South Australian Arid Lands Natural Resources Management Board REGIONAL NATURAL RESOURCES MANAGEMENT PLAN

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for the SA Arid Lands Natural Resources Management Region

VOLUME 1 TEN-YEAR STRATEGIC PLAN



It should be noted that, the Department of Water, Land and Biodiversity Conservation and the Department for Environment and Heritage ceased to exist as of 1 July 2010. The functions of the defunct agencies have been transferred to the new Department of Environment and Natural Resources (DENR) and the Department for Water (DFW) which were established on 1 July 2010, and the existing Primary Industries and Resources SA. The Board is working closely with these agencies on the development of arrangements that will help to achieve the best possible natural resources management outcomes for the region.

I, Paul Caica, Minister for Environment and Conservation, after taking into account and in accordance with the requirements of section 80(3) of the *Natural Resources Management Act 2004* hereby adopt the South Australian Arid Lands Regional Natural Resources Management Plan.

Paul Caica Minister for Environment and Conservation Date: 25/05/2010



Foreword

The South Australian Arid Lands (SAAL) Natural Resources Management (NRM) Board (the Board) has responsibility under the *Natural Resources Management Act 2004* to develop and maintain an NRM plan for the region. *The SAAL Regional NRM Plan* provides the Board, State Government agencies and other stakeholders with a coordinated and integrated basis for maintaining and enhancing the region's natural resources over the next ten years.

The natural systems and human activities in the SAAL NRM Region make it fundamentally different from other NRM regions in South Australia. The region covers more than 50% of South Australia and contains a greater percentage of intact ecosystems and natural biological diversity than any other region in the State.

The *SAAL Regional NRM Plan* provides a range of programs to protect valuable ground and surface waters; ensure sustainable industries; help pastoral land management; conserve natural ecosystems; and encourage community participation.

The *SAAL Regional NRM Plan* consists of two volumes which will be reviewed as a whole at least every five years. Volume 1 details the state of the region assessment and the policy and regulatory framework. It also contains a ten-year Strategic Plan, which includes an integrated framework of long and short term targets to guide natural resources management in the region.

Volume 2 describes the three-year Business Plan that will contribute towards achieving the region's vision for NRM through the Board's actions and investments. The Business Plan identifies expected sources of investment funds and provides an implementation plan that assists in the delivery of the region's goals. This volume will be reviewed annually.

The Board acknowledges those who have contributed to the *SAAL Regional NRM Plan*, particularly the authors Hadyn Hanna and Simon Lewis. The *SAAL Regional NRM Plan* also draws upon existing management plans, developed for specific areas and assets of the region (eg *Arid Areas Catchment Water Management Plan*, district soil conservation plans). In addition, the Board commissioned the *Water Allocation Plan for the Far Northern Wells Prescribed Area*, which was adopted early in 2009 and which, in legal terms, forms part of this Regional NRM Plan.

This suite of plans will guide planning and investment in the region for the Board, government agencies and the community.

Community ownership and contribution to the *SAAL Regional NRM Plan* is essential for its successful implementation. The SAAL NRM Board therefore looks forward to ongoing collaboration with the regional community and a range of other stakeholders in the implementation of the *SAAL Regional NRM Plan*.

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Chris Reed Presiding Member

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Figure 1: SAAL NRM Region

Setting the Scene

Part 1

1. INTRODUCTION

The South Australian Arid Lands (SAAL) Natural Resources Management (NRM) Region is one of eight NRM regions established in South Australia under the *Natural Resources Management Act 2004 (NRM Act 2004)*. It is the largest of the NRM regions, comprising approximately 520,000 square kilometres – over 50% of South Australia. The SAAL NRM Region is shown in **Figure 1**.

The South Australian Arid Lands Natural Resources Management Board (the Board) was established on 9 December 2004 pursuant to section 23 (1) of the *NRM Act 2004* and became operationally responsible for its region on 1 July 2005. The Board consists of a governing body of community members appointed on a skills basis and has active representatives from key State Government departments. While all community members' appointments are based on their skills, many work in key industries (pastoralism, mining etc), while others have specific expertise and/or work in relevant bodies.



The Board is supported in its role by regional NRM Groups and is actively developing their capacity to support local input into the Board's planning and delivery. The NRM Group members provide a social and local context for delivery of the Board's programs by providing local input, encouraging broader community engagement and monitoring the Board's performance. The Board is also supported by advisory committees, established to provide it with specialist technical advice.

While the Board has its responsibilities as detailed in the *NRM Act 2004*, it also has a regional leadership role in natural resources management through building knowledge and relationships, and developing tools and policy frameworks to inform and improve its own decision making and that of others.

The delivery of the Board's programs is heavily reliant on numerous stakeholders and partners. The Board works in partnership with people in government, business and the community to develop and deliver natural resources management solutions and influences others by its leadership and effective governance arrangements. It also takes into account the past, present and proposed investments of others (community, state agencies etc) in the region.

Aboriginal people had, and still have, a strong connection with this region and many sites continue to be extremely important from a cultural and spiritual perspective. Along with the Alinytjara Wilurara NRM Region, the SAAL NRM Region is special in that it has not experienced, to any significant degree, broad-scale clearance for agricultural development. A large proportion of the region is now used for pastoralism, where the native vegetation communities form the basis for cattle and sheep production, and where sustainable management is therefore a key objective. Vast areas are also set aside for conservation purposes under the *National Parks and Wildlife Act 1972* and as Aboriginal Managed Lands.

Reflecting its aridity and remoteness, the human population of the SAAL NRM Region is sparse and townships are few. The larger towns, such as Roxby Downs and Coober Pedy, are associated with mining ventures, and mining and mineral exploration activities are now dotted across much of the regional landscape.

In several of the other NRM regions in South Australia there is an attempt to align regional boundaries with water catchments. However, a feature of the SAAL NRM Region is that some of its catchments are national in scale, eg the Great Artesian Basin and surface water catchments such as those associated with the Cooper and Diamantina systems. This adds an extra dimension to NRM planning in the region.

2. THE PURPOSE OF THIS REGIONAL NRM PLAN

The primary purpose of this NRM plan is to provide an integrated and coordinated basis for the management of the region's natural resources. As such it needs to satisfy the legal requirements under the *NRM Act 2004*. Some of the more central legal requirements are summarised below.

- » The plan should describe the state and condition of the natural resources of the region.
- » The plan should include the Board's goals and explain how those goals will be achieved.
- » The plan should set out an implementation program and an associated program for monitoring and evaluation.
- The plan must include a ten-year Strategic Plan and a three-year Business Plan. The tenyear Strategic Plan should cover all relevant NRM issues in the region – not just those that are the Board's direct responsibility. The three-year Business Plan is to focus more directly on the Board's program of activities.
- » The plan must be consistent with the State NRM Plan 2006.

This plan has involved a comprehensive review of existing information and extensive consultation with the regional community, industry groups, government agencies and other interest groups. The overall framework for this NRM plan is shown in **Figure 2**.





Natural Resource Condition Targets is a nationally accepted term for long term targets. As the name suggests they relate to desired changes in natural resource (water, soil etc) condition. These targets must be achievable, measurable and time-bound. Natural resource condition targets are outcome based.

Figure 2: Framework for the SAAL Regional NRM Plan

3. GUIDING PRINCIPLES

The following Guiding Principles were developed in order to set direction for the Strategic Plan. They are based on the guiding principles of the State NRM Plan 2006, *which are highlighted in bold italics* below.

Multiple benefits: ecologically sustainable management of natural resources underpins a sound economy while delivering positive social, cultural and environmental outcomes. *Win, win, win*.

Ecosystem approach: Natural resources management should be within sustainable limits and based on an understanding of the relationship between natural resources and the ecosystems (including agricultural ecosystems) they support. *The whole is greater than the sum of the parts*.

Landscape-scale management: The effectiveness of the majority of natural resources management practices is only realised when the activities are conducted at a landscape-scale. *Look after the future*.

Balanced decisions: Natural resources management decisions should take proper account of the range of environmental, social and economic benefits, values and costs. *Use without losing*.

Shared management: Recommended management practices for natural resources should be developed with land managers (Aboriginal communities, pastoralists, miners etc), industry sectors, the broader community and Government agencies, and incorporate the best available scientific data. *Everyone is responsible*.

Priority-based: Actions to sustain or remediate natural resources and landscapes are to be undertaken according to priorities based on the best available science and information, relevant experience (eg of Aboriginal people) and on assessment of the relative cost-effectiveness of options. *If it's broke – fix it.*

Prevention is better than cure: It is always more efficient to prevent damage than to repair it. Where there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be a reason for postponing measures to prevent environmental degradation. *Precautionary Principle.*

Partnerships: To be effective, natural resources management requires the establishment of partnerships between all levels of Government and the community (including the Aboriginal community, industry, landholders and individuals) with agreed roles and responsibilities. *Work together*.

We are all responsible: The entire community receives benefits from the conservation, use and development of natural resources. We all share responsibility for managing natural resources sustainably and for providing economic resources to do so. Capable, committed and connected people are critical to effective natural resources management. *People are the key*.

Changing climatic conditions: Climate Change is recognised – a scenario approach is adopted considering both changing and increased variability of climatic conditions. Innovative thinking and decision-making are required in dealing with this and other natural resources management issues. *Think outside the square*.

Developing and sharing knowledge. It is essential that the knowledge and experience of rural, urban, Aboriginal and scientific communities is sought and valued. *Knowledge is power*.

Adaptive management: Actions will be monitored to determine their impact and necessary adjustments made to practices to maximise the achievement of goals. *Learn by doing*.

4. VISION FOR NATURAL RESOURCES MANAGEMENT IN THE SAAL NRM REGION

The Vision for the SAAL NRM Region, developed in consultation with the regional community, is:

"The South Australian Arid Lands NRM Region is a healthy functioning ecosystem with sustainable industries and vibrant communities."

The Vision highlights the need to achieve a balance between environmental protection and the use of resources to generate wealth. It emphasises that regional communities are crucial to the effective management of natural resources, through the behaviours they adopt and support.



5. GOALS FOR NATURAL RESOURCES MANAGEMENT

In the development of regional NRM plans it has been found useful to establish broad, high-level goals that help to set the overall philosophy for natural resources management.

The Goals for the region, again developed in consultation with the regional community, are to have:

- 1 Adaptive landscape-scale management, which maintains and strengthens the natural functioning of the region's ecological systems.
- 2 Vibrant communities and industries using and managing natural resources within ecologically sustainable limits.
- 3 Vibrant communities, governments and industries working together with the capability, commitment and connections to manage resources in an integrated way.

The Goals reflect an integrated, landscape-based approach. They have been adapted from the four goals in the *State NRM Plan 2006* and are consistent with the objectives of the South Australian *NRM Act 2004.*

The Goals are also consistent with:

- The priorities of the Australian Government's *Caring for our Country* initiative, which are:
 - » a national reserve system
 - » biodiversity and natural icons
 - » coastal environments and critical aquatic habitats
 - » sustainable farm practices
 - » natural resources management in remote and northern Australia
 - » community skills, knowledge and engagement.
- All of the six objectives of *South Australia's Strategic Plan* but especially objectives 1,2,3 & 5:
 - » Objective 1 Growing Prosperity
 - » Objective 2 Improving Wellbeing
 - » Objective 3 Obtaining Sustainability
 - » Objective 4 Fostering Creativity and Innovation
 - » Objective 5 Building Communities
 - » Objective 6 Expanding Opportunity.

6. THE STRUCTURE OF THIS NRM PLAN

This plan is set out as two volumes.

Volume 1 includes:

- Part 1: Setting the scene
- Part 2: State of the SAAL NRM Region
- Part 3: Ten-Year Strategic Plan for the SAAL NRM Region
- Part 4: The Regulations and Policies to Help Us

Volume 2 comprises the three-year Business Plan for the SAAL NRM Board's activities.

Volume 1 will be reviewed at least every five years, while Volume 2 will be subject to an annual review (as required under the *NRM Act 2004*) and will, in effect, detail the Board's three-year rolling program.



7. LINKAGES OF THIS NRM PLAN WITH THE STATE NRM PLAN

The *SAAL Regional NRM Plan* has been prepared with reference to the *State NRM Plan 2006*. It also forms part of a network of natural resources planning processes, as illustrated by the following figure adapted from the *State NRM Plan*.



The terminology in this NRM plan has been developed to complement, where appropriate, that in the *State NRM Plan*. For example, as noted in Section 3, there is consistency in the guiding principles that are applied. The Goals in the *SAAL Regional NRM Plan* also align closely with those in the *State NRM Plan*, as do the ten-year Resource Condition Targets. As a further example, the Resource Condition Targets set out in Table 10 are linked with milestones within the *State NRM Plan*.

There are, however, some differences in the terminology used in this regional NRM plan and the State NRM Plan. These are noted below.

STATE NRM PLAN TERMINOLOGY	COMMENT ON RELATIONSHIP WITH SAAL REGIONAL NRM PLAN TERMINOLOGY
Vision	Vision used in same context
Goals	Goals used in same context
Resource Condition Targets	Resource Condition Targets used in same context but all have been given a ten- year time-frame
Milestones	Relate closely to Management Action Targets in the SAAL Regional NRM Plan, although the milestones in the State NRM Plan are not as specific in defining action targets
Strategies	The SAAL Regional NRM Plan sets out strategic directions as a basis for Management Action Targets. In addition, several of the Management Action Targets in the SAAL Regional NRM Plan are similar to the "strategies" in the State NRM Plan but with a time constraint applied

Thus there is some divergence in the context of 'milestones' and 'strategies' in the State NRM Plan and 'strategic directions' and 'management action targets' in the SAAL Regional NRM Plan. However, the end result is considered to be compatible - a series of strategies and short-term targets to achieve longer-term Resource Condition Targets.



Bubbler Mound Spring; the surface discharge points of the Great Artesian Basin, mound springs support populations of unique and threatened fauna and flora and are of immense cultural and ecological importance

8. ACRONYMS USED IN THIS DOCUMENT

AACWMB	Arid Areas Catchment Water Management Board
ALT	Aboriginal Lands Trust
CMA	Catchment Management Authority
DAAR	(SA) Division of Aboriginal Affairs and Reconciliation
DEH	(SA) Department for Environment and Heritage
DEP	Department of Environment and Protection
DTEI	(SA) Department for Transport, Energy and Infrastructure
DWLBC	(SA) Department of Water, Land and Biodiversity Conservation
ESD	Ecologically Sustainable Development
GAB	Great Artesian Basin
GABSI	Great Artesian Basin Sustainability Initiative
IBRA	Interim Biogeographic Regionalisation for Australia
INRM	Integrated Natural Resources Management
LEBCAC	Lake Eyre Basin Community Advisory Committee
MAT	Management Action Target
MERI	Monitoring, Evaluation, Reporting and Improving
Min E & C	(SA) Minister for Environment and Conservation
Min E & C NRM	(SA) Minister for Environment and Conservation Natural Resources Management
Min E & C NRM NRMB	(SA) Minister for Environment and Conservation Natural Resources Management Natural Resources Management Board
Min E & C NRM NRMB NVC	(SA) Minister for Environment and Conservation Natural Resources Management Natural Resources Management Board Native Vegetation Council
Min E & C NRM NRMB NVC NWI	 (SA) Minister for Environment and Conservation Natural Resources Management Natural Resources Management Board Native Vegetation Council National Water Initiative
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9. GLOSSARY OF TERMS USED IN THIS DOCUMENT

The following glossary of terms used in this plan is adapted from the State NRM Plan.

Alternative water sources – These sources include stormwater, wastewater, lower quality water and seawater. Offer great scope to provide social and economic benefits while helping to solve some environmental problems.

Aquatic - Includes fresh, brackish, coastal, inland, estuarine and marine.

Biological diversity or biodiversity – The variety of life forms represented by plants, animals and other organisms and microorganisms, the genes that they contain, and the ecosystems and ecosystem processes of which they form a part.

Bioregional – A territory defined by a combination of biological, social and geographic criteria rather than by geopolitical considerations; generally, a system of related, interconnected ecosystems.

Biosecurity – The protection of the economy, environment and public health from native impacts associated with pest animals, plants and diseases.

Capacity building – Programs that identify and seek to address strategically limiting factors to a community's ability to achieve sustainable natural resource outcomes.

Catchment – That area of land determined by topographic features within which rainfall will contribute to runoff at a particular point.

Climate change – A change in climate, which is attributed directly or indirectly to human activity, which alters the composition of the global atmosphere, and is in addition to natural climate variability observed over comparable time periods.

Declared plants/animals – A class of pest animals or plants declared under section 174 of the *Natural Resources Management Act 2004* for control purposes.

District Plan or District Soil Conservation Plan – An approved soil conservation plan under the repealed *Soil Conservation Act 1989*. These plans are taken to form part of the relevant regional NRM plans under the transitional provisions of the *Natural Resources Management Act 2004* (Schedule 4 – subclause 53[4]) until regional NRM plans are prepared under Chapter 4, Part 2 of the *Act*.

Ecological connectivity – The extent of interconnectedness between habitats and subpopulations in a landscape. It is increased by protecting good core habitats, restoring buffer areas around the cores, building links across the landscape by 'stepping stones' and corridors.

Ecological health – A measure of an ecosystem's structural intactness and integrity of ecological processes.

Ecological integrity – A measure of an ecosystem's functional (process) intactness and ability to recover after a disturbance to a stable state.

Ecological processes – Dynamic interactions among and between biotic and abiotic components of the biosphere.

Ecologically sustainable development (ESD) or sustainable development – Comprises the use, conservation, development and enhancement of natural resources in a way, and at a rate, that will enable people and communities to provide for their economic, social and physical well-being while sustaining the potential of natural resources to meet the reasonably foreseeable needs of future generations, safeguarding the life-supporting capacities of natural resources, and avoiding, remedying or mitigating any adverse effects of activities on natural resources.

Ecologically sustainable limits – Limits to the use of, or impacts upon, natural resources beyond which natural resources may be damaged and unable to recover, that is, exceeding an ecosystem's resilience. In this Plan a number of different types of limits are used such as land capability and sustainable water yields.

Ecosystem – A dynamic complex of plant, animal and micro-organism communities and their nonliving environment interacting as a functional unit.

Ecosystem services – The full suite of benefits that human populations gain from a particular type of ecosystem, such as maintenance of climates; provision of clean water and air; pollination of crops and native vegetation; fulfilment of people's cultural, recreational, spiritual and intellectual needs; and provision of options for the future, for example through maintaining biodiversity.

Environment – The interaction of climate, geology, water, soil, topography and biota that provides landscapes that are comprised of bioregions, ecosystems, catchments and land systems that may be natural and/or managed by people.

Environmental and other public benefit outcomes – Environmental and other public benefit outcomes are defined as part of the water planning process, are specified in water plans and may include a number of aspects, including environmental outcomes such as maintaining ecosystem function (for example, through periodic inundation of floodplain wetlands), biodiversity, water quality and river health targets; and other public benefits such as mitigating pollution, public health (for example, limiting noxious algal blooms), indigenous and cultural values, recreation, fisheries, tourism, navigation and amenity values.

Environmental values – The uses of the environment that are recognised as being of value to the community.

