DEVELOPING A NEW CLIMATE CHANGE STRATEGY FOR SOUTH AUSTRALIA

Adapt consultation paper

SOUTH AUSTRALIA

Government of South Australia

INTRODUCTION

Adapting to climate change requires governments, communities, businesses and individuals to change the way we live so that we can prepare for the impacts of climate change that are already occurring and are locked in for coming decades. As we make considered changes, we also can seek to take advantage of opportunities to build resilience.

In 2012, the State Government released its climate change Adaptation Framework, *Prospering in a Changing Climate: A Climate Change Adaptation Framework for South Australia*, and five out of 12 regional and metropolitan adaptation plans have since been completed. South Australia's Strategic Plan includes a target to: *Develop regional climate change adaptation plans in all State Government regions by 2016* (SASP Target 62).

This paper provides an overview of:

- The impact of climate change in South Australia
- Implementation of Prospering in a Changing Climate, the climate change adaptation framework for South Australia
- Proposed future priorities for assisting South Australians to adapt to the impacts of climate change.

Community input is welcomed on any issues raised within this paper, in particular in relation to:

- Where the State Government should focus its efforts to support adaptation
- Whether legislative changes should be considered
- How South Australians can identify and take advantage of opportunities presented by climate change
- Opportunities that exist to increase adaptation partnerships to attract further private sector investment in adaptation.

CLIMATE CHANGE IMPACTS FOR SOUTH AUSTRALIA

Unabated greenhouse gas emissions will continue to influence our climate system in various ways in the future, depending on the level of global action to curb greenhouse gas emissions. Impacts in South Australia are likely to include changing agricultural production, impacts on public health, community wellbeing, natural landscapes and wildlife habitats, and damage to both coastal property and public and private infrastructure. In addition, domestic and international transport and trade are likely to be affected by changing weather patterns and increasing instances of extreme events.

South Australia has always had a variable climate; however we are now experiencing increased temperatures, sea level rise, changes to rainfall patterns, and increased occurrences of extreme events such as heatwaves.

Average temperatures across the State have warmed almost 1 degree Celsius over the past century[1]. Rainfall records since 1900 show that rainfall across South Australian regions varies seasonally, annually and over decades.

Since the 1990s a decline in rainfall, particularly within the agricultural districts[2] of the State between April and October, has been experienced, although trends are less clear than for temperature and sea level rise because of natural rainfall variability[3]. Sea level rise of between 4.7mm and 4.9mm per year has been recorded in South Australia since 1992[4].

The Goyder Institute for Water Research has developed regional climate change projections to 2100 for six variables (including rainfall, minimum and maximum temperature and evapotranspiration) for each individual rainfall station across the State's Natural Resources Management (NRM) regions. These complement the national scale projections produced by the CSIRO and the Bureau of Meteorology. Both sets of projections are available online.

Appendix 1 to this paper includes:

- The latest rainfall, temperature and sea level rise projections
- The projected impact of climate change for different industry sectors in South Australia.

1 *Bureau of Meteorology, 2015*

2 *The agricultural districts within South Australia are the regions south of Goyder's Line. These include the Eyre Peninsula, Yorke Peninsula, Mid-north, Murray lands (part), Mount Lofty Ranges, Kangaroo Island and the South-east.*

3 *Bureau of Meteorology and CSIRO, 2014*

4 *Bureau of Meteorology, 2015*

THE SOUTH AUSTRALIAN GOVERNMENT'S RESPONSE

The *Climate Change and Greenhouse Emissions Reduction Act 2007* provides the overarching governance for climate change action in South Australia. It sets a long-term aspirational emissions reduction target, promotes research and development, and supports measures to consult on and facilitate adaptation actions. The Act also establishes the Premier's Climate Change Council (PCCC) to provide independent advice to the Minister for Climate Change about matters associated with reducing greenhouse gas emissions and adapting to climate change.

The subsequent Adaptation Framework, released in August 2012, sets out four overarching adaptation objectives and, recognising that adapting to climate change is a shared responsibility, articulates roles and responsibilities of all parties. The Framework establishes processes for building partnerships, incorporating adaptation in all decision-making and actively participating in national and international activities. It also supports the delivery of relevant, high-quality science to inform an adaptive management approach to building resilience and adaptive capacity.

The Framework aims to:

- increase the resilience of terrestrial, aquatic and marine ecosystems and primary production systems
- link adaptation, biodiversity conservation and sustainable landscape use
- build resilience and adaptive capacity by empowering communities and businesses with relevant information and decision-making tools and by helping the most vulnerable.

