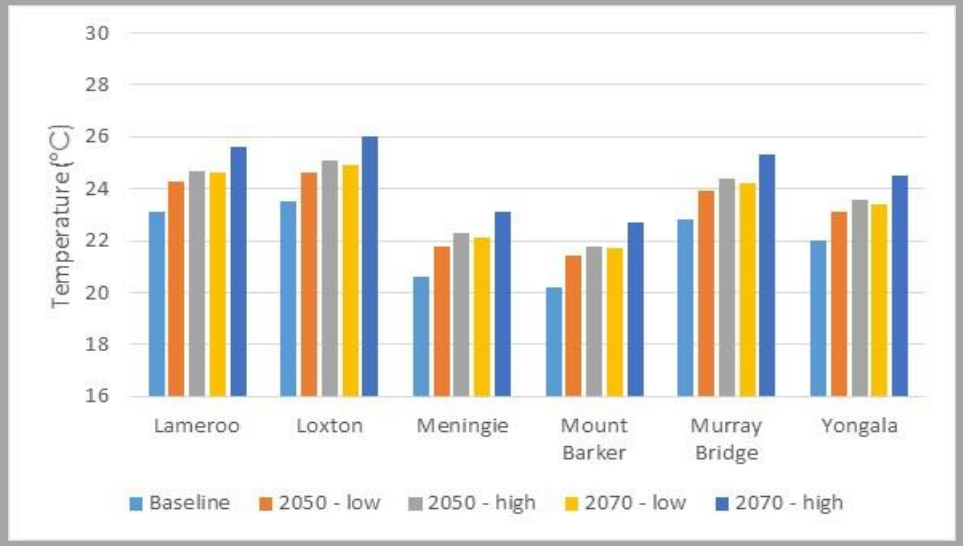


Figure 3. Incidences of at least 2 days with maximum temperatures greater than or equal to 40°C under baseline (1980-1999) and future conditions at six locations in the South Australian Murray-Darling Basin. Low = low emissions scenario; High = high emissions scenario*.

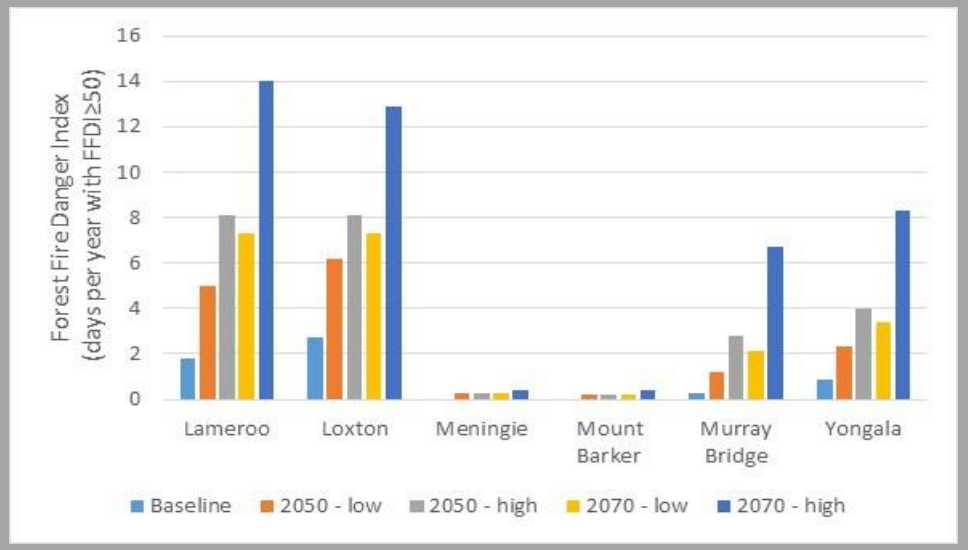


Figure 4. Incidences of at least 2 days with maximum temperatures greater than or equal to 40°C under baseline (1980-1999) and future conditions at six locations in the South Australian Murray-Darling Basin. Low = low emissions scenario; High = high emissions scenario*.

*SKM (2013). Climate change adaptation to vulnerability project. South Australian Murray-Darling Basin NRM region. Climate change scenarios report. Project VW07280.

Priorities for adaptation

Based on the results of the integrated vulnerability assessment, it was agreed that the adaptation plan needed to focus on the following themes:

- native vegetation;
- pest plants and animals;
- Coorong and Lower Lakes;
- vulnerable members of the community;
- emergency services;
- essential services;
- irrigation; and
- dryland farming.

The identification of the themes in this list does not mean that other assets, services or characteristics of the region are not vulnerable to climate change, but that they were assessed to be less vulnerable than those listed.

The Plan presents priority adaptation actions in relation to key areas of decision making based on these themes (Table 1). Most relate specifically to individual sectors in the region and will need those sectors to further prioritise and implement actions. While some actions may form part of current practice or be existing ideas, adaptation needs them to be acted on, or, accelerated.