Environmental water requirement – The water regime needed to sustain the ecological values of aquatic ecosystems, including their processes and biological diversity, at a low level of risk. Basically, this means what these ecosystems – including watercourses, riparian zones, wetlands, floodplains, estuaries, cave and aquifer ecosystems – need.

Environmentally sustainable level of extraction – The level of water extraction from a particular system which, if exceeded, would compromise key environmental assets, or ecosystem functions and the productive base of the resource.

Erosion – The breakdown and movement of soil and rock by water, wind or ice. Natural erosion processes may be accelerated by human activities.

Geological features – Include geological monuments, landscape, topography and amenity and the substrate of land systems and ecosystems.

Groundwater - See Underground water.

Habitat – The natural place or type of site in which an animal or plant, or communities of plants and animals, live.

Integrated pest management – The coordinated use of pest and environmental information along with available pest control methods, including physical, biological, genetic and chemical methods, to prevent unacceptable levels of pest damage by the most economical means, and with the least possible hazard to people, property, and the environment (ecosystems).

Interim Biogeographical Regional Assessment (IBRA) – A framework for conservation planning and sustainable resource management within a bioregional context. IBRA regions represent a landscape based approach to classifying the land surface from a range of continental data on environmental attributes.

Invasive species - See Pest species.

Land capability – The ability of land to accept a type and intensity of use with minimum risk of permanent damage to the soil resource (land natural resources).

Landholders - Includes everyone who owns, uses, manages, and/or develops land.

Landscape – A heterogeneous area of local ecosystems and land uses that is of sufficient size to achieve long term outcomes in the maintenance and recovery of species or ecological communities, or in the protection and enhancement of ecological and evolutionary processes. For the purposes of this Plan, landscapes include terrestrial environments, inland waters and coastal and marine systems.

Landscape scale management – A whole of system approach that takes into account relevant natural resource system boundaries - ecosystems, bioregions, land systems, catchments, landscapes and seascapes. Systems approaches take into account the sum of all individual decisions - guided by 'whole-of-system' planning and decision-making at appropriate scales in time and space.

National Water Initiative (NWI) – Intergovernmental Agreement on a National Water Initiative 2004.

Native animal – A protected animal within the meaning of the *National Parks and Wildlife Act 1972* and any species included in Schedule 10 of that *Act*, but does not include a dingo or any other animal of a class excluded from the ambit of this definition by the regulations. Fish and invertebrates are excluded from the definition of animal under regulations for the *NRM Act 2004*.

Native vegetation – A plant or plants of a species indigenous to South Australia including a plant or plants growing in or under waters of the sea as defined under the *Native Vegetation Act 1991*.

Native vegetation clearance – Native vegetation is cleared (or would be cleared) if the relevant activity constitutes (or would constitute) clearance of the native vegetation under the *Native Vegetation Act 1991*.

Natural resources – Includes soil, water resources, geological features and landscapes, native vegetation, native animals and other native organisms and ecosystems.

Natural resources management (NRM) – A general meaning is used in the Plan that encompasses the direct use, management and/or development of natural resources by anyone in the community. That meaning includes specific NRM policy, strategies and actions that are initiated under the *NRM Act 2004* and related arrangements.

Natural systems – Systems defined by interactions between topography, geology, climate and biological organisms (plants, animals, bacteria etc). Natural systems include ecosystems, land systems, catchments, basins, bioregions and sub-regions. Natural systems are used for human benefit including settlement, industry, tourism and recreation and in some cases are retained in a natural state to protect their biodiversity values.

NatureLinks – A vision and framework for an ecologically sustainable future for South Australia, through planning and the development of partnerships to integrate landscape scale biodiversity management with regional development and NRM.

NRM Council – The Natural Resources Management Council was established under the *NRM Act* 2004 (section 13) to provide advice to the Minister.

Over-abundant native species – Native species, usually animals that have been favoured by human-induced environmental change, that have detrimental social, economic or environmental impacts.

Over-allocation – Refers to situations where, with full development of water access entitlements in a particular system, the total volume of water able to be extracted by entitlement holders at a given time exceeds the environmentally sustainable level of extraction for that system.

Over-used – Refers to situations where the total volume of water actually extracted for consumptive use in a particular system at a given time exceeds the environmentally sustainable level of extraction for that system. Over-use may arise in systems that are over-allocated, or it may arise in systems where the planned allocation is exceeded due to inadequate monitoring and accounting.

Pathogen – A micro-organism that causes disease.

Pest species – An animal, plant or pathogen that is a risk to indigenous species, ecosystems and/or agricultural ecosystems and/or human health and safety. See *Declared species*.

Plant – Vegetation of any species and includes the seeds and any part of any such vegetation, or any other form of plant material, but does not include any vegetation or material excluded from the ambit of this definition by the regulations.

Protected area – An area of land and/or sea especially dedicated to the protection and maintenance of native biodiversity and associated natural and cultural resources, that is managed through legal or other effective means.

Protected area network – Refers to the protected area system and the adjoining areas of native vegetation that protect and connect individual protected areas in the landscape.

Protected area system or reserve system – These terms generally refer to the same group of protected areas and in South Australia it includes the formally protected areas under these categories: all reserves constituted under the *National Parks and Wildlife Act 1972* and *Wilderness Protection Act 1992*; native forest reserves constituted under the *Forestry Act 1950*; conservation reserves constituted under the *Crown Lands Act 1929*; a Heritage Agreement registered on private land under the *Native Vegetation Act 1991* and Indigenous Protected Areas established by agreement with the Australian Government.

Regional NRM board – A body established under Chapter 3 Part 3 and includes a body appointed under that Part to be a regional NRM board under the *Act*.

Regional NRM plan - A plan prepared by a regional NRM board under Chapter 4 Part 2.

Rehabilitation – Actions that improve the ecological health of a natural asset by reinstating important elements of the environment that existed prior to European settlement.

Remediation – Actions that improve the ecological condition of a natural resource without necessarily reinstating elements of the environment that existed prior to European settlement.

Restoration – Actions that reinstate the pre-European condition of a natural resource.

Stormwater – Runoff from an urban area.

Surface water – Water flowing over land (except in a watercourse) after having fallen as rain or hail or having precipitated in any other manner, or after rising to the surface naturally from underground. Water of the kind referred to in the previous sentence that has been collected in a dam or reservoir.

Sustainable or sustainability – Comprises the use, conservation, development and enhancement of natural resources in a way, and at a rate, that will enable people and communities to provide for their economic, social and physical well-being while sustaining the potential of natural resources to meet the reasonably foreseeable needs of future generations; safeguarding the life-supporting capacities of natural resources; and avoiding, remedying or mitigating any adverse effects of activities on natural resources.

Threatened species – Species or ecological community classified as being threatened by extinction and listed as vulnerable, endangered, critically endangered or presumed extinct. In South Australia threatened species are listed in the Schedules of the *National Parks and Wildlife Act 1972*.

Underground water or groundwater – Water occurring naturally below ground level or water pumped, diverted or released into a well for storage underground.

Wastewater – Water that has been used or extracted for domestic or industrial purposes and is then discharged as waste.

Water allocation – In respect of a water licence, this means the water (taking) allocation or the water (holding) allocation endorsed on the licence. In respect of water taken pursuant to an authorisation under Section 128, it means the maximum quantity of water that can be taken and used pursuant to the authorisation.

Water allocation plan – A water allocation plan prepared by a regional NRM board under Chapter 4, Part 2 and adopted by the Minister in accordance with Division 2 of the *NRM Act 2004*. Water allocation plans form part of respective regional NRM plans.

Water for the environment – A catch-all phrase that describes environmental water requirements and provisions. Water for the environment is often referred to as 'environmental flows'. This is a term applicable to most surface waters and was coined before groundwater-dependent ecosystems were identified. Water for the environment applies to both surface and groundwater systems.

Water resource – A watercourse or lake, surface water, underground water, stormwater (to the extent that it is not within a preceding item) and effluent. A reference to a water resource includes all aspects of a water resource, including the water, organisms and other components and ecosystems that contribute to the physical state and environmental, social and economic value of a water resource.

Watercourse – A river, creek or other natural watercourse (whether modified or not) in which water is contained or flows whether permanently or from time to time and includes a dam or reservoir that collects water flowing in a watercourse; a lake through which water flows; a channel (but not a channel declared by regulation to be excluded from the ambit of this definition) into which the water of a watercourse has been diverted, part of a watercourse; an estuary through which water flows; and any other natural resource, or class of natural resource, designated as a watercourse for the purposes of the *NRM Act 2004* by an NRM plan. A reference to a watercourse refers to either the bed and banks of the watercourse (as they may exist from time to time), or the water for the time being within the bed and banks of the watercourse (as they may exist from time to time), or both, depending on the context.

Wetland – An area that comprises land that is permanently or periodically inundated with water (whether through a natural or artificial process) where the water may be static or flowing and may range from fresh water to saline water and where the inundation with water influences the biota or ecological processes (whether permanently or from time to time) and includes any other area designated as a wetland by an NRM plan or by a Development Plan under the *Development Act 1993.* It does not include a dam or reservoir that has been constructed by a person wholly or predominantly for the provision of water for primary production or human consumption, or an area within an estuary or within any part of the sea, or an area excluded from the ambit of this definition by the regulations.



State of the SA Arid Lands NRM Region

1. INTRODUCTION

The SAAL NRM Region is one of eight NRM regions established in South Australia under the *NRM Act 2004*. It is the largest of the NRM regions, comprising approximately 520,000 square kilometres – over 50% of South Australia.

The SAAL NRM Region is shown in **Part 1**, **Figure 1**.

1.1 THE PURPOSE OF THIS PART OF THE REGIONAL NRM PLAN

Every management plan needs to be based upon a baseline of information – what is there, what are the trends, what needs to be managed. This part of the *SAAL Regional NRM Plan* attempts to summarise that baseline for the natural resources of the region. For each of the natural resource categories, the following aspects are considered:

- » Description and special features
- » Management issues
- » Implications of climate change
- » Summary of key points to be addressed in the SAAL Regional NRM Plan.

Climate change is a particularly important factor for consideration and the implications of climate change are a central theme through the entire plan.

The management of natural resources needs to be viewed in the context of cultural, social and economic values and aspirations, as well as environmental sustainability. This part of the plan therefore also summarises cultural, social and economic aspects relevant to NRM planning.

This section of the *SAAL Regional NRM Plan* does not attempt to provide a detailed description of the natural resources of the SAAL NRM Region. Instead it provides an overview of the natural resources of the region based upon existing more detailed documents. In particular, it uses information from the *State of the Catchment Report* (Arid Areas Catchment Water Management Board 2006), the *SAAL Biodiversity Strategy* (DEH and SAAL NRM Board 2008), the *Pest Management Strategy* (SAAL NRM Board 2006), the earlier *Rangelands Integrated Natural Resources Management (INRM) Plan* (INRM Group 2004) and the *District Soil Conservation Plans* prepared in the late 1990s (Gawler Ranges 1996; Kingoonya 1996; Marla-Oodnadatta 1997; Marree 1997; North-East 1997).

2. OVERVIEW OF THE INTERRELATIONSHIP OF NATURAL RESOURCES IN THE SAAL NRM REGION

Historically, there has been a tendency to consider natural resources in a compartmentalised way, eg to consider soil, water and biodiversity as separate entities. Since the 1990s, however, there has been increasing recognition of the interrelationship between natural resources and the need for them to be managed in a more integrated way. This has become a 'foundation stone' in NRM programs.

Nowhere is the need for an integrated approach to NRM more evident than in the SAAL NRM Region.

- » Its soils support its native vegetation.
- » Its native vegetation supports the pastoral industry as well as highly important ecological communities – primary production and biodiversity conservation therefore need to go hand-in-hand.
- » Its water resources support important and often unique natural biodiversity as well as human communities, pastoralism and industry (eg mining).
- » Its natural landscapes and features are of enormous significance from a cultural viewpoint and in providing a basis for the tourism industry.

These linkages are illustrated in **Figure 4**. Again, the central role of climate (and therefore potential influence of climate change) is highlighted.





3. CLIMATE OF THE SAAL NRM REGION

The information in this section is extracted largely from:

- » the State of the Catchment Report prepared by the Arid Areas Catchment Water Management Board (2006) for the SAAL NRM Board
- » the report of the Inter-governmental Panel on Climate Change (2007)
- » Suppiah et al (2006).

Climatic features of the SAAL NRM Region are its low and unpredictable rainfall, hot summers and very low minimum temperatures in winter. Natural biodiversity has evolved to cope with these extremes and human activities, particularly pastoralism, are managed to match the climatic conditions. Recent drought conditions, for example, have led to widespread de-stocking or at least significant reduction in stock numbers.

3.1 RAINFALL

Rainfall is generally less than 250 millimetres/year and average evaporation can be around 3,500 millimetres/year. It takes a heavy rainfall event for water to significantly infiltrate into the ground. Rainfall in the arid areas of South Australia is unpredictable. Consequently there are no reliable averages and averages are not particularly useful. Sometimes there are no significant rainfalls for years. However, when it does rain, it can be local, very heavy and the annual rainfall can fall in one rainfall event.

The localised drying and wetting cycles associated with these unpredictable rain events, and winds associated with climatic pressure changes, are key factors driving both the natural ecosystems and the lifestyles of people who live and work in the region. Aboriginal people, pastoralists and others whose livelihoods depend on the region's resources have learnt to be flexible, opportunistic and mobile, moving to take advantage of desert rain and the response of the country to the rain events.

One of the defining characteristics of the arid areas of Australia is the 'boom and bust' phenomenon. All rain is important, as the environment has evolved to respond quickly to moisture. Vegetation and animals alike grow quickly and reproduce rapidly after rain. Mostly the rivers do not flow at all and long dry periods are the norm. However, heavy rainfall events, either localised or interstate, can cause massive flooding and during these times the rivers in the region can carry at least five times the amount of water flowing in the River Murray. Massive flooding in the Far North is often caused by heavy rainfall events in Queensland or north-western NSW.

The highly variable rainfall events and flow rates in Australia's arid area rivers and wetland systems have resulted in particular biodiversity which drives the ecology of the rivers and wetlands in the SAAL NRM Region.

Rainfall patterns in the region are illustrated in Figure 5.



Figure 5: Average Annual Rainfall for the SAAL NRM Region and Average Monthly Maximum and Minimum Temperatures for Selected Centres

3.2 TEMPERATURE

Summer is hot, with maximum temperatures in the Far North averaging 36-39°C. Winter is mild by comparison with maximum temperatures averaging 18-24°C. July is generally the coolest month. Temperatures are cooler in the Flinders Ranges. Temperatures in the sand hills are often hotter than the plains, rising to the high 50°C range in summer. In winter the temperature can drop well below freezing with frosts occurring on up to 50% of mornings during July and August.

Average monthly maximum and minimum temperatures for selected centres are shown in **Figure 5**.

3.3 WIND

Wind also plays a significant role in the arid areas environment. The Bureau of Meteorology only records events where horizontal visibility is reduced to below 1,000 metres. At Oodnadatta, for example, five storms are recorded on average per annum. The frequency of dust storms is related to ground cover, or the lack of it. Major dust storms are recorded after periods of drought.



Wind plays a significant role in the Arid Lands region with dust storms a regular occurrence after periods of drought

3.4 PREDICTED TRENDS WITH CLIMATE CHANGE

The report *Climate Change in Australia* (Inter-governmental Panel on Climate Change 2007) considers a range of modelling information on potential climate scenarios across Australia up until 2070. Information from that report includes the following:

- » Mean annual temperatures in the arid zone are predicted to increase by 1 to 1.2°C by 2030, by up to 1.8°C by 2050 and by up to 2.5°C by 2070
- » There is a projected "strong increase" in the frequency of hot days and warm nights
- » The frequency of frost is predicted to decrease but not by as much as might be expected in a global warming scenario
- » Changes in rainfall are not directly influenced by rising greenhouse gases but:
 - » A warmer atmosphere can retain more water vapour (thus creating the capacity for heavier precipitation); and
 - » Changes in wind patterns can also affect rainfall patterns

Overall, a decrease in mean annual rainfall is predicted for Arid Lands

- » The frequency of drought is expected to increase
- » Average wind speeds are predicted to increase
- » Increased fire risk is predicted in SE Australia but this aspect has not yet been examined in detail for other parts of Australia.

Suppiah et al (2006) provide more targeted predictions regarding the implications of climate change for NRM regions in South Australia. For the SAAL NRM Region, the following is predicted under the modelling scenarios:

- » Mean annual temperatures to rise by 0.6 to 1.5°C by 2030, and to rise by 1.2 to 4.7°C by 2070
- » Annual rainfall to change by -9 to +1% by 2030, and by -25 to +4% by 2070.

If carbon dioxide stabilisation scenarios are applied, the predicted warming effects and rainfall changes are reduced.

4. CURRENT LAND USE

Land use in the SAAL NRM Region mainly comprises the following:

- » Pastoral enterprises on pastoral leases constituted under the Pastoral Land Management and Conservation Act 1989
- » Mineral and petroleum exploration and development under the *Mining Act 1971* and *Petroleum Act 2000*
- » Conservation through parks and reserves under the National Parks and Wildlife Act 1972
- » Conservation through other reserves and areas under private management, including areas under the custody and control of Aboriginal people and pastoral leases managed for conservation purposes
- » A mixture of land uses on Aboriginal Managed Lands.

Land tenure in the region is illustrated in Figure 6 while land use is shown in Figure 7.

In terms of geographic extent, pastoralism is by far the dominant land use. There are 328 pastoral leases in the SAAL NRM Region, configured into 222 pastoral properties and covering 409,000 square kilometres. The Pastoral Land Management Program of the Department of Water, Land and Biodiversity Conservation provides administrative, technical and scientific support and advice to the Pastoral Board.

Biodiversity conservation is supported across the region through parks and reserves under the *National Parks and Wildlife Act 1972* and managed by DEH – in some cases through a comanagement agreement with Aboriginal people. There are also privately held conservation areas.

Aboriginal managed lands in the SAAL NRM Region include six pastoral leases, one other leasehold property, two protected areas and a number of other smaller properties. The larger land holdings under Aboriginal management or co-management include:

- » Nantawarrina Indigenous Protected Area
- » Witjira National Park (through a co-management agreement with the Minister for Environment and Conservation)
- » Vulkathunha-Gammon Ranges National Park
- » Mt Willoughby
- » Mabel Creek
- » Mt Clarence
- » Finniss Springs
- » Leigh Creek Station
- » Mt Serle Station
- » Nepabunna
- » Emeroo
- » Yappala.

Although much smaller in area occupied, mining and petroleum industries have become an increasingly significant land use in the region. Further comment on this is included in Section 5.





Figure 6: Land Tenure in the SAAL NRM Region



Figure 7: Land Use in the SAAL NRM Region
5. CULTURAL, SOCIAL AND ECONOMIC PROFILE

The information in this section is extracted largely from:

- the State of the Catchment Report prepared by the Arid Areas Catchment Water Management Board (2006) for the SAAL NRM Board
- The Draft Far North Regional Land Use Framework prepared by Planning SA (2008)
- » The State of the Outback Report prepared by the Outback Areas Community Development Trust (2005)
- Census statistics from the Australian Bureau of Statistics
- » Strategy for Aboriginal Managed Lands in SA (2000).