It also outlines key State Government-led implementation activities to prepare South Australia for the impacts of climate change, including:

- Partnering with regional leaders in each of the State's 12 regions (Figure 1) to undertake integrated vulnerability assessments (IVAs) and develop regional adaptation plans
- Engaging with industry and communities and encouraging the interaction between these sectors and regional and government adaptation planning processes
- Implementing a coordinated approach to climate change adaptation planning across government, including consideration of regional issues and findings, informed by government's internal data and analysis
- Engaging with key State and national scientific institutions to progress climate change adaptation science and the research agenda with particular reference to South Australia's needs
- Developing and implementing a communications strategy to promote the Framework and engage and support industry, community and business to determine the most effective and efficient was to prepare for the impacts of climate change
- Ongoing monitoring and evaluation.

The Government Action Plan accompanying the Framework provides further detail on how government supports the adaptation process and plans for climate impacts on its own operations.

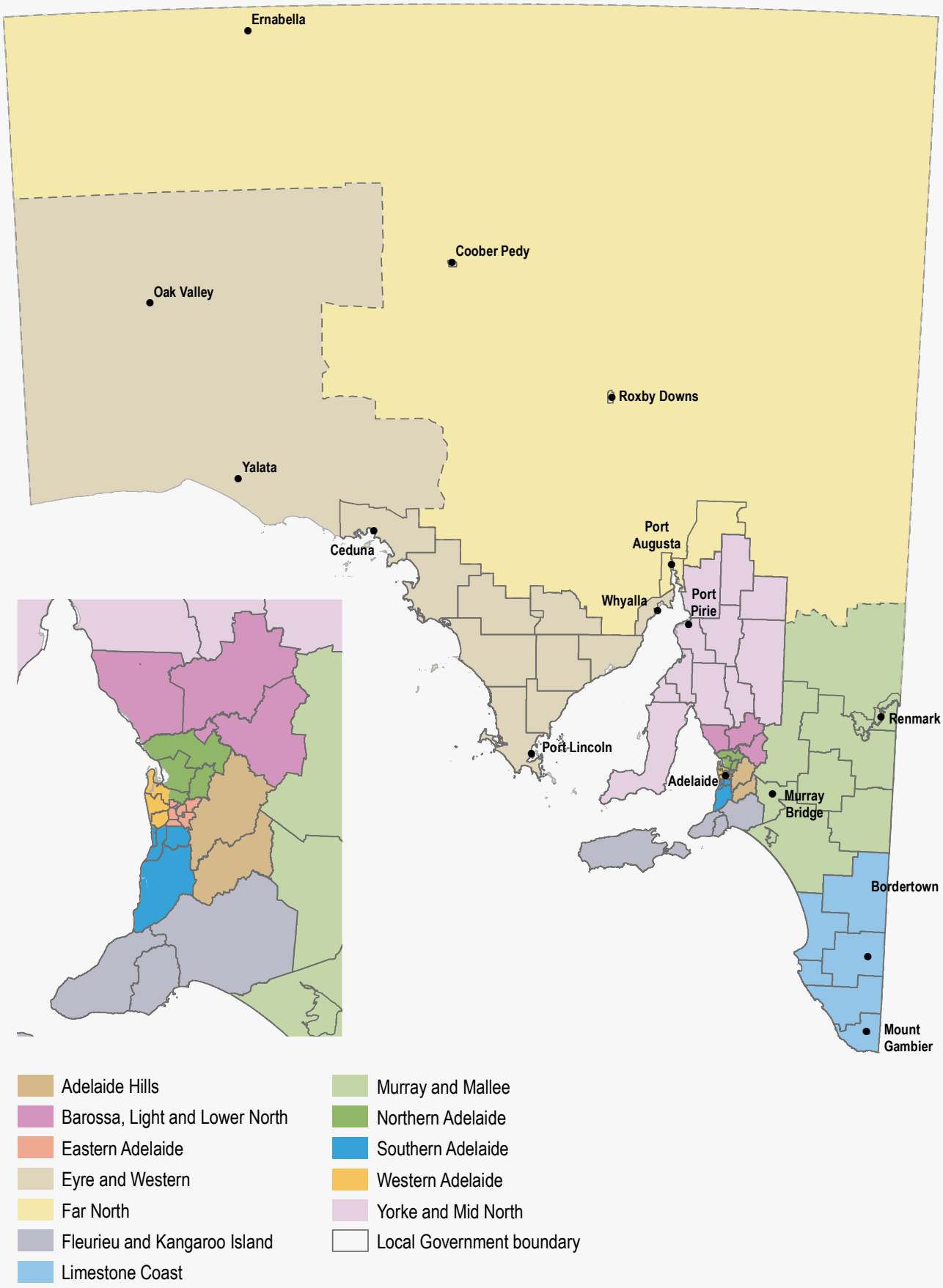

Figure 1 - South Australian State Government Regions

Within each region, the relevant local government authorities, NRM board and Regional Development Australia (RDA) Committee are responsible for collaborating to develop a regional adaptation plan, in partnership with State Government (see Figure 2). Regional adaptation planning processes have been underpinned by sector agreements established under the *Climate Change and Greenhouse Emissions Reduction Act 2007*.