As a regional scale plan, actions that are a priority across a number of sectors were also identified (Table 2). As for sector specific actions, the first five actions are arguably about continuing with current practice, albeit at an accelerated rate. This suggests that the region has already built significant capacity to respond to a variable climate, influenced by experience with past droughts such as the Millennium Drought. In contrast, the future operation and location of the Barrages is one of the most transformational adaptation actions identified in the Plan.

On-ground action is not needed straight away for the Barrages because sea levels are expected to rise slowly over the coming century. However, sea level rise impacts should be considered in the design of any future Barrages upgrades. The immediate priority is to start engagement to increase community awareness and to promote informed debate about the future operation and location of the Barrages.

Table 1. Summary of priority actions for key areas of decision making and lead stakeholders.

Key area of decision making	Immediate priority for adaptation
How do we maintain functional vegetation communities that provide habitat for regional birds and mammals (many of which exist outside of DEWNR reserves) in the face of warmer and drier conditions and more frequent and intense bushfires?	Support and promote landholders managing high value native vegetation on private properties. Lead responsibility: Natural Resources South Australian Murray-Darling Basin.
How do we improve our adaptive management to minimise the impact of pest plants and animals on agriculture and biodiversity from rangelands areas in the north of the region in response to warmer and drier conditions?	Immediate priority is to rapidly identify and assess the risk of emerging pest species. Lead responsibility: Natural Resources South Australian Murray-Darling Basin; Biosecurity SA.
How do we protect key habitats and species in the Coorong and Lower Lakes region as river flows continue to decline, salinity levels in the estuary rise in response to increasing sea levels pushing more sea water into the region, and the risk of pest plant and animal incursions increases?	Start social engagement to increase community awareness and to promote informed debate about the future adequacy, operation and location of the Barrages. Lead responsibility: Natural Resources South Australian Murray-Darling Basin; Murray-Darling Basin Authority; SA Water.
How do we help vulnerable members of the community maintain health and well-being which may otherwise be affected by increasing frequency and intensity of extreme events such as bushfires and heatwaves?	Help vulnerable members of the community be better prepared for extreme events by building social capital (connectivity and resilience) and encouraging the construction of more climate resilient buildings. Lead responsibility: Regional Councils; NGO service providers; SA Health; State Emergency Service.
How can we manage and reduce where possible the growing demand for emergency services as extreme events such as bushfires become more frequent and intense and rates of volunteering decline?	Facilitate increased rates of volunteerism. Lead responsibility: Zone Emergency Management Committee and emergency services providers
How can we establish and maintain telecommunications, electricity and water management infrastructure, which together support the regional economy, in the face of climate extremes such as increasing frequency of bushfires, which may physically damage infrastructure, and generally increasing temperatures which are likely to increase demand for services?	Develop adaptive infrastructure for local solutions to backup power for water, sewer and telecommunications infrastructure, as well as domestic storage to support distributed power systems like solar photovoltaic (PV). Lead responsibility: Essential service providers
How can we build on existing work in the irrigation sector to ensure that levels and quality of production can improve in the face of warmer and drier conditions and potentially reduced river flows and water allocations?	Support further evolution of water market products and greater adoption of water-use efficient technologies. Lead responsibility: Irrigators; irrigation trusts; water market operators.
How will farmers maintain the productivity of existing cropping-based farming systems under warmer and, most likely, drier conditions in the future?	No till or reduced till practice, crop breeding and soil improvement are high priority adaptation actions that form part of current practice and where applicable and cost effective should continue to be encouraged. Lead responsibility: Farmers; industry associations and research and development organisations; Bureau of Meteorology.

DEWNR = Department of Environment, Water and Natural Resources.

Table 2. Summary of cross sectoral adaptation actions.

Action	Lead responsibility
Improve the identification, prioritisation and management of pest plants and animals	Natural Resources SA MDB; Biosecurity SA
Facilitate increased participation in community activities to build connectivity and resilience	Regional Councils
Improve water use efficiency	Private irrigators with the support of irrigation trusts where relevant
Improve seasonal weather forecasting	Bureau of Meteorology
Establish and implement bushfire management, response and recovery plans	Natural Resources SA MDB; Zone Emergency Management Committee and emergency services providers
Further research into climate change impacts on River Murray flows	Department of Environment, Water and Natural Resources with support from water research organisations
Reassess the future operation and location of the Barrages	Natural Resources SA MDB; Murray-Darling Basin Authority; SA Water

Further information

Further information on how the region can adapt and the sources of information on which the Regional Climate Change Adaptation Plan and this summary are based can be found at:

http://www.naturalresources.sa.gov.au/samurraydarlingbasin/projects/all-projects-map/adapting-to-climate-change

How do I get involved?

Do you want to get more involved in working in the community to respond to climate change? If so, contact Natural Resources S.A. Murray-Darling Basin, Murray Bridge Office on (08) 8532 9100.