5.1 CULTURAL AND SOCIAL

5.1.1 Indigenous Culture

Traditionally, Aboriginal people have a strong connection with their land and the resources found within it. Water has been an important aspect of their connection in such an arid environment. Water provided food in the form of fish, mussels and plants, and for drinking. Many sites were, and continue to be, extremely important from a cultural and spiritual perspective.

Following the spread of pastoralism into the region, the way in which water is managed has changed dramatically. At some sites, degradation occurred through the activity of livestock and feral animals and, at others, infrastructure such as fencing and stock yards damaged archaeological sites. The once unimpeded travel of the traditional inhabitants became limited by pastoral managers. Political and economic changes also influenced the way in which Aboriginal populations lived, with many moving away from their traditional lands to live on reserves and in towns.

Aboriginal access to pastoral lands has been provided in the past by relevant pastoral lease conditions, and currently by provisions of the *Pastoral Land Management and Conservation Act 1989*. In South Australia Crown land can also be granted under the *Aboriginal Land Trust Act 1966* to the Aboriginal Land Trust, which leases the land to local Aboriginal groups. In the adjacent Alinytjara Wilurara NRM Region, land has been granted as inalienable freehold to traditional Aboriginal owners under provisions of the *Pitjantjatjara Land Rights Act 1981* and *Maralinga Tjarutja Land Rights Act 1984*.

In 1992, the High Court of Australia brought down its landmark Mabo decision, recognising native title (traditional land rights) in Australia. In 1993, the Australian Government passed the *Native Title Act 1993* to give effect to the principles of the Mabo decision. Since then, several native title claims have been lodged for areas within the SAAL NRM Region. The status of native title claims in the region, as at March 2009, is shown in **Figure 8**. In some areas Indigenous Land Use Agreements (registered agreements about native title) have been entered into. Areas subject to Indigenous Land Use Agreements are shown in **Figure 9**.

Within the SAAL NRM Region, Aboriginal people have gained access to land by purchasing a number of pastoral properties in the Far North, often with the assistance of the Indigenous

Land Corporation. In conjunction with these property acquisitions, Aboriginal people are involved in the joint management of Witjira National Park and Vulkathunha-Gammon Ranges National Park. There may be more opportunities for co-management following the recent amendments to the *National Parks and Wildlife Act 1972*. Further, of the 24 Indigenous Protected Areas (IPAs) declared in Australia, three are located in the SAAL NRM Region – Mount Willoughby, Nantawarrina and Mt Serle. In addition, Finniss Springs is Crown land under licence to manage to the Aboriginal Lands Trust.

Planning and strategy documents, such as the *Strategy for Aboriginal Managed Lands in SA*, have identified the following natural resources management issues as being of particular interest or concern to Aboriginal people:

- » Limited engagement of Aboriginal people in traditional practices that support natural resources management
- » Maintaining, sharing and promoting traditional knowledge
- » Protecting and maintaining culturally important sites and items
- » Restoration of degraded land and associated natural resources (eg looking after mound springs, managing feral animals)
- » Preventing further degradation of land and water and loss of biodiversity
- » Pollution/siltation of rock-holes
- » Environmental dust
- » Management of public access (eg to sensitive areas)
- » Protection and re-establishment of plants and animals used for bush tucker, medicine, fuel-wood and in arts and crafts
- » Economic development and use of the land for self-sufficiency
- » Sustainable pastoralism involving Aboriginal people
- » Development and maintenance of ecotourism for economic return and to improve understanding of and respect for culture and country.

During the preparation of the *SAAL Regional NRM Plan* there was targeted consultation with a number of Aboriginal communities in the region. That consultation showed that many of the above issues are still of significant concern to Aboriginal people. It also showed other emerging issues that are of concern to Aboriginal people, such as camel control and climate change.

The SAAL NRM Board has embarked on a range of activities to support Aboriginal communities in natural resources management. Several of these activities have been part of general programs across the region such as for pest control and water resources management. In addition there have been activities with a specific focus on engagement of Aboriginal communities in natural resources management. The Board has an Aboriginal Engagement Officer, prepares and distributes a targeted community newsletter, and assists the community to develop projects that meet their needs. In addition, there is ongoing work to incorporate collection and use of traditional indigenous knowledge.





5.1.2 European Settlement

The Flinders Ranges and the North East were the first areas of the SAAL NRM Region to be settled. They were also the first to experience the effects of the inappropriate land tenure and use applied at the time. Droughts crippled the small land holdings in the late 1800s and, even after the First World War, the Government actively supported the cut-up of larger holdings in the North East, and high stocking rates were encouraged during the years of reconstruction between 1910 and 1940.

In the Far North, the discoveries of the springs at the western and southern margins of the Great Artesian Basin (GAB) provided a springboard for exploration and pastoral settlement, and the desert rivers system provided intermittent but sometimes quite extensive surface water supplies.

The unsuccessful approaches to farming (cropping etc) in the Flinders Ranges and North East region changed the way the outer areas (the Far North) were settled. People did not attempt to farm these areas and thus protected them from clearing.

The first recorded GAB bore in South Australia was drilled at Tarkaninna, 56 kilometres north-east of Marree, in the 1880s. The implications for the fledgling pastoral industry of the Lake Eyre Basin of the discovery of the GAB were profound, not the least being the potential ability to drought-proof the designated travelling stock routes which were used to walk stock south towards markets in and near Adelaide.

There were four stock routes that traversed the region. Easily the biggest beneficiary of the new water source was the Birdsville to Hergott route (better known as the Birdsville Track) that catered particularly for cattle travelling from Queensland's channel country to the Marree (Hergott) railway yards. The bores complemented the semi-permanent water holes on the Diamantina and Warburton Rivers south of Birdsville, and the base supply at the Marree bore.



Streetscape; undoubtedly one of the most unique towns in Australia, Coober Pedy has a population of 3,500 people many of whom live underground

5.1.3 Townships

The population in the arid areas is sparse. However populations increase dramatically during peak tourist season. The towns in the SAAL NRM Region are listed in **Table 1**, along with (where available) their current population.

Table 1. Townships and Populations – SAAL NRM Region(2006 Census, 2001 figures in brackets)

FAR NORTH	GAWLER RANGES	FLINDERS AND NORTH EAST
Oodnadatta 277 (160)	Andamooka 528 (600)	Beltana 83 (~20)
William Creek ~10	Glendambo 77 (30)	Blinman 151 (~25)
Marla 72 (140)	Tarcoola 38 (~ 2)	Cockburn 90 (~38)
Innamincka 131 (~15)	Woomera 295 (< 200)	Copley 104 (~100)
Coober Pedy 1,472 (3,500)	Iron Knob 199 (~ 200)	Hawker 361 (~300)
Marree 70 (150)	Roxby Downs 4,055 (4,200)	Leigh Creek South 548 (~300)
		Lyndhurst (~20)
		Yunta 104 (~70)

Towns were established in response to differing imperatives. Most of the towns of the Flinders Ranges and North East were originally developed as service and supply points along the two major inland railways.

The township of Roxby Downs was established in 1987 with the development of the Olympic Dam mine. Roxby Downs has its own council, created under the *Roxby Downs Indenture Ratification Act 1982*. Coober Pedy was established following the discovery of opal in the Stuart Range. Marree, William Creek, Oodnadatta and Marla were established to support rail or road transport corridors, and Innamincka was surveyed around a police and tax-collecting presence. Coober Pedy has a designated council while the other districts are unincorporated areas with facilities controlled by Community Progress Associations under the Outback Areas Community Trust.

The majority of centres in the Far North have steady populations while the town of Marree is in decline (Northern Regional Development Board, 2000), although influxes of tourists during peak times increase populations.

5.1.4 Regional Infrastructure

The following information is extracted from the Far North Regional Land Use Framework (Planning SA 2008).

Road and rail networks linking Adelaide to Darwin and Sydney to Perth cross the region and converge at Port Augusta. These networks are also of strategic importance to the State. South Australian Government road and rail networks that are important to freight and tourist movements include Pimba to Roxby Downs/Olympic Dam (primary freight route), Port Augusta to Moomba via Leigh Creek (secondary freight route), Peterborough to Port Augusta and Hawker (secondary freight route), Leigh Creek to Marree, Birdsville Track, Oodnadatta Track and the Strzelecki Track. In addition, a comprehensive network of public and private unsealed roads serves mining operators, pastoralists, tourists and local communities. Mining exploration and development has led to a significant increase in roads in the region.

The region generates the largest intrastate freight task outside Adelaide, and an estimated 40% of the interstate freight task moves through the region. Increased mining and defence activities will see both volumes of freight and the sizes of vehicles grow substantially.

In conjunction with the proposed expansion of Olympic Dam, BHP Billiton is considering construction of a rail line from Pimba to Olympic Dam, and a private haul corridor between the Upper Spencer Gulf and Olympic Dam.

The cost of maintaining unsealed roads in the Far North is significantly greater than for roads in metropolitan areas. Heavy storm and water flow events occur regularly across the region, making roads impassable and resulting in costly reconstruction of both sealed and unsealed roads. Increasing the level of flood immunity of roads in flood prone areas is a priority.

Airports catering for scheduled regional air services, significant charter services or defence requirements include Coober Pedy (council owned), Woomera (Defence), Moomba, Leigh Creek, Olympic Dam/Roxby Downs, Prominent Hill and other mining company aerodromes. The South Australian Government is identifying a network of strategically located aerodromes to provide all weather 24 hour access for medical emergencies. These include Hawker, Balcanoona, Marla, Glendambo, Marree, William Creek, Oodnadatta, Innamincka, Manna Hill, Mungerannie, and Amata.

Water supply and quality is a critical issue for infrastructure. Coober Pedy and Roxby Downs are supplied with desalinised water drawn from the Great Artesian Basin. Woomera is supplied with water from the River Murray. SA Water manages water supplies for Oodnadatta (from the GAB), Marree and Marla (from shallow aquifers within the Far North Prescribed Wells Area), and Parachilna, Blinman, Cockburn, Mannahill, Yunta and Olary (from shallow aquifers outside the GAB). Other settlements rely on community maintained bores and rain water. Dams, tanks and bores support stock on pastoral leases. Investigations into the feasibility of developing desalinisation plants at Whyalla and Port Augusta are underway. **Energy supplies** vary across the region. Roxby Downs, Woomera and Leigh Creek are supplied by the Port Augusta power stations. Most Outback towns rely on diesel generators with a number of communities exploring small scale hybrid plants based on renewable energy (solar, wind) and gas/diesel. A \$7.1 million solar power station is to be built at Coober Pedy, generating 13% of the town's energy to complement current diesel generated supplies. The feasibility of developing windfarms near Port Augusta to supplement peak supplies is also being assessed. Energy supplies will need to be expanded significantly to meet the needs of mining operations, particularly the proposed Olympic Dam Expansion. The South Australian Government is working with mining companies to identify potential sources. Geothermal technologies are being explored, as is the feasibility of tapping into the gas supplies from Moomba for mines within the vicinity of the Moomba to Adelaide pipeline.

Wastewater varies across the region. Roxby Downs is fully sewered. Community Wastewater Management Schemes (CWMS) at Oodnadatta and Marla are maintained by the Outback Areas Community Development Trust (OACDT). Coober Pedy also has a local scheme but only the main street area of the town is sewered. Systems in other towns are basic and are managed by local progress associations.



5.2 ECONOMIC ASPECTS

The economic prosperity of the SAAL NRM Region relies heavily on three industries: mining, pastoralism and tourism. Other industries, such as building and construction, are also significant in several localities in the region.

5.2.1 Mining Industry

The SAAL NRM Region currently accounts for 70% of South Australia's mining outputs and generates in excess of \$3 billion annually to the South Australian economy. Expenditure on mineral exploration in the State has increased from \$32.5 million in 2001-02 to \$260.7 million in 2006-7 (Planning SA 2008). The SAAL NRM Region has been the focus for much of this activity.

Gas and oil production and exploration, centring on the Cooper and Eromanga Basins, is expanding. Since the 1970s cumulative petroleum sales from this region have totalled \$21.3 billion. More recently, in just two years, investment in exploration has doubled. Interest in a unique heat flow anomaly under the east of the region has also seen a rapid rise in interest in geothermal energy, with more than 100 applications for exploration being lodged (Planning SA 2008).

The proposed \$7 billion Olympic Dam expansion would be a significant contributor to continued growth of the region. The expansion would make Olympic Dam one of the largest mines in the world and would directly employ around 2000 permanent workers and more than 1000 contract workers. The proposal is subject to a formal Major Development Assessment process by the SA Government (Planning SA 2008).

In addition to the above, it is noted that Leigh Creek coal mine has been a major industrial activity and economic driver in the region for more than three decades.

While mining operations usually have a limited life and cannot be treated as sustainable in the same context as some other industries, it is clear that there is very substantial scope for the mining industry to partner with other NRM stakeholders for agreed natural resources management outcomes.

5.2.2 Pastoral Industry

Pastoral activity in the SAAL NRM Region is based on both sheep and wool production and beef production. The value of output generated directly by pastoral activity in the region in 2002/03 was estimated to be \$77 million. The region's pastoral industry was responsible for the direct employment of approximately 625 people in South Australia in 2002-03 with a total household income of \$15 million. Flow-on business activity was estimated to have generated a further 492 jobs and household income of \$20 million to give total employment of 1,118 jobs in the State.

Direct revenue generated in South Australia by the SAAL NRM Region pastoral industry was estimated to be \$36 million. Associated with this was flow-on value added in the other sectors of the State economy of \$42 million. The flow-ons were greatest in the business services (\$8 million), manufacturing (\$4 million), trade (\$6 million) and transport (\$3 million) sectors.

In total, the SAAL NRM Region pastoral industry was estimated to have contributed \$78 million or almost 0.2% of South Australia's Gross State Product in 2002-03.

5.2.3 Tourism

The SAAL NRM Region is one of the State's premier tourism destinations. In 2002, the Flinders/South Australian Outback tourism region attracted 594,000 overnight visitors who stayed nearly 2.1 million nights in the region (1,193,000 nights in the Flinders and 886,000 nights in the Outback) (AACWMB 2006).

In 2006, 962,000 people visited the region (including Pt Augusta and environs), with visitors staying more nights than in any other tourism region of the state except Adelaide. Tourists to the region tend to be young activity seekers, young (15-29 years) overseas backpackers and 'grey tourers'. Indeed, the growing market segment of older non-working couples accounted for nearly a third of all visitors to the Outback (Planning SA 2008).

Tourism is critical to the survival of many Outback towns and a major contributor to the South Australian economy. Income just from accommodation in the Far North Region generated \$27.6 million in 2006. The industry directly provides 961 jobs (or 8% of regional employment) with many more indirect jobs in sectors such as retail. Tourism SA is working with local Councils, communities and tourism operators to develop strategies to further increase visitor numbers and expenditure in the region (Planning SA 2008).

Many points of interest in the South Australian Outback are located on pastoral lands and many pastoralist are now securing additional income through tourism ventures on their leases. In 1989, the *Pastoral Land Management and Conservation Act* was revised, in particular, rules relating to public access, whereupon a series of public access routes were established. Originally around 30 public access routes were proposed, but only eight initially gazetted due to a lack of resources allocated to this process. The Year of the Outback in 2002 stimulated more interest in this issue, and a Public Access Consultative Committee and Working Group were formed. An immediate result was the addition of a further ten public access routes. However issues remain, including funding the maintenance of public access routes.

Priority Issues for Economic Development

Planning SA (2008) identifies the following priority issues relating to economic development.

- » Expanded mining activities and support industries are bringing employment opportunities to the region, but are also leading to a loss of people from towns to work in the mines.
- » Need to ensure sufficient supply of industrial and residential land in Port Augusta and Coober Pedy so they are well positioned for opportunities arising from new mining activities.
- » Decreasing employment opportunities in the pastoral industry and a shift from family to corporate ownership, including mining companies and Aboriginal companies.
- » Need for economic diversity to provide resilience to boom and bust cycles of mining industry.
- » Future development needs to support retention of the unique character of towns and pristine environments as these are critical to the tourism industry.
- » Need to attract and retain a skilled workforce (health professionals, police, trades) including through provision of affordable housing and rental accommodation – to ensure ongoing services in towns to counter loss of people to the mining industry.

Although not highlighted in the Planning SA report, waste management is also an increasing issue in the region. There are waste management issues and impacts associated with townships, tourism and mining development and only limited regional infrastructure to deal with this.

The State of the Outback Report (OACDT 2005) also includes a number of pertinent comments regarding the social and economic frameworks relating to natural resources management in the region. For example, the report concludes that:

Strengths

- » There is a strong regional 'Outback' culture and strong identification with the local community/township
- » Regional bodies are dynamic and progressive
- » Those who are employed are comparatively well-paid
- » There has been a steadily declining unemployment rate and growing diversity of employment
- » Improving communications and transport infrastructure is reducing the tyranny of distance
- » Strong adoption of renewable energy is leading to more-reliable power supply
- » The region is rich in mineral resources

Weaknesses

- » There are dichotomies within the population between 'haves' and 'have nots'
- » Physical remoteness means high cost-structures and management costs, poor public transport
- » There is over-reliance on a few, traditionally male-dominated industries
- » There is growing reliance on income support
- » The vastness and remoteness of the region puts a significant amount of pressure on resources required to managed this area
- » Poor condition and non-standardisation of infrastructure adds to maintenance challenges
- » There are deficiencies with some communications infrastructure
- » Very little recycling occurs in the SA Outback, mainly due to the large distances
- » There is little land designated and available for housing, despite the vastness of the region
- » There is a risk of 'burn-out' of community leaders
- » Declining community populations jeopardise the provision of services needed to support the regional economy (eg tourism)
- » High fuel costs undermine the region's economy and the wellbeing of its people, and constrain the ability of people to volunteer for community roles.

5.3 KEY PARTNERSHIPS AND RESPONSIBILITIES IN REGIONAL NATURAL RESOURCES MANAGEMENT

A fundamental purpose of this NRM Plan is to foster effective partnerships among those who have responsibility for natural resources management in the SAAL NRM Region and among those who have an association with the region through common interests in natural resources management. Those with important roles, responsibilities and linkages with the region include the following:

- » The SAAL NRM Board and its sub-regional NRM Groups with broad responsibilities for NRM actions, community engagement, overall coordination etc
- The broad regional community, in adopting sustainable practices in natural resources management and in supporting and participating in programs and projects as groups and individuals. There is already substantial community involvement in NRM activities and issues through the region, for example through progress associations, other local groups, Friends of Parks groups and through individual and joint efforts not linked with formal groups. These involve local people and others from outside of the region. Many are actively supported by the Board and by other community based organisations.
- » Aboriginal communities in managing land, in maintaining practices, traditional and otherwise, that support sustainable natural resources management, and in passing on knowledge regarding natural ecosystems and management practices
- » Industry groups, with the pastoral, tourism, mining and petroleum sectors being particularly significant in the region
- » Community and industry organisations such as the Outback Areas Community Development Trust (OACDT), the Aboriginal Lands Trust (ALT), SA Chamber of Minerals and Energy (SACOME), several Aboriginal Groups and several Progress Associations
- » Other non-government organisations (NGOs) in, or with links with, the region
- » Tertiary bodies and research organisations
- » Local Government, particularly the District Council of Coober Pedy and the Municipal Council of Roxby Downs
- » Peak bodies identified in the NRM Act 2004: the Local Government Association, Conservation Council of SA and SA Farmers Federation
- » Other regional NRM Boards, particularly those adjoining the SAAL NRM Region (ie Alinytjara Wilurara, Eyre Peninsula, Northern and Yorke, SA Murray Darling Basin)
- » Australian Government agencies such as the Department of Environment, Water, Heritage and the Arts; Department of Resources, Energy and Tourism; Department of Defence; and the Department of Agriculture, Fisheries and Forestry

- State Government agencies, such as the Department of Water, Land and Biodiversity Conservation (DWLBC); Department for Environment and Heritage (DEH); Primary Industries and Resources SA (PIRSA); Division of Aboriginal Affairs and Reconciliation (DAAR); SA Tourism Commission (SATC); and Department for Transport, Energy and Infrastructure (DTEI)
- » Government agencies in other States, for example, there has been collaboration with the Western Australian Government regarding camel control and other NRM issues
- » Statutory bodies such as the Pastoral Board and the Native Vegetation Council (NVC)
- » National bodies such as the Lake Eyre Basin Community Advisory Committee and the Great Artesian Basin Coordinating Committee
- » Friends Groups under the National Parks and Wildlife Act 1972 (eg Friends of Arid Recovery, Friends of the Simpson Desert, Friends of Mound Springs).