All parties contribute funding and resources to the regional adaptation projects, which are guided by *Climate Adaptation Planning Guidelines* developed by the Local Government Association of South Australia (LGA) in partnership with the Department of Environment, Water and Natural Resources (DEWNR). Planning processes begin by allowing stakeholders to identify what is currently valued in the region then use regional integrated vulnerability assessments (IVAs) to identify key vulnerabilities and priorities across all sectors in the region. The results of the IVA, along with a range of planning tools provided in the guidelines are then used to develop a plan for future adaptation at a regional scale.

These processes are designed to take into account the knowledge of local communities and the differing circumstance and impacts within each region. Implementation of the Framework will empower all South Australians to be prepared for the impacts of climate change, allowing for policy responses that are efficient and effective and have a high degree of community acceptance.

Figure 2 - Regional adaptation planning model

WHAT HAS BEEN ACHIEVED?

Since releasing the Adaptation Framework, the State Government has undertaken a number of initiatives to support its implementation and facilitate adaptation planning and action across the State. These include:

- Working with RDA committees and NRM boards, the LGA, local councils and other key stakeholders to develop regional adaptation plans in the State's 12 regions. These parties have contributed funding and resources, as have the State and Australian Governments (through the Natural Disaster Resilience Program).

- Providing national and international leadership and advocacy on climate change adaptation. Examples include the Premier's role as a Co-chair of The Climate Group's States and Regions Alliance and the associated international Adaptation Peer Forum, and South Australia's support for the establishment of the national Adaptation Working Group under the Council of Australian Governments' Meeting of Environment Ministers.

- Partnering with or supporting the National Climate Change Adaptation Research Facility (NCCARF) on a number of projects to deliver strategic research and tools to support climate change adaptation action in South Australia.

- Hosting the South Australian Climate Change Adaptation Showcase in 2013 and 2014, attracting approximately 160 and 200 delegates respectively. The LGA was a sponsor in 2013 and co-host in 2014. In 2016, the next national NCCARF and CSIRO Adaptation Conference will be held in Adelaide, with the State Government as a platinum sponsor.

- Partnering with the LGA to provide advice to Councils, NRM boards and RDA committees on adaptation, including developing the *Climate Adaptation Planning Guidelines* and supporting *Science to Solutions*, a significant project looking at overcoming barriers to adaptation within these organisations.

- Collaborating with the Coast Protection Board and the LGA to investigate the management of sea level rise risks faced in coastal areas.

- Negotiating and administering Sector Agreements under the *Climate Change and Greenhouse Emissions Reduction Act 2007*, including with the LGA and regional groups.

DEWNR assists other agencies to support government's own adaptation planning, including by providing forums for networking and discussion. Individual agencies also continue to work with their partners and stakeholders to prepare for risks and opportunities associated with climate change. Examples can be seen in transport, coastal management, emergency management, public health planning, primary industries, and natural resources management.

Phase one of the *Science to Solutions* project (a partnership project between DEWNR and the LGA) has identified a number of barriers within organisations that have the potential to impact the implementation of adaptation actions. The Phase 2 work program recently commenced. Activities include:

- Further collaboration with regional project partners to support implementation of regional adaptation plans

- A review of finalised adaptation plans to understand and analyse priorities for South Australia

- Development of practical, specific and targeted guidance and training to enhance inclusion of climate risk considerations into key operational and strategic planning documents within councils, NRM boards and RDA committees.

REGIONAL PRIORITIES

All of the 12 State Government regions are on track to deliver their adaptation plans by 2016, with five already completed (Yorke and Mid North, Eyre Peninsula, Southern Adelaide, Murray Darling Basin and Barossa). A number of broad themes have emerged from these five, though it must be noted that four are from rural areas.

The key issues highlighted in more than one region include: biodiversity management; water resources management; industry adaptation; vulnerable citizens; community services; and planning, development and infrastructure, including green infrastructure. These themes reflect a number of the key sectoral impacts identified in the Framework, and are elaborated on below. Plans have also highlighted two key enablers of implementation: State level coordination and leadership; and social capital and capacity building.

BIODIVERSITY MANAGEMENT

Biodiversity management is highlighted in all five regional plans. Regions have identified many adaptation options to protect local ecosystems, including using resilience-based models in natural resources management planning, establishing refuge areas, risk-based pest management, and social engagement to build community acceptance of adaptation actions in this area.

WATER RESOURCES MANAGEMENT

All regions also identify the management of water resources as a priority issue. Preferred adaptation options are a mix of current practices and more transformational actions. These include: harvesting rainwater, groundwater and stormwater; waste water recycling; water trading; water-sensitive urban design; increased use of water-efficient technologies; and investments in new infrastructure.

INDUSTRY

The themes of industry adaptation and economic resilience are evident in all plans, with focus areas varying region by region. These include manufacturing and business, and viticulture (Southern Adelaide); agriculture and fisheries (Eyre Peninsula); industry and workforce development (Yorke and Mid North); irrigated horticulture and dryland farming (Murray-Darling Basin); as well as viticulture and manufacturing (Barossa).