While there is undoubtedly scope for improved partnerships and collaborations, a number of productive partnerships have already been forged and many more are evolving, particularly through programs undertaken, coordinated or promoted by the SAAL NRM Board. Community and industry groups have also been proactive in promoting partnerships.

SUMMARY OF KEY NRM ISSUES RELATING TO CULTURAL, SOCIAL AND ECONOMIC PROFILE IN THE SAAL NRM REGION

Major Regional Assets

- » The people of the region
- » The cultural features (Aboriginal and post-European settlement)
- Industries (particularly mining, pastoralism and tourism) and the natural resources that underpin those industries
- » Infrastructure supporting the people and industries of the region

Key Risk Factors Requiring Management

- Ensuring that regional people have the information, skills, motivation and resources to manage natural resources appropriately
- » Protection of cultural features from inappropriate land use
- » Ensuring that potential sustainable industries such as pastoralism and tourism are sustainable with minimal impact upon natural resources
- » Ensuring that more exploitative industries such as mining have minimum practical impact upon natural resources and are offset by actions to achieve positive environmental outcomes
- » Ensuring that regional communities and industries are well placed to adapt with climate change

6. STATUS AND CONDITION OF NATURAL RESOURCES IN THE SAAL NRM REGION

The information in this section is extracted largely from:

- the State of the Catchment Report prepared by the Arid Areas Catchment Water Management Board (2006) for the SAAL NRM Board
- » the Pest Management Strategy (2006) prepared for the SAAL NRM Board
- » District Soil Conservation Plans prepared by the former District Soil Conservation Boards in the late 1990s.

6.1 LANDSCAPES, GEOLOGY AND SOILS

6.1.1 Description and Features

The SAAL NRM Region contains approximately 520,000 square kilometres, which is over 50% of South Australia. Landscapes in the area range from sandy and gibber stone deserts and breakaway country in the Far North, to the rounded ranges and volcanic outcrops in the Gawler Ranges, and the mountainous northern Flinders Ranges in the east. Ephemeral saline lakes are present across most of the study area.

In northern South Australia, distinctive arid landscapes prevail. Folding and faulting of all rocks, which occur due to movement of the earth, have a strong influence on the landforms produced and the direction of surface and groundwater drainage. In the Flinders Ranges, groundwater is mainly found in fissures and joints of crystalline fractured rock aquifers. Further north, long periods of tectonic extension have formed large sedimentary basins, which infill with sediments and can be water bearing, such as the GAB. Granite outcrops in the Gawler Ranges area form historic and current water catchment areas as well as tourist attractions (AACWMB 2006).

Geology

This section comprises an extract from the State of the Catchment Report (AACWMB 2006).

Over 600 million years ago (Upper Pre-Cambrian era), an area which can be traced through the Mount Lofty and Flinders Ranges and beyond the northern regions of the State, was depressed below sea level to form a long, narrow trough through which the sea entered – now described as the Adelaide Geosyncline. As with all geosynclines, the trough over many years collected sediments laid down in the water until episodes of earth movement caused the trough to buckle and uplift. This process produced the highland chain of the Mount Lofty and Flinders Ranges.

Further to the west, sediments were laid down on a more stable flat area located west of the Adelaide geosyncline and Lake Torrens, known as the Stuart Shelf. The Stuart Shelf contains the Roxby Downs copper-uranium-gold ore body. Further west again are the Gawler Ranges, which lie within the Gawler Craton, an ancient stable land mass extending from Port Lincoln to Tarcoola and including some of the oldest rocks in SA. Older sedimentary basins, which initially formed in South Australia, are the Warburton, Officer and Arrowie. Following these, between 230 and 280 million years ago, the Pedirka, Arckaringa and Cooper Basins formed, then the Eromanga Basin. Economically important deposits of liquid petroleum and natural gas have been found in the Eromanga basin and the underlying significant Cooper Basin.

Until about 180 to 230 million years ago (late Mesozoic), Australia had remained part of Gondwanaland. From about 180 million years ago, the supercontinent began to break up, and sediments of the Eromanga basin were deposited in a shallow continental sea around 180 to 65 million years ago. The seas retreated leaving behind a series of thick saucer shaped basins filled with silt and sand. Over time these have turned into shales and sandstones which trap or act as a conduit for the artesian water now of such social, economic and environmental importance

The Great Artesian Basin occurs in these sedimentary rocks. The boundary of the GAB is shown in **Figure 13**. The south-eastern margin of the GAB underlies the Frome Embayment, east of the northern Flinders Ranges. The entire GAB covers an area of 1.7 million square kilometres, which is about one fifth of Australia's land mass.

Tectonic activity caused tilting of the strata in eastern Australia somewhere between 5 to 15 million years ago, forming highland areas (such as the Great Dividing Range) and exposing the GAB sediments, through which recharge from rainfall occurs. A thin sedimentary blanket extending in age from 55 million years to the present, known as the Lake Eyre Basin, overlies most of the GAB. The Lake Eyre Basin contains the major surface water drainage systems of the Cooper and Diamantina systems. These systems infrequently flood with water sourced from interstate rainfall.

The gibber deserts of the Far North are broken and weathered duricrust which cap and protect an underlying softer surface highly susceptible to erosion. This is particularly seen west of Lake Eyre where the duricrust has been dissected by stream erosion to form the spectacular break-away country. This can be observed in the Arckaringa Hills and around Coober Pedy. During the formation of the duricrusts (during mid-Tertiary times), silicabearing solutions deposited the precious gemstone material within rocks on the western edge of the GAB, forming SA's principal opal fields, Coober Pedy and Andamooka.

Millions of years ago, the Far North was lush with vegetation and numerous freshwater lakes and water courses supporting numerous fauna. The large salt pans of northern South Australia were fresh water lakes in those wetter, warmer days, and the ancestral Lake Eyre formed an extensive inland sea. Lake Eyre, which currently forms the terminus of an extensive area of surface drainage (namely the Lake Eyre Basin) has always been a centre of inland drainage, with no outlet to the sea. Lake Torrens, however, probably drained to the sea at the head of the Spencer Gulf before the connection was severed approximately 200 million years ago. Lake Frome has always been landlocked.

Soils and Land Systems

Reflecting its complex geology, the SAAL NRM Region has a broad range of soil types, including:

- » Flat gibber tablelands with gilgais and light dispersive soils often with a cover of grasses and chenopod shrubs
- » Extensive sand dune systems with woodland and shrubland vegetation
- » Eroding shales and saline soils creating distinctive 'breakaway' country
- » Claypans and floodplains
- » Stony tablelands and downs with clay-loam soils
- » Skeletal soils in range country
- » Areas of alluvial plains with solonized brown soils in the outwash of range country with woodland, scrubland and shrubland vegetation
- » Calcareous and non-calcareous plains with woodland, scrubland and shrubland.

The land systems of the SAAL NRM Region are illustrated in **Figures 10 to 13**.







Figure 11: Land Systems, Marree-Innamincka NRM Group Area

ALE Alerumba ANT Antro NC Anzac ARR Arrowie BAG Bagalowie BAR Ballara BEL Beltimore BEG Benagerie BEN Benda BM Bimbowne BLA Blanche BRA Braemar BUR Burr 000 Coonarbine CON Corona 0.0 Diorah EAS East Whydown ERI Eringa ETI Etina EUR Eurinilla RT Fitton FRE Freeling CAM Gammon GLW Glen Warwick Grindstone GRU HEM Hemming HD Hideaway LEN Lennard LOC Lockhart BAAN! Mandarin MAD Manunda ML Milang MOR Morris MUM Mumple MUW Mundawatina MUN Mundi Munyallina MUY MUT Mutooroo MYR Myrtie NAK Nackara OAK Oakvale QLA Olary ARO Orama ORT Oratan QUL. Oulnina PAR Parachilna PAD Paradise PRR Parara PTO Paratoo PEA Pearce PIT Pitcaim 54 Salta SAN Sandyoota SC Siccus SOU



Figure 12: Land Systems, North Flinders NRM Group and North East Pastoral NRM Group Area



6.1.2 Management Issues Relating to Soils and Geology

Historically, until the formation of the SAAL NRM Board in 2004, soil management was principally the responsibility of Soil Conservation Boards:

- » Gawler Ranges SCG
- » Kingoonya SCB
- » Marree SCB
- » North East Pastoral SCB
- » Marla-Oodnadatta SCB
- » Northern Flinders SCB
- » Eastern Districts SCB.

Each board prepared a District Soil Conservation Plan identifying the factors affecting soil condition in the district and setting out programs and priorities for management. The following information is extracted from those plans.

Unlike the NRM regions to the south, the SAAL NRM Region has not experienced broadscale clearance to a significant extent, with the exception of localised areas in and near the Flinders Ranges and associated with mining sites and urban centres. For the most part the native vegetation cover has been retained – over an estimated 95% of the region. At the same time, there has been a long history of grazing which has had some impact upon soil condition.

Changes in rangeland condition, whether as improvement or otherwise, can occur rapidly or accumulate over a long term. They can be a result of a single event, for example a fire, a brief episode of over-stocking or rabbit grazing at the onset of drought conditions, a localised heavy rainfall, hailstorm or a major flood occurrence.

Longer term changes can be driven by climate variation. For example, the almost continuous series of droughts from the turn of the century to the late 1940s contributed to loss of rangeland condition over much of arid SA. Less arid seasons later in the 20th century aided improvement in condition.

A decline in soil condition or stability often results in soil erosion, either by wind or water. This in turn can affect vegetation productivity, further compounding the erosion problems.

Wind Erosion

Wind erosion occurs where soil surface protection is low and soil particles are small enough to be moved by the wind (often referred to as drift). The major cost of wind erosion to the land manager is the loss of fine soil particles and organic matter, with a corresponding loss of nutrients. The loss of the most productive part of the soil reduces the productivity of the site and increases its susceptibility to further erosion. The sand blasting effect of eroding soil may damage plants, particularly seedlings. Soils prone to drift are the sandy soils of the sand plain and dune land systems. The areas in the SAAL NRM Region with sandy soils are highly susceptible to wind erosion.

Water Erosion

Water erosion is a natural process of soil movement that involves both removal and deposition and occurs in a variety of forms – sheet, rill (small gutters) and gully erosion. It occurs through the action of rainfall, runoff and seepage and can be exacerbated by topography, poor land management or infrastructure placement.

Where the protective stone cover has been removed, gully erosion can result from high intensity rainfall events. Creek systems are prone to natural erosion, especially following high intensity rainfall events. Land systems particularly prone to gully erosion include Breakaway, Coongra, Crispe, Wilyunpa and Oodnadatta, and upland areas such as in the Gawler, Flinders and Olary Ranges.

6.1.2.1 Factors Affecting Soil Condition

Management issues affecting the soils of the region therefore revolve around factors that affect native vegetation cover and condition. These factors include:

- » Total grazing pressure by stock and pest herbivores
- » Other pest animal species that affect vegetation health or soil condition
- » Pest plants
- » Infrastructure placement.

These are discussed below. Soil compaction, such as sometimes associated with mining and tourism ventures, can also affect soil condition but usually on a localised scale.

While the comments following tend to focus on soil issues, virtually all of the issues are also relevant to biodiversity conservation. Thus there is a direct link between this discussion and section 6.3.2, which focuses on management issues affecting biodiversity in the region. Many of the comments following refer to the effects of management issues upon both soils and natural biodiversity.

(a) Total Grazing Pressure

The two main factors most directly influencing rangeland condition are the seasonal conditions and the total grazing pressure. This includes domestic stock, native animals, rabbits, other feral herbivores and insects. It is important to separate these factors when assessing changes in rangeland condition.

As a rough measure for comparison, some equivalents with respect to impact from grazing are as follows (taken from the *Marla-Oodnadatta District Soil Conservation Plan 2002*):

CATTLE	CAMEL	BRUMBY	DONKEY	KANGAROO	SHEEP	RABBIT
1	1	1	2	8	7	80

Therefore one camel eats as much as eight kangaroos or seven sheep. Although not included in this comparison, goats also have severe impacts in the region and are a particular problem in the arid ranges where access for control is difficult (see below).

Indicators of high grazing pressure are:

- » Loss of the more palatable perennial species and/or remaining perennial species in poor condition
- » Replacement of perennial species with annual and ephemeral species
- » Replacement of palatable species with less palatable species, eg Replacement of bladder saltbush by copper-burr
- » Bare unstable soil surfaces with associated water and wind erosion, and
- » Increased grazing of normally unpalatable species
- » Increased weed infestation (in some situations).

Grazing pressure is generally highest where stock and other animals congregate, such as watering points and dam catchments. High grazing pressure and excessive or poorly positioned watering points in relation to fencing and topography, can be major causes of poor rangeland condition. Grazing behaviour can also be important in affecting vegetation and soil condition and hoof impacts can also be significant in terms of soil surface stability.

(a-1) Stock (Cattle and Sheep) Management

The production of cattle and sheep in this region is solely dependent on native vegetation as the grazing resource. There are virtually no improved exotic pastures as have been developed in the agricultural areas of the State. The sustainable management of the land therefore aims to conserve the condition of the rangeland, which includes:

- » Plant density
- » Plant diversity
- » Mixed age stands of vegetation
- » The vegetation's ability to respond to seasonal influences
- » Soil stability and structure.

Plants are used as indicators of rangeland condition or the 'health' of the vegetation or pasture. The grazing impact on palatable species needs to be managed so that these species are maintained. Vegetation diversity, vegetation cover and the susceptibility of soils to erosion is determined by land capability, and previous and current land use and management. Extreme weather conditions, such as thunderstorms, hail, fire or a run of drought years, influence the potential condition of the land, affecting nutrient cycles and the dynamics of the ecosystem.

The legal framework for management of pastoral land comprises the *Pastoral Land Management and Conservation Act 1989*, administered by the Pastoral Board and its support staff in the DWLBC. Activities in this program include pastoral inspection, assessment and monitoring aimed at maintaining or improving the condition of pastoral leasehold land. Lease assessment includes gathering information on plant composition and abundance, grazing impacts and other forms of disturbance, soil surface cover and soil erosion. An overall assessment is then made regarding the sustainability of current management practices or the need for remedial action or changes in management practice.

In recent years, most of the pastoral country in the region has suffered several very dry years. Pastoral lessees have responded by substantially reducing stock numbers and completely de-stocking in some cases.

(a-2) Pest Animals – Herbivores

Pest management has been undertaken in the SAAL NRM Region for many decades as the impacts of pests progressively became evident, particularly to pastoral production. In recent decades, growing awareness of the impacts of pest plants and animals to biodiversity and ecosystem functioning has added impetus to pest management programs for environmental outcomes. Most pest species present in the region have been introduced, although over-abundant native species also cause problems in some cases.

Feral and other pest species may compete directly with livestock or native wildlife for forage, or may impact on areas which livestock do not utilise. They can contribute significantly to land degradation. Lessees and land managers have legal obligations under the *Natural Resources Management Act 2004* to control populations of proclaimed pest animals. The SAAL NRM Board and support staff within DWLBC, DEH and PIRSA work with landholders to undertake pest control programs consistent with State policies.

Pest animal herbivores of significance in the region are briefly discussed below. The information is extracted from the SAAL NRM Board (2006) *Pest Management Strategy* 2005-2010.

Impacts - Introduced Pest Herbivores

Feral herbivores such as rabbits, camels, goats, horses and donkeys add to total grazing pressure. Their impact varies with pest density and species, vegetation type, location and season, ranging from widespread subtle changes to extreme vegetation removal. These species can also degrade water quality, damage riparian habitats and deplete water reserves. This is a major issue in a region where water resources are relatively scarce and highly significant to the survival of native species and for livestock production. Often, naturally occurring water resources are also important tourist destinations and are culturally significant to Aboriginal people.

Rabbits, goats and camels are currently considered the most damaging of the feral herbivores present, due to their range, total numbers present and reproductive potential. Rabbits are widely distributed throughout the entire SAAL NRM Region, camels are mainly limited to the northern and western portions, and goats are mainly limited to the Flinders and Gawler Ranges and areas in the east of the region south of the Dog Fence.

Rabbits generally remain within a small home range. When in high numbers rabbits have devastating and very visual impacts on vegetation, with impacts on entire ecosystems and pastoral production. At low numbers the impacts of rabbits are less noticeable but still significant eg recruitment of palatable species is suppressed as a result of selective grazing by rabbits; and for mulga, rabbit numbers as low as one per square kilometre can remove all seedlings. Competition and land degradation by rabbits has been listed as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999*.

Goats have rapid reproduction potential and are well suited to less accessible areas such as ranges. They prefer to browse palatable species but can exist on a wide range of vegetation. These characteristics can result in a disproportionate amount of damage to some species and have the potential for long-term vegetation species loss from infested areas. The Dog Fence generally limits the distribution of goats with predation by dingoes preventing further spread into the north of the region.

Camels are highly mobile and may range over hundreds of kilometres browsing selected vegetation species. Edwards et al (2004) estimated the population in 2001 to be 300,000 nationally, predicting it would increase at about 10% per year. The Desert Knowledge Cooperative Research Centre estimates the camel population to be approximately one million in 2010. Grazing pressure and damage to fencing from feral camels has been noted although little research has been undertaken to quantify this impact.

Pigs are limited in their distribution in the SAAL NRM Region because of a lack of a suitable habitat and access corridors, but they have demonstrated the capacity to move large distances when conditions permit. They have been recorded on river systems in the north-east of the SAAL NRM Region and along the Murray Darling system in the SA Murray Darling Basin NRM Region. They are also known to occur in western NSW and may enter the SAAL NRM Region from Queensland or New South Wales in wet years. Feral pigs are omnivores with potential to impact vegetation due to grazing and animals due to predation of frogs, lizards, snakes, turtles and ground-nesting birds. They also degrade riparian areas by disturbing soil and vegetation. There is potential for feral pigs to spread exotic diseases, particularly foot-and-mouth disease (if it entered Australia), which could have disastrous consequences for the SAAL NRM Region cattle industry and the Australian meat export market as a whole in the event of an outbreak. Feral pigs are also vectors of diseases and parasites that can affect livestock and humans, including leptospirosis, brucellosis, melioidosis, tuberculosis and sparganosis. A further potential impact of feral pigs includes direct predation of lambs impacting on pastoral enterprises.