Preferred options for primary industries adaptation include improving irrigation efficiency, developing bushfire management plans, planting more resilient crop varieties, soil modification, improving weather forecasting, and diversifying income sources. Preferred actions in relation to manufacturing and business include, but are not limited to, a review of development plan policy to reduce the risk of climate hazards; safeguarding the supply of essential services; and educating and building capacity through the use of targeted information systems and programs.

VULNERABLE CITIZENS

The Southern Adelaide and Murray Darling Basin regions describe the protection of vulnerable members of the community as a key focus. Contributing factors to vulnerability include poor health, limited mobility, access to transport, and dependence on others for care. The Yorke and Mid North region has also identified community engagement and social inclusion as a key area for decision making. In addition to proposed adaptation actions for emergency, health, social and essential services, examples of priority actions to protect vulnerable citizens include exploring service subsidies, vegetating public spaces, constructing climate-resilient infrastructure, and investment in strengthening social networks.

COMMUNITY AND EMERGENCY SERVICES

The theme of community services encompasses regions' consideration of emergency, essential, health and social services. Four plans (Southern Adelaide, Yorke and Mid North, Murray-Darling Basin and Barossa) have considered adaptation action in the community services sector, with a strong emphasis on emergency services management.

The Eyre Peninsula plan considers these issues in the context of the local government and development sectors. Examples of preferred adaptation actions include: refurbishing or constructing critical buildings and infrastructure (including health facilities) to increase resilience to extreme events; increasing rates of volunteerism in community services; and creating adaptive infrastructure for essential services in the form of back-up and storage. Regions also identify adaptation options for creating a community engagement plan that would promote emergency preparedness; and a review of development plan policy as it relates to emergency services.

DEVELOPMENT AND INFRASTRUCTURE

Given the demographic and geographic differences between the regions the plans raise a diverse range of issues within the theme of development and infrastructure planning. The Yorke and Mid North region has a distinct decision stream for infrastructure and planning. The Eyre Peninsula region identifies the key decision areas of road infrastructure, management of coastal development, and peri-urban expansion, along with port and wharf facilities.

The Southern Adelaide and Murray-Darling Basin plans address issues relating to urban development and infrastructure as an aspect of several key decision areas. Barossa Region prioritises climate-sensitive infrastructure design.

COASTAL MANAGEMENT

Coastal management and planning for the impacts of sea level rise are emphasised in a number of the completed adaptation plans.

Several of the regions consider the need for inundation mapping, improved planning policy and education, along with implementation of structural and physical protection works. Retreat is identified as a long term option in the Eyre Peninsula plan. Coastal digital elevation modelling was identified as a priority action in the Yorke and Mid North adaptation plan. The Murray and Mallee plan also considered these issues in the context of the Coorong and Lower Lakes. The response of coastal settlements to sea level rise and associated storm surge impacts was similarly identified as an adaptation priority in the Barossa region.

THE NEXT STEPS

South Australia has been recognised nationally and internationally for the approach taken in its Adaptation Framework, and has made great progress in the development of regional adaptation plans. However, further work is required to ensure the benefit of this work is fully realised.

A legislated review of the *Climate Change and Greenhouse Emissions Reduction Act 2007* is required in 2015, and feedback is sought, as part of this consultation process, on whether its aims are being achieved and what additional legislative measures might be considered to help achieve its targets. While the Objects of the Act contemplate and support climate change adaptation measures, the legislation could play a stronger role in supporting and building capacity in our communities, industry and government to undertake adaptation actions.

In its advice to the Minister for Climate Change, *South Australia's Climate Change Vision: Pathways to 2050*, the PCCC made a number of recommendations to the government regarding the governance of adaptation. In particular, that the government develop a state-wide framework to prioritise and implement adaptation actions and support regional stakeholders to set goals to ensure progress against each regional priority. The PCCC also recommended that government embed climate change in the planning system and partner with the community services sector to support vulnerable members of the community.

There are a number of potential areas that the new Climate Change Strategy could focus on to further support prioritisation, resourcing and implementation of adaptation actions. These are presented below to facilitate discussion with stakeholders during the consultation process.

- Developing or enhancing effective governance arrangements to support planning and implementation across governments at all levels. This could include increased use of Sector Agreements or other partnership approaches.
- Facilitating a whole-of-Government approach to adaptation, including setting goals, identifying, prioritising and resourcing adaptation strategies for State Government's own operations.
- Provide a legislative basis for regional adaptation planning in the *Climate Change and Greenhouse Emissions Reduction Act 2007*.
- Developing an innovating financing mechanism for adaptation activities, and/or supporting financing by building a business case for adaptation.
- Mainstreaming adaptation across governments, communities and the private sector to ensure that decision-makers are cognisant of the best available tools and information, and cost-effective adaptation strategies are implemented.
- Continuing to support regional collaboration on adaptation through planning and Sector Agreements, and encouraging cross-regional collaboration.
- More fully developing the adaptive management approach of the Adaptation Framework, including the development of a monitoring and evaluation process to support implementation of regional adaptation plans by all partners.
- Working with governments at all levels and community services organisations to develop strategies to support adaptation for the most vulnerable members of the community, including the socio-economically disadvantaged, the elderly, youth and those living with chronic illness.
- Engaging with business and industry to promote private sector involvement in adaptation actions and with a focus on the key sectors identified in the Adaptation Framework.
- Ensure policies and initiatives applied at a regional scale support adaptation and cross-sectoral collaboration.