Feral horses and donkeys are present in the SAAL NRM Region. The distribution and density of donkeys is limited, but horses are widespread and in some areas impact biodiversity and pastoral production through grazing, trampling and fouling of waterholes. Both species have demonstrated the potential to severely degrade rangeland areas in Australia.

Feral deer are not officially recorded in the SAAL NRM Region, but bioclimatic modelling has indicated that chital deer could occupy most of the Australian rangelands.

Impacts - Native Herbivores

Some native species have increased in abundance in the SAAL NRM Region and can be considered as pests when they conflict with industry, social and biodiversity objectives. Demonstrated or potential impacts range from increased total grazing pressure and changes to floristic composition and structure, to substantial defoliation of desirable native vegetation by native insects and birds. While the duration of these events is often limited, many of the resulting impacts are persistent with negative environmental, economic and social outcomes. A range of larger herbivores are included in this category, impacting through added grazing pressure and risks to infrastructure and traffic, eg red kangaroo (*Macropus rufus*), western grey kangaroo (*M.fuliginosus*), euro (*M. robustus*), emus (*Dromaius novaehollandiae*) and southern hairy-nosed wombats (*Lasiorhinus latifrons*).

Kangaroo management in SA is conducted under *The Macropod Conservation and Management Plan for South Australia* (DEH 2002). This plan is approved under both State and Australian Government environmental legislation and outlines the conservation and management of the three common kangaroo species found in the SAAL NRM Region. This management plan aims to conserve and manage the three common kangaroo species in South Australia: the red kangaroo (*Macropus rufus*), the western grey kangaroo (*M. fuliginosus*) and the euro (*M. robustus*). Activities covered under the plan include commercial harvest and the non-commercial destruction of kangaroos.

Other impacts of native herbivores may include damage to infrastructure including fences, presenting a significant road and rail hazard and in the case of wombats and rabbits burrows and warrens may be a hazard when mustering stock. Predation of stock by dingoes is a concern for pastoralists both inside and outside of the Dog Fence. However, removing predators may also have a negative impact on industry and the environment by allowing other pest species to multiply. There is some evidence that that kangaroo, goat, fox and, perhaps, cat populations are greater inside the Dog Fence where dingoes have been effectively controlled.



(b) Other Pest Animals Impacting on Soil and/or Vegetation Condition

(b-1) Introduced Pest Animals

Introduced carnivores have the potential to impact upon soil and/or vegetation condition because of their interactions with herbivores. Foxes, feral cats and wild dogs (including dingoes) occur throughout much of the region and include several of the previously mentioned stock, native and pest herbivores in their diet. Introduced carnivores also have major impacts upon native wildlife (see 6.3 Biodiversity for more information).

Introduced pest bird species of concern in the SAAL NRM Region, such as feral pigeons, house sparrows, spotted turtle doves, common starlings and common blackbirds, generally occur in modified habitats where permanent water can be accessed, such as around towns, homesteads and stock watering points.

The impact of introduced pest bird species in the SAAL NRM Region, while difficult to quantify, is generally regarded to be low. Birds can be reservoirs and vectors for a range of diseases that can affect other wildlife, domestic animals and people and there is also a risk that imported or migratory birds could bring new exotic diseases into Australia (Bomford and Sinclair 2002).

Native birds may also cause social impacts. Little corellas (*Cacatua sanguinea*) and galahs (*Eolophus roseicapilla*) for example, can be destructive to both amenity plantings and local eucalypt populations around water sources. Other perceived impacts are documented. For example, wedge-tailed eagles (*Aquila audax*) and corvid species (ravens and crows) are implicated in lamb deaths, although it is likely that death by predation accounts for only a small percentage of lamb losses.

Invertebrate pests can cause significant damage to the region's assets when seasonal conditions or predator-prey imbalances favour a species and enable a population explosion. These events are usually infrequent and irregular and are generally beyond current management options.

For example, the Australian plague locust, a native species, can cause enormous damage to agricultural crops. The Australian Plague Locust Commission (APLC) has a national charter to deal with this problem. As part of the APLC's agricultural protection program spraying is carried out within the SAAL NRM Region. Locusts can also cause damage to the SAAL NRM Region's vegetation, including amenity plantings, but their biodiversity value also needs to be considered – such as their food value to other native fauna.

The native sap-sucking whitefly is one insect species in the SAAL NRM Region that will have a lasting impact. A previously undescribed species of native whitefly has caused dieback in western myall (*Acacia papyrocarpa*) trees over a 10,000 square kilometres area around Roxby Downs. The western myall is a very long-lived, slow growing tree. Recruitment is naturally infrequent but further reduced by rabbits and stock browsing the highly palatable seedlings.

6.1.2.2 Pest Plants

Pest plants have the potential to impact upon soil conservation issues. Weeds can displace native species and affect soil stability. They can impact upon livestock management with flow-on effects for soil conservation. Methods used for weed control can have significant effects upon soils. Conversely, soil disturbance can provide a suitable environment for the establishment of many weeds.

In a regional context, introduced weeds are not a major problem in many areas as most have originated in areas of higher rainfall and are incapable of long-term survival in the Australian arid zone. The management and control of declared weeds is primarily the responsibility of individual land managers, with the overall program managed through the SAAL NRM Board. Policy advice and other assistance is provided through the DWLBC.

Approximately 500 species of introduced plants have been identified in the SAAL NRM Region. Many of these are now recognised as pest plants in the region. Determining which species are the most threatening to the SAAL NRM Region is difficult. National and State agencies have adopted various processes to identify pest plants of concern to industries, regions, states and the nation. These include by proclamation and declared lists under State legislation, Weeds of National Significance (WoNS) as a result of the National Weeds Strategy, and other weeds lists for specific purposes such as the National Environmental Alert List.

Several WoNS listed species are sparsely present in the SAAL NRM Region but are more widespread in the catchments of major river systems entering from adjoining States. These include Athel pine (*Tamarix aphylla*), parkinsonia (*Parkinsonia aculeata*), mesquite (*Prosopis sp*) and prickly acacia (*Acacia nilotica*) on river systems such as the Finke, Diamantina-Georgina and Cooper Creek. These woody weeds have demonstrated invasive potential in similar rangeland habitats elsewhere in northern Australia.

Highly visible pest species such as wheel cactus (*Opuntia robusta*), devil's rope (*Cylindropuntia imbricata*) and other *Opuntia* species (eg prickly pear) can affect the aesthetic values of the region, impacting both socially and economically. Alternatively, salvation Jane (*Echium plantagineum*) and onion weed (*Asphodelus fistulosus*) may be attracting visitors to the Flinders Ranges when in full flower.

Many pest plants have proliferated in the SAAL NRM Region because of their ability to take advantage of disturbed soils or areas where the competition from native species is reduced. Species such as onion weed, saffron thistle (*Carthamus lanatus*), Ward's weed (*Carrichtera annua*) and salvation Jane often establish in heavily grazed or other disturbed areas. This competitive advantage is further enhanced by toxicity and unpalatability, enabling plants such as Mexican poppy (*Argemone mexicana*), silverleaf nightshade (*Solanum elaeagnifolium*), potato weed (*Heliotropium europaeum*) and African rue (*Peganum harmala*) to escape the pressures of grazing.

Some invasive species dominate the vegetation they invade. Introduced species such as buffel grass (*Cenchrus ciliaris*) occupy vast tracts of Australian rangelands, increasing biomass production and altering fire regimes. The distribution of buffel grass is expanding in the SAAL NRM Region with further spread anticipated. Other pest plants in the region may have restricted distribution, however impacts can be quite severe within the areas they infest. For example, it is estimated that there has been a 50% reduction in invertebrate biodiversity and an almost total loss of floristic biodiversity as a result of date palm (*Phoenix dactylifera*) infestation in some of the Great Artesian Basin springs at Dalhousie (T Gotch 2006 *pers comm*).

Native Plants as Pests

The majority of the plants that cause pest plant problems in the SAAL NRM Region have originated from other countries. However, native species can also negatively impact on regional assets. Increaser native perennials, or 'woody weeds' as they are commonly referred to, present not so much a problem of invasion and colonisation but one of natural plant dynamics in an altered environment. The increase in range and density of a native shrub can generally be attributed to factors such as soil disturbance, change in fire frequency, overgrazing or altered grazing regimes. Climate change may also influence the distribution and density of native plants.

Woody weeds such as *Senna*, *Dodonaea* and *Eremophila* species can form monocultures with little or no economic use, reduce the land's grazing and biodiversity value and can influence natural processes such as fire regimes. Management that aims to conserve the whole native vegetation community will generally succeed in minimising the increase in woody weeds.

6.1.2.3 Other Management Issues Affecting Soils

Fire

Prior to European occupation, Aboriginal people used fire extensively to promote good feed for kangaroos and to assist hunting. Wildfires are rare over most of the SAAL NRM Region as continuous areas of flammable vegetation simply do not exist. Only in a year of exceptionally high rainfall does growth of this nature occur. The ecological effects of fire in the arid zone are poorly understood but it is evident that fire has a significant role in the germination of some native plant species and therefore in the succession of ecosystems in parts of the region. Conversely, other vegetation communities (eg Chenopod shrublands) may need long periods of recovery following fire. As a general comment it can be said that the importance of fire in the region relates to a number of factors such as likely fire response of the species involved, fire intensity and frequency and potential post-fire effects such as grazing or browsing by fauna, soil erosion and potential weed invasion.

At present, fire is not used as a management tool to any significant degree in the region. There has been some experimentation in the use of fire to manage prolific reed growth in GAB springs but this has not proven to be effective as a stand-alone management tool.

Infrastructure Placement

Infrastructure placement is an additional management issue affecting soils. For example, there may be an increase in water erosion due to vehicle tracks, roads and airstrips, mining areas, along fence lines (particularly on hill slopes) and pipelines. The Old Ghan railway line provides an example of this as there are many examples of gully erosion associated with embankments, bridges etc along the alignment.

6.1.3 Implications of Climate Change for Soil Management

The predicted increase in mean temperature and frequency of drought, of hot days and of windy conditions has the potential to impact negatively on the soils and vegetation of the SAAL NRM Region. Maintenance of native vegetation cover may become more difficult, particularly if total grazing pressure is not managed conservatively and appropriately. Thus the potential for soil erosion and loss of soil condition could increase.

Climate change is expected to increase the risk of invasion by exotic organisms, such as pest plants and animals and diseases (IPCC 2007) and may also favour some established organisms that are currently restricted in range, causing them to become invasive. Possible future impacts on particular ecosystems include increasing encroachment of woody shrubs into arid and semi-arid rangelands. The rangelands incorporate a great diversity of plant and animal species and climate change and increased carbon dioxide levels may affect the interactions between these species.

SUMMARY OF KEY ISSUES FOR MANAGEMENT OF SOILS AND GEOLOGICAL FEATURES

Major Regional Assets

- » 'Iconic' landscapes (eg ranges, sandy deserts, stony deserts, gibber plains, breakaways)
- » Soils (supporting biodiversity and primary production)
- » Native vegetation (supporting biodiversity, soil stability and soil condition)

Key Risk Factors Requiring Management

- » Management of total grazing pressure by
 - » Stock (cattle, sheep)
 - » Pest animals
 - » Kangaroos
- » Management of pest plants
- » Adaptive management with climate change

Current Status

Based upon available information, summary comments are provided below for the above natural resource assets in terms of:

- » Health the overall health and condition of the resource at a regional scale
- » Trend the apparent trend in the health of the resource, mainly using the last ten years as a reference point
- » Information base an appraisal of the amount of information on which the health and trend ratings are based.

	HEALTH	TREND	INFORMATION BASE
ICONIC LANDSCAPES	At a regional scale, the broad, 'iconic' landscapes (vistas of deserts, stony plains etc) are reasonably intact and have not been significantly affected by infrastructure, roads, etc	Little change over last ten years, although increased vehicle access off of designated tracks is having an effect.	Apart from landscape assessment work in the Flinders Ranges, there is very little landscape assessment information for the region
SOILS	Overall, soils are considered to be in reasonable condition but there are still significant impacts in some areas from threatening processes such as pest herbivores	No significant changes apparent over last ten years apart from seasonal fluctuations	Some information available (eg through Pastoral Assessment program), but not a comprehensive regional coverage
NATIVE VEGETATION COVER & CONDITION	Reasonable condition but there are significant impacts in some areas from threatening processes such as pest herbivores. Condition does vary across the region reflecting seasonal effects, status of pest management etc	Insufficient information to make a regional assessment of trend. Trends in either direction at sub-regional level reflecting seasonal effects, pest impacts and, in some cases, effective pest management	Some information available (eg through Pastoral Assessment program and Biological Surveys by DEH), but not a comprehensive regional coverage

6.2 WATER RESOURCES OF THE SAAL NRM REGION

6.2.1 Groundwater

The information in this section is extracted largely from the State of the Catchment Report, prepared by the Arid Areas Catchment Water Management Board (2006) for the SAAL NRM Board.

6.2.1.1 Groundwater Description and Features

Throughout the region the mixed geology, resulting from depositional environments from over 600 million years ago to the present, has resulted in a variety of complex aquifer types. Groundwater underlies most of the region but is highly variable in quality and quantity. There are four main aquifer types present in the region. These are:

- » Sedimentary basins
- » Fractured rock
- » Palaeochannels (unconsolidated material deposited in ancient river channels)
- » Surficial aquifers (near surface aquifers of unconsolidated material extending to depths generally not exceeding 150 metres).

The distribution of the main aquifer types is presented in Figure 14.

The groundwater resources of the region include both deep and shallow aquifers.

Deep aquifers are generally considered to be those aquifers existing at a depth greater than 150 metres. These include:

- » The Great Artesian Basin (GAB), which covers the entire Far North area
- » The Pirie-Torrens Basin, adjacent the western edge of the northern Flinders Ranges
- » Deep fractured rock aquifers underlying the Gawler Ranges area and the North East and Flinders area.

Shallow aquifer systems in the region are generally less than 150 metres deep. In general, there is a poor understanding of recharge of the shallow aquifers and their extent. Most shallow aquifers are recharged by heavy rainfall events which are infrequent in the arid areas, and excessive use may cause depletion or an increase in salinity.



GROUNDWATER AQUIFERS





SA Arid Lands NRM **Region Boundary** Main Road

> Resource Information Group, Department of Vistor, Land and Bodiversity Concentration Lantwet Conformal Conc Geocolettic Datum of Australia 1904 January 2009 Protocold by Map Project Map Dotum Date:

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Government of South Australia

South Australian Arid Lands Natural Resources Management Board

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6.2.1.2 Major Aquifers of the SAAL NRM Region

(a) Great Artesian Basin (GAB)

Description

The GAB is an extensive groundwater system covering 22 % of the Australian continent, and covering an area of 310,000 square kilometres within South Australia. It has a large storage capacity of 64,900 million megalitres (Hillier and Foster 2002). The GAB is a multi-layered system of water-bearing sandstone aquifers which are up to 3,000 metres deep. The aquifers are separated by less pervious rock layers and are continuous across the basin. Within South Australia, the major water-bearing aquifers are the Cadna-owie and Algebuckina aquifers. These are the primary site of water extraction and also support the ecologically significant GAB spring ecosystems.

Above the GAB sedimentary sequence are the shallow Tertiary sediments of the Eyre Formation. The aquifers within the Eyre Formation are a source of stock and drinking water supplies within the region (Shepherd 1978), and appear to be important in supporting surface wetland ecosystems such as the Coongie Lakes (Sampson 2003).

Below the GAB sedimentary sequence are the deeper older sedimentary basins such as the Arckaringa, Cooper, Simpson and Perdika Basins. These may also be a useful source of saline water for purposes such as mining.

Water within the GAB has been dated from several thousand years near sites of recharge to over two million years in the centre of the GAB. That means it may have taken between one and two million years for water entering the recharge areas to reach the central part of the Basin.

Recharge of the GAB is generally considered to occur at the margins of the Basin, predominantly along the eastern margins along the slopes of the Great Dividing Range. There also appears to be recharge along the north-western and southern margins. The western recharge area overlies the Finke River. Recharge processes in this area are not well understood.

In the south-western part of the GAB, two regional groundwater flows meet and mix and are directed towards the main natural discharge area near the Basin margin. The westward flowing groundwater originating from the Basin's eastern recharge zone (in Queensland and New South Wales) is bicarbonate rich (Na-HCO3-Cl type), whereas the eastwards flowing water, derived from the smaller recharge area in the western margin, is of a sulphate (Na-Cl-SO4) type. Salinity values increase towards the discharge area.

Figure 15 shows the extent of the GAB in Australia, the potential recharge zones, the direction of groundwater flow and the location of the natural springs through which part of the groundwater exits the basin.


The GAB supports significant GAB spring ecosystems that are natural surface expressions of the GAB. These are now listed under the *Environment Protection and Biodiversity Conservation Act 1999* as an endangered ecosystem (Environment Australia 2002). Springs form where the deep artesian waters reach the surface along fault lines that cut through the impermeable clays overlying the aquifer beds, where the aquifer abuts against impervious bedrock, and where the pressurised water breaks through thin confining beds near the discharge margins of the basin.

A string of GAB springs is present along the western margin of the GAB. Exceptions to this include the well known Dalhousie Springs, which are located within the Basin and account for a significant proportion of total natural artesian discharge in South Australia. Some springs have developed reed-fringed pools which support a diverse aquatic fauna of invertebrates and fish.

The GAB springs have provided important watering points in the dry inland. Some of the springs have dried up due to reduction in aquifer pressure caused by the numerous artesian bores. However, the well rehabilitation and piping program in SA has also resulted in an improvement in the flow from some springs.

Discharge occurs essentially via GAB springs, bores and vertical leakage. A significant portion of the water flowing out of the basin in South Australia is in fact natural vertical leakage. Vertical leakage is caused by the artesian aquifer pressure which forces water upwards into or through the overlying thin shale. This natural discharge evaporates unseen where the water table is near the surface, leaving salt behind.

The relationship between the various discharge components is schematically shown in **Figure 16**.

Based on current understanding, the implication is that the GAB can be utilised as a sustainable resource, although current estimates suggest that the present water usage rate is not sustainable regionally (Land and Water Australia 2003). Careful management of aquifer pressure is required. The implementation of the *Water Allocation Plan for the Far North Prescribed Wells Area* is an important step aimed at ensuring a more sustainable approach.



Water Quality

Water quality is highly variable across the Great Artesian Basin. Total dissolved solids and generally mineral components within the South Australian portion of the GAB are relatively high and increase in a south-west direction (Bureau of Rural Science 2000).

The water quality characteristics of the groundwater limit its potential uses. GAB water is generally unsuitable for irrigation due its high sodium content and salinity. Water is, however, suitable for stock and in some areas for town water supplies. Total dissolved solids above 500 milligrams per litre are considered poor quality for drinking water, and above 1,000 milligrams per litre corrosive and with poor taste. A number of towns, such as Roxby Downs and Coober Pedy, desalinise their drinking water using reverse osmosis. Marree and Marla have groundwater with high concentrations of dissolved solids and mineral components which give the water a corrosive nature and make it unsuitable for drinking; these towns are supplied with water by SA Water from shallow aquifers within the GAB.

In addition to the above, there is potential for localised contamination of the GAB (and other aquifers) through wastewater intrusion, such as leakage from mine tailings areas or town effluent, and through water re-injection.

(b) Shallow Aquifers

(b-1) Palaeochannels

Palaeochannels are generally found within the Gawler Ranges and North East and Flinders areas. These aquifers are formed by the infilling with sand of ancient surface drainage lines, which were incised into the crystalline Precambrian basement rocks and used to drain mountain ranges such as the Flinders and Gawler Ranges. The palaeochannels have the potential to contain large quantities of groundwater, although often saline.

Noteworthy palaeochannels include:

- » The Kingoonya palaeochannel with fresh water that supplies Kingoonya township
- » Palaeochannels within the Frome Embayment, east of the Flinders Ranges.

Frome Embayment Geographical Area

Lake Frome lies within a broad drainage basin named the Frome Embayment and flanked to the west by the northern Flinders Ranges. The Frome Embayment is identified as a discharge area for the GAB. The principle discharge mechanism for the Lake Frome region is via upward vertical leakage from the GAB into overlying aquifers (Heathgate Resources, 1998). Water from all aquifers, except the Namba Formation at Beverley, is used for stock watering.

Stuart Shelf region

The Olympic Dam, Andamooka, Woomera and Arcoona area lies within the Stuart Shelf Geological Province. A prominent groundwater divide exists between Andamooka and Olympic Dam. Prior to Olympic Dam, groundwater flowing from the west and south in this area most likely would have been deflected at the groundwater divide and discharged into northern Lake Torrens. This groundwater is currently being intercepted at Olympic Dam.

Gawler Ranges

The aquifers in the Gawler Ranges area are fractured rock aquifers (volcanic and metamorphic rock assemblages), which may be weathered near the surface to produce minor weathered-zone aquifers. Outside the GAB and Eromanga aquifers, the Gawler Ranges area does not have many productive water bores and generally yields are less than two litres per second. Some higher yielding bores, some of which are relatively fresh, are present near Lake MacFarlane, close to the boundary with the Stuart Shelf.

Salinity levels are generally very high throughout the area. Lower salinities are found in areas where surface water concentrates after heavy rainstorms (such as swamps and drainage lines). Underground water supplies of stock water quality are sparse. Recharge in the Gawler Ranges area is generated only by high intensity rainfall.

Northern Flinders and North East area

Fractured rock aquifers are present in the northern Flinders Ranges, with highest yields occurring near faults, where most springs occur. Recharge occurs by direct infiltration from rainfall. Water quality varies from less than 1,000 milligrams per litre Total Dissolved Solids (TDS) to greater than 10,000 milligrams per litre TDS. Discharge occurs into the numerous ephemeral creeks and along the range front at springs, such as the Paralana Hot Springs.

Aquifers also occur in unconsolidated (Quaternary) sediments in sand and gravel which abut the hard rock of the Flinders Ranges at the base of the Ranges or adjacent streambeds. There are many stock bores drilled into these shallow aquifers, which although they do not have high efficiency are suitable for stock watering requirements.

It is important to note that there is considerable underground flow in many streams in the Flinders Ranges (Environment Australia 1994). This is termed 'hyporheic' (below flow) and is an area which is home to a unique assemblage of invertebrates. It is also an important refuge for a number of benthic invertebrates during the dry season.

6.2.1.3 Management Issues Relating to Groundwater

The information in this section is extracted largely from the State of the Catchment Report, prepared by the Arid Areas Catchment Water Management Board (2006) for the SAAL NRM Board.

(a) Great Artesian Basin

Throughout the last 110 years, bores have accessed the aquifers of the GAB. There have been more than 4,700 artesian bores and 2,403 sub-artesian bores drilled across the whole of the GAB. Approximately one third of the original artesian bores have ceased to flow and the loss of over 1,000 natural springs (and their ecosystems) has occurred. Net volumes of water extracted from the GAB in South Australia peaked around 1972, at 203 megalitres per day.

Since 1977, the South Australian Government has operated a bore rehabilitation program to cap bores on pastoral properties and pipe open bore drains. Programs such as the Great Artesian Basin Sustainability Initiative (GABSI) of 1999 have added impetus to the bore rehabilitation works. Over the life of the program, it is estimated that more than 200 wells have been rehabilitated across the whole GAB and around 105 megalitres per day of water saved. There is, however, upwards leakage from the pressurised aquifers in the GAB to shallower, overlying strata still occurring through an unknown number of bores, which have deteriorated over time or been inadequately constructed or rehabilitated. There has been little action on the bore rehabilitation program since 2005 and the deterioration of capped or rehabilitated bores is a significant issue requiring attention.

GAB water is currently used in the mining industry. Peak water usage at Moomba was 31 megalitres per day and has now declined to 18 megalitres per day. The Olympic Dam copper, uranium and gold mine and associated Roxby Downs mining township currently use approximately 32 megalitres per day. The GAB resource is also utilised for town water at Roxby Downs, Coober Pedy, Marla and Marree, totalling around 3.3 megalitres per day.

The potential maximum water requirements for pastoral use have been estimated from stocking rates to be of the order of 33 megalitres per day. While some of this is drawn from surface water sources, the majority is supplied from groundwater resources.

It should be noted that the above usage figures are estimates only. A concise summary of GAB water usage is not currently available. The need for better information regarding water usage and future demand is discussed in Part 3.

De-pressurisation of the Great Artesian Basin

Achieving sustainable use of the GAB resource is a balance between providing useful water supplies and retaining adequate pressure to maintain sustainability of these supplies (such as artesian pressure), GAB springs ecology, and water quality of the GAB (that is, preventing GAB water becoming saline).

Recent estimates suggest that current water usage of the GAB is not sustainable (Land and Water Australia 2003), although the *Water Allocation Plan for the Far North Prescribed Wells Area in SA* suggests that the GAB aquifer system in this State is at or close to equilibrium at the present. Declines in artesian pressure (that is, potentiometric pressure) have reduced water levels by up to 100 metres below original levels in other States. These reduced levels will be maintained as long as bore discharges continue at current levels, particularly in New South Wales, but are capable of total recovery if or when discharge stops. This has altered the steady state equilibrium of recharge and discharge processes, resulting in reduced discharge rates. GAB draw-down and decreases in potentiometric potential is considered to be the largest threat to the resource and ecosystems that depend upon it. Impacts of the threat include:

- » Decline in artesian pressures at bores
- » Reduction in water quality at bores
- » Reduction in adjacent GAB spring discharges and associated ecosystems
- » Reduction in GAB spring water quality.

GAB spring discharge has been reduced significantly from 82,000 megalitres to 47,000 megalitres, accompanied by large scale extinctions of GAB springs.

The threat of declining artesian pressure impacts on pastoral viability as it increases the economic costs of extracting water because pumping is required. The pastoral industry is currently a major user of the GAB. Freely flowing bores were once a common pastoral practice and extensive open drainage systems were used to transfer water across properties (Great Artesian Basin Consultative Council 1998). This led to extensive water wastage (up to 90 %) and in South Australia has been linked to GAB spring extinctions along the western margins.

Reductions in artesian pressures can also cause saline water from overlying aquifers to contaminate the main aquifer as the upward pressure decreases and allows a downward vertical gradient.

Substantial work has been undertaken since 1989 to increase the water use efficiency of pastoral groundwater bores. The GAB bore rehabilitation program has rehabilitated bores that were in poor condition and fitted control valves to free-flowing bores in order to reduce leakage. State and Australian Governments currently run an incentive program to encourage pastoralists to pipe water from controlled bores and thereby reduce wastage. The GAB in the Far North region has also been declared a prescribed wells area. A water allocation plan has been prepared.

The GABSI program has successfully addressed the issue of freely flowing bores. However, some issues still remain regarding GAB bores, namely:

- » Leaking of artesian wells
- » Monitoring of the bores to ensure their rehabilitation has been successful in the longterm
- » Monitoring of the impacts of the GABSI program (that is, of the pressure recovery).

Arising from concerns about sustainability of supply, the *Water Allocation Plan for the Far North Prescribed Wells Area* was adopted in 2009. This applies to all groundwater in the Prescribed Wells Area and provides a tool for regulation of water use, particularly by the mining sector. The Far North Prescribed Wells Area is shown in **Figure 14**.

Management of Total Grazing Pressure

As discussed in section 6.1, total grazing pressure is an important issue in the management of soils and vegetation. The impacts of grazing, whether by stock or feral animals, are often most pronounced at GAB springs because of the available water and 'green-pick' associated with the springs' wetland vegetation. Grazing can have severe impact in terms of vegetation damage, pugging of soils and water contamination

(b) Shallow Aquifers

Generally little is known about the sustainable yield of these aquifers. In the case of pastoral bores, it is usually discovered by trial and error, and often the wells have been pumped dry. Little is known about the nature, extent and sustainability of most shallow aquifer systems in the arid areas of South Australia. Detailed investigations for freshwater bodies in shallow aquifer systems have not generally been undertaken, most likely due to the lack of optimism of finding a suitable supply and the presence of the GAB and other large resources outside the study area. Available information suggests that it is easy to inadvertently over-extract these shallow aquifers systems as, in most cases, they rely on direct infiltration from local rainfall for recharge.

SA Water collects water quality and yield information for those aquifers where it manages town water supplies.

6.2.1.4 Implications of Climate Change

The implications of climate change for groundwater systems in the SAAL NRM Region are not particularly clear. In the long-term changing rainfall patterns will have some impact upon recharge of the GAB and other groundwater basins. Increasing temperatures and the increasing frequency of drought, hot days and windy conditions may increase evaporation at the GAB springs, possibly reducing the areas of associated wetlands. There may also be increasing pressure in some quarters for greater extraction from the basins to offset the effects of regional warming and drying.

SUMMARY OF KEY ISSUES FOR GROUNDWATER MANAGEMENT

Major Regional Assets

- » The Great Artesian Basin
- » Other groundwater basins
- Groundwater supplies to support natural ecosystems (particularly GAB springs) and community and industry use.

Key Risk Factors requiring Management

- » Sustainable use of the GAB
 - » Retaining adequate pressure to maintain supplies of adequate quantity and quality for human use (pastoral, domestic, industry) and for conservation of GAB springs and their associated ecosystems
- » Management of total grazing pressure at GAB springs
- » Lack of understanding of the occurrence, extent or sustainable yield of shallow aquifer systems
- » Implications of, and adaptation to, climate change.

Current Status

Based upon available information, summary comments are provided below for the above natural resource assets in terms of:

- » Health the overall health and condition of the resource at a regional scale
- » Trend the apparent trend in the health of the resource, using the last ten years as a reference
- Information base an appraisal of the amount of information on which the health and trend ratings are based.

	HEALTH	TREND	INFORMATION BASE
GREAT ARTESIAN BASIN, DEPENDENT ECOSYSTEMS	Reasonable, but there are still significant impacts from threatening processes	Variable reflecting seasonal changes and associated grazing pressure. No significant changes noted overall, based on existing information	Quite good baseline of information re species but limited information re species interactions and management of threatening processes
OTHER GROUNDWATER BASINS, DEPENDENT ECOSYSTEMS	Largely unknown	Largely unknown	Very little information
GROUNDWATER SUPPLIES, GAB	Reasonable but current use is near the estimated threshold for sustainability	There has been a trend towards increasing use, mainly through the mining sector	Reasonable estimates available but much use is not measured/metered and overall GAB monitoring is limited
GROUNDWATER SUPPLIES, OTHER BASINS	Largely unknown	Largely unknown	Very little information

6.2.2 Surface Water

The information in this section is extracted largely from:

- » the State of the Catchment Report, prepared by the Arid Areas Catchment Water Management Board (2006) for the SAAL NRM Board
- » the Pest Management Strategy (2006) prepared for the SAAL NRM Board

6.2.2.1 Surface Water Description and Features

Three major surface drainage divisions cover the SAAL NRM Region, namely the Lake Eyre Drainage Division, the Western Plateau Drainage Division and the South Australian Gulf Drainage Division. These are shown in **Figure 17**.

Drainage in the Lake Eyre Drainage Division ultimately ends at the playa lake (lake with no outlet), Lake Eyre. Playa lakes act as collection areas for surface water flows and discharge zones for groundwater flows. Major rivers that drain the Lake Eyre Basin from the west are the Macumba, the Arckaringa and the Neales. These are normally dry yet are capable of carrying large volumes of water in times of flood and have dissected the country west of Lake Eyre to form the tableland or breakaway country. Semi-permanent waterholes are supplied from flood events.

Rivers more likely to fill Lake Eyre lie to the east and drain a vast area extending to the highlands of central Queensland. These are the Warburton (from the Diamantina River) and Cooper Creek. In South Australia, these river systems approach Lake Eyre through the interconnected river courses of the Channel Country. Annual run-off from the Great Dividing Range and the Barkley Tablelands of Queensland into the river systems fills some waterholes close to the borders, which are considered permanent.

The Western Plateau Drainage Division is vast, covering large portions of Western Australia, Northern Territory and South Australia. It is divided into nine basins, of which only one (the Gairdner Basin) lies within the region. There are no true riverine systems within the Gairdner Basin, resulting in many large salinas. Lake Gairdner is the largest salina in the sub-basin, being 8,884 square kilometres.

The South Australian Gulf Drainage Division is divided into 13 basins of which two, namely the Mambray Coast Basin and the Torrens Basin, lie within the SAAL NRM Region. Drainage in the Torrens Basin is directed towards Lake Torrens mostly from the western flank of the northern Flinders Ranges.

The major rivers and natural wetlands systems are presented in Figure 18.

The arid zone is typified by infrequent but large flood events which punctuate an otherwise dry landscape and climate. In arid central Australia, 15 to 20 millimetres of rain of moderate intensity can cause a flow in minor streams that lasts for an hour or two. Such a flow can occur as often as five times a year. However, around twice this amount is needed before major streams begin to flow. Such falls can be expected less frequently than once a year. Major floods in the Lake Eyre Basin result from annual rainfalls which exceed 500 millimetres (Kotwicki 2002).





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Figure 18: Major Rivers and Wetlands, SAAL NRM Region

Table 2 provides a summary of stream flow data published by the DWLBC for stations with over five years of data in the SAAL NRM Region. The table highlights the extreme variability in stream flow from one year to the next. Median flows are typically less than a third of the mean, while minimum annual flows are all less than 1% of the mean.

STATION NAME	LOCATION	YEARS OF RECORD	МАХ	MEAN	MEDIAN	MIN	MEDIAN AS PROPORTION OF MEAN (%)
Diamantina River at Birdsville	Far North	38	10,990,000	1,332,000	313,400	6,022	24
Cooper Ck at Cullyamurra Waterhole	Far North	31	14,340,000	1,574,000	422,700	17,460	27
Mt McKinley Ck at Wertaloona	Nth East & Flinders	17	96,680	8,966	1,200	15.2	13
Arcoona Ck at Gammon Ranges Nat Pk	Nth East & Flinders	9	618.6	124.3	0	0	0
Arcoona Ck at Aroona Dam	Nth East & Flinders	19	17,020	2,835	0	0	0
Warruwarldunha Hill Channel at Hawker	Nth East & Flinders	7	32.8	4.7	0	0	0
Windy Ck at Maynards Well	Nth East & Flinders	17	6,483	909.2	340.7	10	37
Windy Ck at Leigh Ck	Nth East & Flinders	18	8,846	2062	597.9	2	29
Emu Ck at Leigh Ck	Nth East & Flinders	18	37,260	6,484	2,120	55.3	33

Table 2. Stream Flow Data (megalitres per year) from DWLBC Data (from AACWME

Recent studies have demonstrated the importance of flooding to the health of the arid river systems. These studies have also shown how little we know about the significance of various flood events. The research studies to date have identified both high and low flows as having important ecological functions in the river systems. It is also clear the overall flow pattern, and not just individual floods, is important for maintaining the ecology of the rivers and wetlands in the Lake Eyre Basin.

Surface Water Management Areas

The Surface Water Management Areas present in the arid areas comprise:

- » Finke River (Far North area)
- » Hay River (Far North area)
- » Georgina River (Far North area)
- » Diamantina River (Far North area)
- » Cooper Creek (Far North area)
- » Lake Frome (Far North and North East and Flinders area)
- » Gairdner (Gawler Ranges area)
- » Lake Torrens (Gawler Ranges and North East and Flinders area)
- » (part of) Mambray Coast (Gawler Ranges area)
- » (part of) Spencer Gulf (Gawler Ranges area)

Information regarding each of the Surface Water Management Areas is included in the *State of the Catchment Report* prepared for the SAAL NRM Board (AACWM Board 2006). Stream-gauging information is limited but particular features include the wetlands and lagoons associated with the Diamantina (eg Goyder Lagoon) and those associated with Cooper Creek (eg Coongie Lakes and Strzelecki Creek wetland).

By world standards, the rivers of the Lake Eyre Basin are considered to be relatively unregulated and retain much of their natural flow patterns.

Dams, Waterholes and Springs

There is an enormous array of dams, waterholes and springs across the region. Waterholes and springs are shown in **Figure 19.** These include:

- » hundreds of GAB or mound springs as surface manifestations of the Great Artesian Basin; as discussed under the Groundwater section, these are of immense importance from an environmental and cultural perspective
- » natural waterholes and springs through the Flinders Ranges and in other ranges within the region
- » natural waterholes associated with the river systems, as described above
- » artificial dams, mainly associated with the pastoral industry, but also associated in some cases with mining enterprises and some with historic links with the former Ghan railway line (eg at Beresford).





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Waterholes and springs are often a focal point of animal activity, particularly during summer months and drought. The impact on these areas by feral animals, in particular rabbits and goats, has been significant and in many cases devastating. Goats have been attributed to the fouling of many waterholes in the Flinders Ranges to a point where they have no longer been able to support the aquatic life that had once been present.

Many landholders have already undertaken management actions to ensure the health of waterholes on their property, as they are naturally a focal point for stock and feral animals. Fencing has been undertaken in some areas. Although rockholes and waterholes are known to exist in water courses and creeks throughout the region, very little has been documented about these. It is therefore difficult to ascertain their current status, their sustainability, what their role is in maintaining ecosystems of the area, and the land management practices these environments are exposed to.

Surface and ground water in the Gawler Ranges is singularly lacking. The lack of natural surface catchments and the paucity of ground water supplies meant that a large number of earth tanks or dams were constructed. No true riverine systems are present in the Gawler Ranges area. For dams importantly, evaporation rates greatly exceed rainfall, by more than an order of magnitude. This means that uncovered dams or other water holding features are extremely inefficient.

Comparatively, in the North East, there are very few reliable natural waters. Stock and domestic supplies for early settlement had to be obtained from wells drilled into small local aquifers and the construction of earth tanks and reservoirs. The effectiveness of surface water storage in dams however was, and remains (as with everywhere in the arid lands), severely limited by the high evaporation rates which can cause losses of up to 90%.

The majority of documented or known springs in the north of the SAAL NRM Region consist of GAB Springs. These are discussed more fully in section 6.2.1.2. The watercourses of the Flinders Ranges are characterised by many springs and waterholes, which are of a permanent or semi-permanent nature. A number of freshwater soaks are known to occur on the surface of Lake Gairdner.