APPENDIX 1: CLIMATE CHANGE IMPACT IN SOUTH AUSTRALIA

PROJECTIONS

The latest rainfall and temperature projections to 2050 and 2090 are presented below. This information is based on selected future climate change scenarios, projected to occur under two future emissions scenarios described by the Intergovernmental Panel on Climate Change (IPCC) as 'representative concentration pathways' (RCPs). The high emissions scenario referred to in this document is RCP8.5 and the intermediate emission scenario is RCP4.5. Each table displays the median projection in bold (50th percentile) and the range (10 – 90th percentile) in brackets. The table displays information from both the Climate Change in Australia (CCIA) and Climate Ready South Australia projection (Goyder) sets.

Mean sea level will continue to rise and height of extreme sea-level events will also increase. By 2030 the projected range of sea-level rise for the Southern Australian coastline is 0.07 to 0.19 m above the 1986–2005 level, with only minor differences between emission scenarios.

By 2090, the intermediate emissions case (RCP4.5) is associated with a rise of 0.27 to 0.66 m and the high case (RCP8.5) a rise of 0.39 to 0.89 m. Under certain circumstances, sea-level rises higher than these may occur.[1]

1 Bureau of Meteorology and CSIRO (2015).

2050 PROJECTIONS

Source	Region	Annual rainfall change (%) *Median (range)*		Annual maximum temperature increase (°C) *Median (range)*		Annual minimum temperature increase (°C) *Median (range)*	
		Intermediate Emissions	High Emissions	Intermediate Emissions	High Emissions	Intermediate Emissions	High Emissions
CCIA	Southern and South Western Flatlands	-7.3 (-16.4 to 1.0)	-10.7 (-20.7 to 1.2)	1.3 (0.9 to 1.7)	1.6 (1.4 to 2.1)	1.1 (0.7 to 1.4)	1.4 (1.8 to 1.8)
Goyder	Adelaide and Mount Lofty Ranges	-6.8 (-8.8 to -3.5)	-7.4 (-14.0 to -4.0)	1.3 (1.1 to 1.5)	1.6 (1.5 to 2.3)	1.0 (0.7 to 1.2)	1.3 (1.2 to 1.8)
Goyder	Kangaroo Island	-7.5 (-10.2 to -4.5)	-8.9 (-13.9 to -3.8)	1.1 (0.8 to 1.2)	1.3 (1.1 to 1.8)	0.8 (0.6 to 1.1)	1.1 (0.9 to 1.6)
Goyder	Northern and Yorke	-12.0 (-17.5 to -4.7)	-13.5 (-24.2 to -7.3)	1.4 (1.2 to 1.6)	1.7 (1.6 to 2.5)	1.1 (0.9 to 1.3)	1.5 (1.3 to 2.0)
Goyder	Eyre Peninsula	-9.5 (-14.5 to -5.4)	-10.1 (-19.4 to -6.0)	1.2 (1.0 to 1.4)	1.6 (1.5 to 2.1)	1.0 (0.8 to 1.2)	1.3 (1.1 to 1.8)
CCIA	Rangelands	-1.7 (-12.7 to 7.3)	-2.1 (-14.6 to 8.8)	1.6 (1.1 to 2.1)	2.0 (1.5 to 2.6)	1.4 (0.9 to 1.9)	1.9 (1.6 to 2.4)
Goyder	Alinytjara Wilurara and SA Arid Lands	-12.1 (-16.9 to -1.9)	-7.6 (-23.7 to -0.6)	1.5 (1.2 to 1.7)	2.1 (1.7 to 2.6)	1.2 (1.1 to 1.5)	1.6 (1.6 to 2.3)
CCIA	Murray Basin	-1.0 (-12.5 to 6.5)	-3.7 (-14.2 to 8.0)	1.4 (0.9 to 1.9)	1.9 (1.4 to 2.3)	1.2 (0.8 to 1.4)	1.6 (1.3 to 2.0)
Goyder	SA Murray Darling Basin	-10.4 (-12.5 to -4.5)	-12.2 (-18.4 to -7.7)	1.3 (1.2 to 1.6)	1.7 (1.6 to 2.4)	1.0 (0.9 to 1.3)	1.5 (1.2 to 1.9)
Goyder	South East	-4.8 (-8.4 to -3.1)	-7.9 (-10.1 to -1.9)	1.1 (1.0 to 1.4)	1.4 (1.3 to 2.2)	0.9 (0.8 to 1.1)	1.3 (1.1 to 1.7)

Table 1 - Climate change projections for South Australia to 2050: The high emissions scenario referred to in this table is RCP8.5 and the intermediate emission scenario is RCP4.5. The table displays the median projection in bold (50th percentile) and the range (10 – 90th percentile), in brackets. The table displays information from both the Climate Change in Australia (CCIA) and Climate Ready South Australia projection (Goyder) sets.[1]

1 *Beecham, S: Goyder Institute for Water Research, 2015 and Bureau of Meteorology and CSIRO, 2015*

2090 PROJECTIONS

Source	Region	Annual rainfall change (%) *Median (range)*		Annual maximum temperature increase (°C) *Median (range)*		Annual minimum temperature increase (°C) *Median (range)*	
		Intermediate Emissions	High Emissions	Intermediate Emissions	High Emissions	Intermediate Emissions	High Emissions
CCIA	Southern and South Western Flatlands	-10.4 (-21.6 to -0.5)	-14.6 (-36.2 to -2.5)	1.8 (1.2 to 2.3)	3.8 (2.7 to 4.3)	1.6 (1.0 to 2.0)	3.2 (2.5 to 3.8)
Goyder	Adelaide and Mount Lofty Ranges	-7.7 (-10.7 to -5.0)	-15.6 (-25.3 to -11.2)	1.8 (1.5 to 2.2)	3.2 (2.8 to 4.3)	1.3 (1.0 to 1.9)	2.8 (2.3 to 3.5)
Goyder	Kangaroo Island	-8.0 (-11.3 to -5.4)	-16.9 (-26.4 to -13.3)	1.4 (1.1 to 1.9)	2.6 (2.3 to 3.6)	1.2 (0.9 to 1.7)	2.2 (2.0 to 3.1)
Goyder	Northern and Yorke	-14.1 (-18.6 to -9.6)	-23.6 (-36.8 to -20.3)	1.9 (1.7 to 2.4)	3.4 (3.0 to 4.7)	1.5 (1.2 to 2.1)	3.1 (2.6 to 3.9)
Goyder	Eyre Peninsula	-9.1 (-14.2 to -6.9)	-19.2 (-30.8 to -12.8)	1.7 (1.5 to 2.1)	3.1 (2.7 to 4.0)	1.4 (1.1 to 1.9)	2.6 (2.4 to 3.5)
CCIA	Rangelands	-4.7 (-15.4 to 6.6)	-4.1 (-31.9 to 17.7)	2.2 (1.4 to 3.1)	4.4 (2.9 to 5.6)	2.0 (1.3 to 2.7)	4.1 (3.1 to 5.2)
Goyder	Alinytjara Wilurara and SA Arid Lands	-9.9 (-14.2 to -2.1)	-13.8 (-31.5 to -8.5)	2.0 (1.9 to 2.5)	4.0 (3.2 to 4.9)	1.8 (1.5 to 2.4)	3.3 (3.2 to 4.5)
CCIA	Murray Basin	-5.7 (-16.1 to 3.9)	-5.0 (-26.7 to 8.6)	2.0 (1.3 to 2.6)	4.1 (2.9 to 5.0)	1.7 (1.1 to 2.1)	3.5 (2.8 to 4.2)
Goyder	SA Murray Darling Basin	-11.0 (-15.0 to -8.4)	-21.5 (-29.3 to -14.4)	1.8 (1.6 to 2.3)	3.3 (3.0 to 4.5)	1.4 (1.2 to 2.0)	3.0 (2.6 to 3.7)
Goyder	South East	-6.8 (-9.2 to -3.5)	-15.7 (-21.3 to -10.8)	1.6 (1.3 to 2.0)	2.9 (2.7 to 4.1)	1.3 (1.0 to 1.8)	2.6 (2.3 to 3.4)

Table 2 - Climate change projections for South Australia to 2090: The high emissions scenario referred to in this table is RCP8.5 and the intermediate emission scenario is RCP4.5. The table displays the median projection in bold (50th percentile) and the range (10 – 90th percentile), in brackets. The table displays information from both the Climate Change in Australia (CCIA) and Climate Ready South Australia projection (Goyder) sets.[1]

1 *Beecham, S: Goyder Institute for Water Research, 2015 and Bureau of Meteorology and CSIRO, 2015*

LIKELY IMPACTS BY SECTOR

Changes in climate will have varying impacts on our natural features, industries and communities. Table 2, below, provides a summary of the different risks and opportunities faced by each of these sectors.