6.2.2.2 Major Management Issues

Changing Surface Water Flows

The relationship of the arid areas natural wetting/drying regime with ecosystems, surface water systems (such as waterholes, semi-permanent creeks) and groundwater systems is poorly understood. However, what is known indicates that these things rely to a great degree on the variability of the cycle and are currently in balance.

The implications of changing the surface water flows are great. It is difficult to quantify water requirements of ecosystems since natural flow regimes involve periods of flooding at large time intervals. In the Far North, natural flooding is a vital mechanism for maintaining ecosystems, through regeneration and maintenance of adult species and maintaining floodplain food sources for cattle. Surface water (and its cycle) maintains riparian vegetation, which also prevents erosion of stock watering points. Protection of flows is important for the ongoing viability of the pastoral industry and ecosystem health.

Water extraction or interception in upstream catchments of the drainage systems that feed into Lake Eyre has the potential to negatively impact on water dependent ecosystems. Significant features such as wetlands and waterholes are an essential component of inland river systems and their ability to support diverse ecosystems is critically linked to the hydrological regime. A whole of catchment perspective will recognise the interdependencies between the complex elements of arid river systems and help to protect ecologically significant sites including the Ramsar-listed Coongie Lakes.

Reduced Groundwater Pressure and Level Affecting Springs

This is discussed in section 6.2.1.3. Reduced groundwater pressure and/or level could have significant impact upon the springs of the GAB and elsewhere within the region.

Water Quality

The ongoing protection of recharge areas for all aquifer and surface water systems is important. Many of these re-charge areas occur outside the region. Vegetation clearance and poor land management practices can degrade both surface water and groundwater supplies.

Currently at Innamincka, effluent is pumped to an evaporation lagoon that is situated below the one in 100-year floodplain. Monitoring shows that the lagoon has a high algal content, indicating current treatment systems (septic tanks) are not able to reduce the organic load. A major flood event could therefore lead to contamination of the river system.

More generally, there is scope for surface water contamination through pugging and fouling by stock and feral animals and through run-off from urban or industrial areas. At present there is little information to help quantify this situation.

Introduced Aquatic Pests

This information is extracted from the Pest Management Strategy (2006) prepared for the SAAL NRM Board.

A number of introduced species of fish have been recorded in the waterways of the SAAL NRM Region. While some of these are known from only isolated records, eg carp (Cyprinus carpio) in a diversion dam at Leigh Creek, others such as plague minnow (Gambusia holbrooki) are widespread and of major concern. Introduced fish are a potential threat to aquatic biodiversity (particularly important considering the high number of restricted and endemic fishes occurring in the region). New introductions in areas with restricted native populations could have devastating impacts. The plague minnow has been implicated in the decline of numerous fish species, including Ambassis, Chlamydogobius, Craterocephalus, Melanotaenia, Mogurnda and Retropinna species, all of which are known to occur in the region. Carp are widely recognised as a nuisance species in south-eastern Australia and are capable of causing serious environmental harm in the inland waters of SA. Goldfish (Carrasius auratus) are widespread but patchy in the Cooper Creek catchment. They have also been recorded from the Coongie Lakes where they were apparently first introduced in the 1970s. They are, however, considered a relatively benign introduction and have not become a serious pest. Nevertheless, like any introduction, they may potentially introduce or have already introduced diseases and parasites to which native species may be susceptible.

Cane toads have now been recorded in the Cooper system upstream of South Australia and represent a significant potential threat to the aquatic biodiversity of the SAAL NRM Region.

Introduced aquatic pests are not necessarily from outside Australia. Three large native fish species, Murray cod (*Maccullochella peelii peelii*), Murray-Darling perch (*Macquaria ambigua ambigua*) and silver perch (*Bidyanus bidyanus*), have been translocated into the Lake Eyre Basin (LEB) from the Murray-Darling Basin. Specimens have since been captured, although it is not known if they will establish self-maintaining populations. As yet, it is too early to know whether they will cause ecological (eg predation), biological (eg disease) or genetic (eg hybridisation and reduced fitness) problems in the LEB.

Management of Total Grazing Pressure Around Water-points and Wetlands

As discussed in section 6.1, total grazing pressure is an important issue in the management of soils and vegetation. The impacts of grazing, whether by stock or feral animals, are often most pronounced along rivers and wetlands because of the occasional concentration of stock and other animals at water points or in areas where there is sufficient soil moisture to support more 'vigorous' vegetation.

6.2.2.3 Implications of Climate Change

It is difficult at this stage to predict the implications of climate change for the surface water systems of the SAAL NRM Region. Some of the major river systems emanate from the highlands of central Queensland. Predicted climate change effects across these huge catchments may vary from one section of the catchment to another. For those river systems with catchments entirely within the arid zone, the predicted higher temperatures, less rainfall and greater incidence of drought would mean a generally drier scenario. However, what this means for occasional larger scale flood events is unclear.

Another aspect of this is that, with the trend to hotter, drier conditions, total grazing pressure along river and associated wetland systems may tend to increase unless appropriate management is in place.



SUMMARY OF KEY ISSUES FOR SURFACE WATER MANAGEMENT

Major Regional Assets

- The river systems and wetlands of the Lake Eyre Drainage Division, the Western Plateau Drainage Division and the South Australian Gulf Drainage Division
- » Springs of the GAB and northern Flinders

Key Risk Factors Requiring Management

- » Maintenance of recharge and flows to sustain dependent ecosystems and pastoral and other uses
- » Maintenance of water quality
- » Management of introduced aquatic pests
- » Management of total grazing pressure
- » Adaptive management with climate change

Current Status

Based upon available information, summary comments are provided below for the above natural resource assets in terms of:

- » Health the overall health and condition of the resource at a regional scale
- » Trend the apparent trend in the health of the resource, using the last ten years as a reference
- Information base an appraisal of the amount of information on which the health and trend ratings are based.

	HEALTH	TREND	INFORMATION BASE
RIVER SYSTEMS – FLOW REGIMES	Good. Flow regimes largely unimpeded	No significant change noted over last ten years. Some issues emerging interstate that could affect this	Very limited flow data available. Health rating just based upon general knowledge re catchments
RIVER SYSTEMS – DEPENDENT ECOSYSTEMS	Reasonable, but significant impacts from threatening processes	Cannot be estimated at a regional scale on current information	Some baseline data but very limited regional coverage

6.3 BIODIVERSITY OF THE SAAL NRM REGION

The information in this section is extracted largely from the South Australian Arid Lands Biodiversity Strategy prepared by the Department for Environment and Heritage and the SAAL NRM Board (2009). A link to this can be found on the SAAL NRM Board's website. A more detailed account of the biodiversity resources of the region can be found in An Inventory of the Biological Resources of the Rangelands of South Australia (Neagle 2003).

The landscapes and biodiversity of the SAAL NRM Region are diverse and complex. Planning for biodiversity conservation at such large spatial scales requires a landscapebased system of classifying the land surface. The landscape classification system used for this strategy is the Interim Biogeographic Regionalisation for Australia (IBRA) regions. The IBRA bioregions found in the SAAL NRM Region include the Stony Plains, Flinders Lofty Block, Broken Hill Complex, Channel Country, Simpson–Strzelecki Dunefields, Finke and Gawler bioregions. These are shown in **Figure 20**.

The floristic vegetation of the SAAL NRM Region is shown in **Figure 21**, although coverage for the area is incomplete. **Figures 22** and **23** show sites in the region where threatened fauna and flora have been recorded. **Table 3** lists threatened flora and fauna as described under the *Environment Protection and Biodiversity Conservation Act 1999*. There are also many species that are rated as of particular conservation significance at the State level. More information about these can be found in the regional the *South Australian Arid Lands Biodiversity Strategy* and in Neagle (2003) as referred to above.

The Strategy consists of six documents. Five documents identify conservation priorities for each of the bioregions that occur within the South Australian Arid Lands. These are the:

- » Channel Country Conservation Priorities
- » Flinders and Olary Ranges Conservation Priorities
- » Gawler Conservation Priorities
- » Sandy Deserts Conservation Priorities
- » Stony Plains Conservation Priorities.

The sixth document, *Region-Wide Priority Actions* identifies the region-wide goal for biodiversity conservation, sets resource condition targets and details a comprehensive suite of management action targets and strategies to be implemented regionally in order to achieve this goal.

In addition to the above *SAAL Biodiversity Strategy*, a biological inventory for the Rangelands region was prepared by the Department for Environment and Heritage (Neagle 2003). Although the boundaries of the Rangelands and SAAL NRM regions do not correspond exactly, there is close correlation and the inventory is a valuable resource in describing the biodiversity of the SAAL NRM Region.

For the purpose of this part of the *SAAL Regional NRM Plan*, information from the five descriptive documents of the *SAAL Biodiversity Strategy*, as above, is summarised as follows:

- » Brief description of main landforms and vegetation types
- » List of nationally threatened fauna and flora, threatened ecological communities, endemic fauna and endemic flora
- » Summary of identified conservation priorities
- » Main management issues.



Table 3. Environment Protection and Biodiversity Conservation Act 1999 Listed (threatened)Species and Ecological Communities for which Conservation Advices Exist for SAALNRM Region

SPECIES AND COMMON NAMES	EPBC ACT 1999 STATUS	LOCATION WITHIN SAAL NRM REGION
Plant Species or Vegetation Community		
<i>Acacia araneosa</i> (spidery wattle, Balcanoona Wattle)	Vulnerable	Restricted to a small area of northern Flinders Ranges in South Australia. It is confined to Vulkathunha–Gammon Ranges National Park and adjacent Arkaroola Sanctuary
<i>Acacia carneorum</i> (needle wattle, dead finish, purple-wood wattle)	Vulnerable	Scattered distribution from south-west of Lake Frome and near Peterborough in eastern South Australia, to near Tibooburra, Menindee Lakes and Wanaaring in western NSW
<i>Acacia menzelii</i> (Menzel's wattle)	Vulnerable	Scattered populations from the northern Flinders Ranges to Murray Bridge
<i>Codonocarpus pyramidalis</i> (slender bell-fruit, camel poison)	Vulnerable	Populations are bounded by the North Olary Plains area (Yunta) in the south, Lake Callabonna in the north, the Flinders Ranges in the west and the NSW border in the east
Frankenia plicata	Endangered	North of Port Augusta along the Stuart Highway to the Northern Territory border and from Port Augusta north-east to Marree
<i>Hibbertia crispula</i> (Ooldea guinea-flower)	Vulnerable	Lake Everard region
<i>Limosella granitica</i> (granite mudwort)	Vulnerable	A small number of disjunct sub-populations across N Eyre Peninsula (just into SAAL NRM Region)
<i>Eucalyptus odorata</i> (peppermint box) grassy woodland of South Australia [ecological community]	Critically endangered	From the southern Flinders Ranges to Lake Alexandrina. The majority of this ecological community is found in the Flinders-Lofty Block Bioregion
Prasophyllum pallidum (pale leek-orchid)	Vulnerable	Known singly or in groups in well-grassed open forests from the Flinders Ranges to the Northern and Southern Lofty regions of South Australia
<i>Pterostylis sp. Eyre Peninsula</i> (nodding rufous-hood)	Vulnerable	Just into SAAL NRM Region. Occurs in coastal areas to areas about 100 kilometres inland, in the high country (75–200 metres above sea level) between Cleve and Kimba in the 300 millimetre rainfall zone
Senecio megaglossus (superb groundsel)	Vulnerable	Occurs in six scattered localities from the southern Flinders Ranges to the northern Lofty Ranges.
<i>Swainsona murrayana</i> (slender Darling-pea, slender swainson, Murray swainson-pea)	Vulnerable	This species has been recorded approximately 200 kilometres north-east of Port Augusta and in the far-east near Broken Hill
Xerothamnella parvifolia	Vulnerable	Moro Gorge in the Flinders Ranges

SPECIES AND COMMON NAMES	EPBC ACT 1999 STATUS	LOCATION WITHIN SAAL NRM REGION
Animal Species		
<i>Acanthiza iredalei iredalei</i> (slender-billed thornbill (western))	Vulnerable	In the SAAL NRM Region the subpopulations are located in the Gawler Ranges, near Tarcoola. Additional subpopulations could exist in rarely-visited regions of northern South Australia
Amytornis barbatus barbatus (grey grasswren (bulloo))	Vulnerable	Sightings of Grey Grasswrens from the Cooper Creek system could potentially also be of this subspecies. Such sighting extend just over border into SAAL NRM Region
Aprasia pseudopulchella (Flinders Ranges worm-lizard)	Vulnerable	From the Flinders Ranges of South Australia, extending south to the western slopes and northern and central Mt Lofty Ranges
<i>Leporillus conditor</i> (wopilkara, greater stick-nest rat)	Vulnerable	Successfully re-introduced into a conservation reserve near Roxby Downs – Arid Recovery
<i>Mogurnda clivicola</i> (Flinders Ranges gudgeon)	Vulnerable	Occurs along a few kilometres of Balcanoona Creek in the Gammon Ranges National Park in the northeast Flinders Ranges .
<i>Notomys fuscus</i> (dusky hopping-mouse, wilkiniti)	Vulnerable	Occurs in north-eastern South Australia in the southern Strzelecki and the Cobblers Deserts
<i>Ophidiocephalus taeniatus</i> (bronzeback snake-lizard)	Vulnerable	Populations have been found at Abminga in northern South Australia, the Arckaringa Hills south-west of Oodnadatta, at Breakaways Reserve in the Stuart Range, 25 kilometres north- west of Coober Pedy and at a number of sites along the W and N sides of the Lake Eyre Basin
Petrogale xanthopus xanthopus (yellow-footed rock-wallaby)	Vulnerable	Colonies persist in the Gawler Ranges, Flinders Ranges and Olary Hills
<i>Polytelis alexandrae</i> (princess parrot, Alexandra's parrot)	Vulnerable	The species has been recorded at low densities in the Great Victoria Desert









Figure 22: Rare & Threatened Fauna Sites, SAAL NRM Region





Figure 23: Rare and Threatened Flora Sites, SAAL NRM Region

6.3.1 Biodiversity Description and Features

6.3.1.1 Channel Country

The dominant landscape features that give the region its name are the two huge drainage systems that enter South Australia from the north and north-east: the Georgina–Diamantina and the Cooper systems. Their catchments extend hundreds of kilometres into Queensland and the Northern Territory and their flows are largely dependent on rainfall in these faraway parts of the country. The Georgina-Diamantina's multiple intertwining small stream channels and flood courses spread to form the ephemeral Goyder Lagoon before recombining into the narrow flood courses and channels of the Warburton and Kallakoopah Creeks that eventually feed into Lake Eyre. Cooper Creek enters South Australia and spreads through the shallow Coongie Lakes system and large flood-outs between the dunes north of the Strzelecki Desert. It forms a single, defined channel below Lake Hope and stays this way for most of the remaining distance to Lake Eyre.

When floods are large enough, waters spread and follow broad and shallow flood plains through the gibber country toward Lake Eyre. The Coongie Lakes wetland system is the only major unpolluted, unregulated freshwater system in arid Australia. The wetlands change depending on the amount of rainwater flowing down from the north. In extreme flood conditions this north-east corner of the State is transformed into a huge expanse of interconnected lakes and wetlands.

In 1987, part of the Cooper Creek system was proclaimed as the Coongie Lakes Wetland of International Importance under the 1971 Ramsar Convention, to which Australia is signatory. The Strzelecki Creek and Diamantina wetland systems are also listed as nationally important, the Strzelecki providing extremely important habitat for 18 raptor species of which 16 breed locally.

Water bird diversity in the lower Cooper system is particularly high with 73 water bird species and another 13 wetland dependent species recorded. The wetlands also provide an important drought refuge for water bird populations.

LANDFORMS	CONSERVATION PRIORITIES
Drainage Line and Flood Plains	Significant response of water birds to water flow along the Diamantina and Cooper Creek drainage systems
	Important permanent and semi-permanent waterholes of the Diamantina and Cooper Creek drainage systems
	Threatened ecological communities on drainage lines, flood plains and swamps
	Grey Grasswren on flood plains and swamps
Stony Plains	Significant and endemic flora and fauna on stony plains
Dunefields and Sand Plains	Mulga low woodland on low dunes and sand plains

Table 4: Conservation Priorities for the Channel Country

6.3.1.2 Flinders and Olary Ranges

The Flinders and Olary Ranges lie in a south to north transition zone from winter to summer dominant rainfall. Mallee communities typify southern parts, responding mostly to cool season rains, whereas Mitchell grass communities typify the northern area. The southern arid zone is characterised by chenopod shrubland. These low chenopod communities often form a mosaic with other communities such as low woodland, low shrublands and ephemeral grassland. In sandier country, sandhill wattle and mulga overstorey with mixed shrub or tussock grass understorey variously dominate vegetation communities. Species diversity is highest in the ranges and drainage lines where there is greater habitat diversity.

The northern Flinders Ranges form part of an archipelago of arid ranges habitats. Species such as the little woodswallow, painted firetail, Finlayson's cave bat and euro occupy this habitat. Flinders grey mallee, white Cypress-pine low woodlands and hummock grasslands are common along the central quartzite spine of the ranges, while mallee communities dominated by beaked red mallee and white mallee are found on lower slopes and valleys in the central and northern ranges. Curly mallee is also found on the slopes of the northern and central Flinders Ranges and, in the Flinders and Olary Ranges, mixed shrubland variously dominated by elegant wattle, dead finish, emu-bush and senna are widespread on lower shaley hills and rocky hills.

Mixed mallee communities dominate hills and plains in the western Olary Ranges, with chenopod low shrublands and non-eucalypt woodlands more common in the eastern part. Drainage lines provide significant habitat and dispersal corridors for species throughout the region. These areas generally support a similar level of species diversity to the mountain habitat because of the higher moisture levels, nutrient availability and habitat diversity. River red gums characterise most drainage lines with a variable understorey including rushes and sedges in moist areas and inland paper-bark, elegant wattle, boobialla and lemon-scented grass in the drier parts.

LANDFORMS	CONSERVATION PRIORITIES
Drainage Lines and Floodplains	River Red Gum woodland along drainage lines and flood plains Permanent and semi-permanent streams and waterholes Significant and endemic species in drainage lines
Plains and Rises	Significant bird species in chenopod shrubland Bullock Bush tall shrubland and significant plant species on alluvial plains Plain-wanderer in sparse grassland and mixed grassland-herbland Mulga and needle wattle low woodlands on low dunes and sand plains
Ranges and Hills	Ecological communities on high ranges Yellow-footed rock-wallaby on ranges and hills Significant and endemic plant species on low ranges and hills

Table 5: Conservation Priorities for the Flinders and Olary Ranges

6.3.1.3 Gawler

The Gawler bioregion covers over a quarter of South Australia's pastoral rangelands. The Gawler bioregion is a transition zone between the temperate agricultural regions of the south and the semi-arid and arid pastoral regions of the north. This bioregion is a transition zone for numerous South Australian and Western Australian species of flora and fauna that are either at the limit of their range or have some close affinities with species in the west, while others may have closer affinities with eastern species.