Community Health and Individual Wellbeing	Climate change will have varied direct and indirect impacts on regions, communities and the individuals in them. Some regions and communities are likely to be more vulnerable to the adverse effects of climate change (such as increased frequency and intensity of heatwaves). These include the elderly, people with a disability, young children, those living in remote or coastal communities and those on low incomes who are least equipped to move or adapt their living conditions. Opportunities include using the cross-sector focus on climate change adaptation to proactively improve community health, community cohesion, social inclusion and individual wellbeing; improving emergency responses; and reducing exposure to poor air quality
Water Resources	Higher temperatures, lower average rainfall and changing rainfall patterns, and higher evaporation rates will pose additional challenges for the State's future water supplies. Adapting to drier conditions will mean thinking about completely new ways of managing our rural and urban water supplies, using a mix of traditional water sources in combination with water reuse and water sources that do not rely on rainfall, such as desalinated water. Opportunities also exist to improve water resources management, sustainable irrigation, management of recycled and stormwater and infrastructure.
Coastal and Catchment Management	Potential impacts of sea level rise threaten a range of sectors, including tourism, emergency management, stormwater management, insurance and finance. Damage to critical infrastructure, property, agricultural land and natural environments could cost billions of dollars in losses. Coastal ecosystems, including estuaries, coastal vegetation, wetlands and reefs, will also be vulnerable. Opportunities include further developing the State's expertise and approach to coastal and catchment management, and improving linkages between coastal adaptation policy and other sectors such as emergency management and development planning.
Biodiversity	Healthy and diverse natural systems are essential to support vibrant economies and healthy, prosperous communities. The impact of climate change on natural systems extends beyond rainfall and temperature to changes in ecological processes influenced by hydrological and fire regimes. Plants, animals and micro-organisms will be especially affected by climate change, as they have more difficulty adapting to large-scale, rapid changes in climate and experience increased competition with invasive species that proliferate and cause greater impacts due to climate change. Flowering and fruiting times may change in response to climate change, including varying year to year with potential for misalignment with pollinators and grazers. Possible opportunities include rehabilitating previously cleared or degraded natural systems to provide ecosystem services, managing and restoring key ecological assets, building resilient ecosystems and linking fragmented habitats to enable species adaptation.
Agriculture	Agriculture in Australia has evolved to cope with risk and uncertainty, not only in response to the extremely variable climate but also in response to issues such as supply and demand factors, biosecurity threats and legislative arrangements. This adaptive management approach may need to extend to altered farming systems, diversification, economic restructuring and understanding of changes to global markets and development of new systems.

Fisheries and Aquaculture	Impacts of climate change on commercially/recreationally important fisheries include species' range shifts, reproduction, feeding, behaviour and habitat and broader ecosystem changes. Marine aquaculture production may be impacted by increased stormwater discharge due to flood events, changes in nutrient levels, ocean warming, increased sea levels, extreme weather events and increased incidence of disease. Land based aquaculture may be impacted by declines in water availability and increased water temperatures. Tools such as the fisheries Redmap Australia represent opportunities to assess how marine ecosystems might be changing in response to potential climate change impacts. Opportunities may arise to develop new fisheries or expand existing fisheries based on opportunities from climate change and facilitate fisheries and aquaculture sectors transition to new or expanding fisheries.
Forestry	A large percentage of the land used for commercial forestry has multiple purposes, including timber production, carbon sequestration, aesthetics and recreation for people. All commercial forestry in South Australia is plantation based. Reduced forest productivity would have significant economic impacts on forest and wood based industries, with flow-on effects to local communities. Drier conditions and increased temperatures are expected to affect the State's forestry industry, with potential impacts to growth rates, the frequency and intensity of bushfires and attack by pests, diseases and weeds. Opportunities for adaptive management includes specialised tree breeding and alternative species.
Infrastructure and Urban Areas	Almost all types of major infrastructure in South Australia are likely to be at risk from storms, coastal inundation, flooding, higher temperatures and increased frequency of bushfires. The planning and development sector faces a major challenge in facilitating adaptation responses for settlements and infrastructure. The impacts of climate change must be factored into policy and regulations for land use and urban planning, infrastructure planning and design, including critical energy, transport, and waste management assets and facilities, and building design and performance standards. The sector has an opportunity to create more liveable urban environments and buildings, while improving energy performance and reducing emissions.
Emergency Management	Emergency management organisations will have a significant role to plan in assisting South Australians to cope with the more severe and extreme impacts of climate change. There are opportunities to build on the State's expertise in hazard prevention, mitigation, response and recovery, and disaster preparedness. Hazards likely to be impacted by climate change include animal and plant disease, bushfire, extreme weather, flood, threats to human health, River Murray riverbank collapse and urban fire.
Tourism	There is potential for significant social and economic impacts on the tourism industry, extending to the regional communities that provide goods and services to tourists. Impacts may include a loss of tourist attractions, a loss in the quality of attractions, increased costs for repair, maintenance and replacement of tourism infrastructure and increased costs for developing alternative attractions. However, some regions are exploring new tourism opportunities that may arise from climate change.

Manufacturing and Services	Local manufacturers and service providers face both challenges and opportunities as a result of climate change. Risks associated with natural resource security and increased business costs are key for some manufacturing sectors. Demand for products and services that help the community respond to climate change will increase and demand for new and innovative products will stimulate business growth. Opportunities in this sector will arise from growing our knowledge intensive service sector, increasing market share in response to changes to consumer preferences and transitioning to a low carbon economy.
Minerals and Energy	Mining operations around Australia are not immune to the impacts of climate change, with specific impacts depending on mine location. Operational productivity is likely to be affected by climate change. For example, damage to infrastructure, transport networks, and welfare of the workforce have the potential to be impacted by extreme weather, reduced access to water and increased costs associated with mining operations. Opportunities for this sector will also include renewable energy generation and transitioning to a low carbon economy.
Natural Resources Management	The risks for this sector include risks for soil management, invasive animals and weeds, shifts in potential distribution of invasive animals, weeds and diseases, and how changes in land use impact water supply and demand. The opportunities for this sector include integrated pest and disease management and risk assessment to identify new and emerging threats.

Table 2: Adapted from: Key adaptation sectors from the Climate Change Adaptation Framework for South Australia (2012)

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GLOSSARY & ACRONYMS

CLIMATE CHANGE

Any change in climate over time, whether due to natural variability or as a result of human activity.

CLIMATE CHANGE ADAPTATION

Action in response to, or anticipation of, climate change to reduce or avoid adverse consequences or to take advantage of beneficial changes. Adaptation is usually distinct from actions to reduce greenhouse gas emissions.

CLIMATE CHANGE AND GREENHOUSE EMISSIONS REDUCTION ACT 2007

South Australian legislation to provide for measures to address climate change by setting targets to achieve a reduction in greenhouse gas emissions within the State; to promote the use of renewable sources of energy; to promote business and community understanding about issues surrounding climate change and to facilitate the development of policies and programs to address climate change.

CLIMATE CHANGE PROJECTIONS

A forecast of expected climate changes into the future based on scientific modelling and greenhouse gas emissions scenarios.

CLIMATE CHANGE SECTOR AGREEMENT (CCSA)

Sector agreements are formal cooperative agreements between the state government and specific business entities, industry sectors, community groups and regions to help tackle climate change.

CLIMATE RISK

A risk resulting from climate change affecting natural and human systems and regions.

CLIMATE SYSTEM

A highly complex system consisting of the atmosphere, the water cycle, ice, snow and frozen ground, the land surface and plants and animals, and the interactions between them.

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION (CSIRO)

The federal government agency for scientific research in Australia.

GREENHOUSE GAS EMISSIONS

The release of greenhouse gases into the atmosphere. A greenhouse gas is an atmospheric gas that absorbs and emits infrared or heat radiation, giving rise to the greenhouse effect. Typical greenhouse gases include carbon dioxide, methane, nitrous oxide and refrigerants.

INTEGRATED VULNERABILITY ASSESSMENTS (IVAS)

The process of understanding the sectors and systems most at risk of climate change and the interconnections between them.

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)

The scientific intergovernmental body under the auspices of the United Nations, established in 1988 by the World Meteorological Organisation (WMO) and the United Nations Environment Program (UNEP) at the request of member governments. The IPCC produces reports that support the United Nations Framework Convention on Climate Change (UNFCCC).

NATIONAL CLIMATE CHANGE ADAPTATION RESEARCH FACILITY (NCCARF)

NCCARF works to support decision makers throughout Australia as they prepare for and manage the risks of climate change and sea-level rise. It has a national focus to build resilience to climate change in government, NGOs and the private sector.

PREMIER'S CLIMATE CHANGE COUNCIL (PCCC)

The Premier's Climate Change Council was established under the *Climate Change and Greenhouse Emissions Reduction Act 2007*. The primary function of the Council is to provide independent advice to the Minister responsible for Climate Change about matters associated with reducing greenhouse gas emissions and adapting to climate change.

REPRESENTATIVE CONCENTRATION PATHWAYS

Four greenhouse gas concentration trajectories adopted by the IPCC for its fifth Assessment Report in 2014. The pathways are used for climate modeling and research. They describe four possible climate futures, all of which are considered possible depending on how much greenhouse gases are emitted in the years to come.

SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE (SARDI)

The South Australian Research and Development Institute is the State Government's principal research institute.

SEA LEVEL RISE

The rise in the average level of an ocean for which heights can be measured.

SOUTH AUSTRALIA'S CLIMATE CHANGE VISION: PATHWAYS TO 2050

The official advice presented to the Minister for Climate Change by the Premier's Climate Change Council (PCCC) in February 2014.

THE CLIMATE GROUP STATES AND REGIONS ALLIANCE

The Climate Group States & Regions brings together sub-national government leaders from around the world in a powerful, high-profile network that shares expertise, demonstrates impact and influences the international climate dialogue.

SOUTH AUSTRALIA

Government of South Australia

www.environment.sa.gov.au/climatechange