There is a wide diversity of landscapes in the bioregion. In the central and southern parts, immediately north of the agricultural area, are extensive areas of mallee and the distinctive granite rocky hills of the Gawler Ranges surrounded by large salt lakes. The mulga sand plains and dunes to the northwest are an extension from the Great Victoria Desert bioregion and are a stark contrast to the undulating stone-covered Arcoona Tablelands west of Lake Torrens. Calcareous plains with chenopod shrubland occur across the central and northern parts of the bioregion, while similar country in the southeast supports open western myall shrubland with Bluebush.

The arid north is covered by sand plains and dunes that support mulga woodlands and chenopod shrublands. Outcropping iron-rich rocks northeast of Tarcoola are remnants of a younger sedimentary phase, and further south abutting the higher rainfall agricultural area, the calcareous loamy plains support open myall woodlands with chenopod shrublands of bluebush and saltbush.

LANDFORMS	CONSERVATION PRIORITIES
Drainage lines, Floodplains and Salt Lakes	Ecological response to water flows in the landscape Significant threatened and endemic flora species on gypseous soils in and around saline areas
Sand Dunes and Sand Plains	Pernatty knob-tail (<i>Nephrurus deleani</i>) on sand dunes Mulga low woodlands on sand plains
Stony Plains	Significant fauna species on cracking clay plains and stony plains with gilgais
Plains and Rises	Bullock bush tall shrubland on alluvial soils of plains Significant bird species in chenopod shrublands Significant species in mallee habitat
Hills and Ranges	Significant and endemic plant species on rocky outcrops Yellow-footed rock-wallaby on ranges and hills

Table 6: Conservation Priorities for the Gawler Bioregion

6.3.1.4 Sandy Deserts

The Simpson-Strzelecki Dunefields bioregion is one of the largest linear sand dune environments in the world. The region forms part of a huge complex of linear dunes in central Australia, dunefields that extend well into Queensland, the Northern Territory and north-western New South Wales.

The region is characterised by extreme climatic variability, which has brought about a huge variety of landscapes and habitats. Distribution and availability of water is a key factor determining what plants and animals can live there. Despite this arid and often harsh and unforgiving landscape, the region is full of plants and wildlife which have adapted remarkably well. Besides the variety of small mammals, such as hopping mice, dunnarts and mulgaras, dingoes and kangaroos are also found. There are numerous reptiles including Military dragons, perenties (Australia's largest lizard), goannas, western brown snakes, woma pythons and banded skinks. Of the more than 150 species of birds that inhabit the sandy deserts, there are the rare eyrean grasswren and Australian bustard, and the more common wedge-tailed eagles, brown falcons, budgerigars and zebra finches. Black kites, crested pigeons and galahs are also common in the flood plain areas, and a variety of waterbirds, some migratory, can be found, sometimes in huge numbers on the playa lakes when there is water about.

The semi-permanent wetlands, rivers and flood plains provide a great variety of habitats. Many water and land-based species depend on these refuge areas for survival during dry periods, and they are important breeding areas for many species which forage and hunt in the adjacent dunefields and sand plains. Much of the plant life has adapted to the extreme and unpredictable seasonal conditions, with short lifecycles enabling opportunistic germination, growth, flowering and setting seed after rain.

LANDFORMS	CONSERVATION PRIORITIES
Drainage lines and flood plains	Ecological response to water flows in the landscape Threatened ecological communities on drainage lines, flood plains and swamps
Salt Lakes	Ecological response to water flows in the landscape
Great Artesian Basin springs	Habitat diversity of the Lake Callabonna – Lake Frome GAB Spring complex
Dunefields and Sand Plains	Dusky hopping-mouse in the Strzelecki Desert Marsupial mole in the Simpson Desert and Finke bioregion Threatened ecological communities on low dunes and sand plains

Table 7: Conservation Priorities for the Sandy Deserts

6.3.1.5 Stony Plains

The predominant feature is the vast gently undulating gibber and gypsum plains. Saltbush, bluebush, samphire, Mitchell grass or the short-lived bindyi, thyme sea-heath and bonefruit dominate these plains which are dotted with occasional lakes, claypans, some low hills and the floodplains of ephemeral watercourses that drain toward Lake Eyre.

Where dunefields, swales and sand plains overlay the gibber surface, sandhill cane-grass grasslands dominate although areas containing mulga, sandhill wattle, umbrella bush, nitrebush, Sturt's pigface and bladder saltbush are also common. The breakaways and stony hills are a unique habitat within the region supporting a number of endemic species such as the Arckaringa daisy, Barker's mulla mulla, pebble and ochre dragons and bronzeback legless lizard that are restricted to or rely heavily upon these areas. Mulga, emubushes, wattle and occasionally silver needlewood are found in these rocky areas.

Saltpans are usually bare and salt-crusted but often have a halo of tussock grassland or samphire. Samphires, salt-loving succulent shrubs, are widespread across the region. Claypans fill with water following rains, providing fresh water and the right habitat for swamp cane-grass. Dense stands over large areas provide protection and habitat for many water bird species.

Drainage channels in the upper catchment tend to have a denser version of the vegetation of the surrounding hills and breakaways. Gidgee is one of the larger trees lining watercourses in the north, with coolibah dominant in wetter areas and waterholes. Downstream in floodplains and swamps, old-man saltbush, lignum, cotton-bush and canegrass dominate. Occasionally the floodplains and channels have permanent waterholes which attract waterbirds, raptors, pardalotes and honeyeaters. These permanent waterholes are extremely important, protecting remnant populations and acting as refuges where species survive droughts and from which they disperse to colonise new locations when environmental conditions allow.

A unique feature of the region is the numerous springs that occur widely throughout the bioregion along the margin of the Great Artesian Basin (GAB). The Dalhousie Spring Complex consists of eight active spring groups, representing some of the largest and finest examples of artesian springs in Australia. The springs range in size and composition, with the largest pool 50 metres long and 10 metres deep. The Dalhousie Springs group accounts for 40% of the water naturally discharged from the Great Artesian Basin and are home to at least 10 species of snail, 90 plant species and three species of fish that are found nowhere else in the world. The springs are protected in Witjira National Park.

A characteristic feature of this region is the high proportion of ephemeral or short-lived plant species. The diversity of habitats present in this bioregion is reflected in the abundance of reptiles present. More than 100 species have been recorded. Native mammals are generally rare - many small and medium sized mammals have become extinct since European settlement. The exceptions are dingoes, often observed out hunting, and kangaroos. Most other mammals likely to be seen are introduced species – rabbits, feral cats, camels, donkeys and horses.

Table 8: Conservation Priorities for the Stony Plains

LANDFORMS	CONSERVATION PRIORITIES
Drainage lines and Flood-plains	Ecological responses to water flows and permanent and semi-permanent waterholes within the landscape Threatened ecological communities on flood plains and swamps
Stony Plains and Tablelands	Endemic species on gypseous clays Significant fauna species on cracking clay plains and stony plains with gilgais
Great Artesian Basin Springs	Habitat diversity of Great Artesian Basin Spring Complexes
Dune Fields and Sand Plains	Mulga low woodlands on sand plains
Breakaways and Stony Hills	Endemic species on gypseous breakaway slopes Northern myall low woodland and significant fauna species on breakaways



Just half an hour north-west of Coober Pedy, the Breakaways are a spectacular example of the region's unspoiled beauty

6.3.2 Main Management Issues

The major management issues for biodiversity conservation in the SAAL NRM Region are set out in the *SAAL Biodiversity Strategy* for the region and are summarised below. As noted in section 6.1, there are very close links between factors affecting soil condition and vegetation cover and those affecting the region's biodiversity. Several of the issues listed below are discussed in more detail in section 6.1. This highlights the need for an integrated approach.

6.3.2.1 Excessive Total Grazing Pressure

Excessive total grazing pressure is the combined effects of grazing pressure from domestic stock, feral and native herbivores. This is discussed more fully in section 6.1.2.1. Impacts include: reduction in recruitment of some native plant species; increase in some unpalatable native plant species; loss of native animals due to competition for resources; reduction in habitat quality; erosion and increased spread of weeds and disease.

6.3.2.2 Reduction in Great Artesian Basin Water Pressure

Excessive water extraction from the Great Artesian Basin can result in a reduction in artesian pressure and flow of water to the surface. As discussed in section 6.2, the historical extraction of excessive water from the GAB has had significant impact on GAB springs and their associated communities – although the bore rehabilitation program of the last 20 to 30 years has partially eased this impact. Impacts of reduced GAB water pressure therefore include reduced availability of water at the springs and likely reduction in area of GAB dependent communities.

6.3.2.3 Alteration to Natural Water Flows

Alteration to natural water flows may include restrictions to natural flow and/or flooding regimes of a watercourse due to diversions or the construction of artificial flow barriers and storage areas, including seismic lines, tracks, roads, borrow pits, dams and other infrastructure. This management is made more problematic in that large areas of SAAL NRM Region surface catchments are interstate. Impacts include change in ecosystem structure; disruption of dispersal mechanisms of aquatic species; loss of refuges and increased soil erosion and salinity.

6.3.2.4 Competition for Resources by Pest Plants and Animals

Introduced fauna and flora species compete with native species for resources. For example, the regional Pest Management Strategy (SAAL NRM Board 2006) notes that common starlings have been reported to take over the hollows of mulga parrots in mallee trees in the Gawler Ranges. In the SAAL NRM Region, where many introduced bird populations are relatively small, isolated and water source dependent, the opportunity may exist to severely suppress populations or locally eradicate them. Pest plants may occupy the niches of native plant species with potentially significant implications for natural ecosystems. Impacts therefore include reduction in recruitment and density of native plants and animals; change in species composition of ecosystems and potential loss of native animal and plant species.

6.3.2.5 Excessive Predation

Hunting and consumption of native animals by introduced carnivores such as foxes, cats and wild dogs are a particular concern in the region, as summarised in the following information from the regional Pest Management Strategy (SAAL NRM Board 2006).

The fox is threatening the survival of many Australian birds and mammals, and predation by foxes is listed as a threatening process under the *Environment Protection and Biodiversity Conservation Act 1999.* Foxes could become uncontrolled vectors for rabies if the disease became established in Australia, as well as carriers of hydatid worms that can affect humans, as well as maintaining reservoirs of many other diseases. Currently, the control of foxes is primarily based on the use of 1080 poison baits, although exclusion fencing is also used. Fertility control is in the experimental stages of development. Further impacts of foxes on biodiversity and details of control methods are covered in the *Threat Abatement Plan for the Predation by the European Red Fox.* This plan can be accessed through www.environment.gov.au

Feral cats are widely distributed throughout mainland Australia and offshore islands and can survive in dry conditions because they are predominantly nocturnal and can utilise the moisture in their diets. Predation by feral cats has been listed as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999*. Feral cats are mobile, especially during periods of food shortage and can disperse widely. There is clear evidence that feral cats have caused the decline and extinction of native animals on islands and that they prevent the re-establishment of native mammals on the mainland. Available methods for cat control are generally expensive, labour intensive, require continuing management effort and can be effective only in limited areas. The control of cats is further complicated by interactions with other pest animal species. There is good evidence that environments are made more suitable for feral cats by the presence of rabbits, as they are a preferred food item and create burrows that provide shelter for feral cats.

Wild dogs (including dingoes) are widely distributed throughout the Australian mainland, including the SAAL NRM Region, mainly north of the Dog Fence. While stable dingo populations are believed to have some benefits for land condition and biodiversity through their regulation of numbers of foxes, cats, rabbits and kangaroos, impacts associated with wild dogs include predation of native wildlife species and livestock. Wild dogs are primarily carnivorous and are known to hunt individually or in packs. Control of wild dogs by baiting, shooting and trapping has been undertaken, with variable results. Exclusion fencing has also been successful in reducing the impact of wild dogs south of the Dog Fence in the SAAL NRM Region.

6.3.2.6 Altered Fire Regimes

Changes to intensity, season and frequency of fire from the previous regime under which the ecosystem evolved can include impacts such as a change in ecosystem structure and habitat value; and loss of local populations of plants and animals.

6.3.2.7 Mechanical Disturbance

Changes to the vegetation cover as a consequence of human activity leaving the soil exposed tend to be localised and small scale, but cumulative impacts can be significant, including loss of habitat and reduction in habitat value for native species; increased potential spread of weeds and increaser native species; and increased soil erosion.

6.3.2.8 Pollution

Reduction in quality of ground and/or surface water can occur as a consequence of human activity. This can be an issue around human settlements and in wetland areas subject to grazing animals. Impacts include loss of native species and decline in habitat value in and surrounding waterholes.

6.3.3 Implications of Climate Change

As noted in the *SAAL Biodiversity Strategy*, changes in rainfall patterns, temperature and climate variability may have significant impact, including reduction in the geographic range of species, changes in the location, structure and composition of habitats and ecosystems, increased risk of extinction of already vulnerable species and expansion of invasive species. Ecological connectivity may also be an issue linked with climate change, with the potential for species and ecosystems to become fragmented as a result of climate change.

SUMMARY OF KEY ISSUES FOR BIODIVERSITY MANAGEMENT

Major Regional Assets

- » The natural ecosystems that cover the vast majority of the region
- » Threatened species and ecological communities and endemic species.

Key Risk Factors Requiring Management

- » Total grazing pressure
- » Reduced pressure in the GAB
- » Disruption of natural water flows in surface water systems
- » Pest plants and animals
- » Climate change.

Current Status

Based upon available information, summary comments are provided below for the above natural resource assets in terms of:

- » Health the overall health and condition of the resource at a regional scale
- » Trend the apparent trend in the health of the resource, using the last ten years as a reference
- » Information base an appraisal of the amount of information on which the health and trend ratings are based.

	HEALTH	TREND	INFORMATION BASE
NATURAL ECOSYSTEMS	Good in some areas that are subject to active management of threats. At a regional scale, reasonable but with a number of threatening processes that are likely to contribute to ongoing decline unless managed effectively	Probably improving in some localities subject to active management. At a regional scale, probably in a state of decline	Some reasonable baseline information about species occurrence. Limited information about species and community dynamics and about trends
THREATENED SPECIES AND ECOLOGICAL COMMUNITIES AND ENDEMIC SPECIES	Regionally, poor with widespread impacts from threatening processes. Reasonable to good in some localities subject to active management of threats	As above	As above
7. SUMMARY OF KEY REGIONAL ASSETS AND RISK FACTORS IDENTIFIED THROUGH STATE OF REGION ASSESSMENT

CATEGORY	MAJOR REGIONAL ASSETS	KEY RISK FACTORS REQUIRING MANAGEMENT
Cultural, Social and Economic	 The people of the region The cultural features (Aboriginal and post-European settlement) Industries (particularly mining, pastoralism and tourism) and the natural resources that underpin those industries Infrastructure supporting the people and industries of the region 	 Ensuring that regional people have the information, skills, motivation and resources to manage natural resources appropriately Protection of cultural features from inappropriate land use Ensuring that potential sustainable industries such as pastoralism and tourism are sustainable with minimal impact upon natural resources Ensuring that more exploitative industries such as mining have minimum practical impact upon natural resources and are offset by actions to achieve positive environmental outcomes Ensuring that regional communities and industries are well placed to adapt with climate change
Soils and Geology	 "Iconic' landscapes (eg ranges, sandy deserts, stony deserts, gibber plains, breakaways) Soils (supporting biodiversity and primary production) Native vegetation (supporting soil stability and condition) 	 Management of total grazing pressure by: Stock (cattle, sheep) Pest animals Kangaroos Management of pest plants Adaptive management with climate change
Groundwater	 The Great Artesian Basin Other groundwater basins Groundwater supplies to support natural ecosystems (particularly GAB springs) and community and industry use 	 » Sustainable use of the GAB » Retaining adequate pressure to maintain supplies of adequate quantity and quality for human use (pastoral, domestic, industry) and for conservation of GAB springs and their associated ecosystems » Management of total grazing pressure at GAB springs » Lack of understanding of the occurrence, extent or sustainable yield of shallow aquifer systems, leading to over-abstraction of the aquifers, leading to increased salinity » Adaptation to climate change
Surface Water	 The river systems and wetlands of the Lake Eyre Drainage Division, the Western Plateau Drainage Division and the South Australian Gulf Drainage Division 	 Maintenance of recharge and flows to sustain dependent ecosystems and pastoral and other uses Maintenance of water quality Management of introduced aquatic pests Management of total grazing pressure Adaptive management with climate change
Natural Biodiversity	 The natural ecosystems that cover the vast majority of the region Some priority to threatened species and ecological communities and endemic species 	 » Total grazing pressure » Reduced pressure in the GAB » Disruption of natural water flows in surface water systems » Pest plants and animals » Climate change



Ten-Year Strategic Plan for the SA Arid Lands NRM Region

1. INTRODUCTION: THE PURPOSE OF THIS SECTION OF THE PLAN

The *Natural Resources Management Act 2004* requires regional NRM boards to include a Strategic Plan for the next ten financial years within the regional NRM plan. This ten-year Strategic Plan needs to be consistent with the *State NRM Plan* and follows the guiding principles as set out in Part 1 of this document.

This Strategic Plan aims to cover all significant NRM issues in the SAAL NRM Region, not just those management issues that are wholly or partly the responsibility of the SAAL NRM Board. The Strategic Plan also sets the scene for the three-year Business Plan – which does focus on the Board's responsibilities and comprises Volume 2 of this NRM Plan.

This section of the SAAL Regional NRM Plan therefore focuses on the following:

- » Reviewing the NRM issues and priorities that need attention over the next ten years based upon the knowledge and aspirations of the Board, the regional community and other stakeholders
- Identifying key program areas and ten-year targets for NRM in the region; these targets relate to the condition of natural resources (rather than achievement of specific actions) and are therefore described as Resource Condition Targets (RCTs)
- » Setting out strategic directions for the achievement of the RCTs
- » Identifying short term (one to five year) targets for management actions (Management Action Targets – MATs), including broad performance indicators, lead agencies and potential partnerships
- Reviewing current processes relating to monitoring and evaluation and setting out proposed arrangements for monitoring and evaluation of progress against the resource condition targets
- » Establishing a strategic framework to guide the development of the Board's Business Plan.

2. SETTING THE SCENE FOR THE TEN-YEAR STRATEGIC PLAN

Part 1 of this document included the Vision and Goals of the SAAL NRM Board for natural resources management. These provide an important basis for the ten-year Strategic Plan and are therefore repeated below.

VISION	The South Australian Arid Lands NRM Region is a healthy functioning ecosystem with sustainable industries and vibrant communities
GOALS	 Adaptive landscape-scale management which maintains and strengthens the natural functioning of the region's ecological systems.
	 Vibrant communities and industries using and managing natural resources within ecologically sustainable limits.
	3. Vibrant communities, governments and industries working together with the capability, commitment and connections to manage resources in an integrated way.

2.1 FOSTERING AN INTEGRATED APPROACH

One of the features of natural resources management programs over the last decade has been the move towards a more integrated approach. Integration in essence means dealing with more than one issue within one coordinated process and can apply at virtually all levels of natural resources management. For instance:

- Integrated planning: for example, planning for pest animal and plant control should take into account production and biodiversity conservation objectives
- Integrated actions: for example, protection of riparian zones combined with improved land management practices in the catchment can contribute to improved water quality, reduced sedimentation etc
- Integrated management and integrated outcomes: for example, an integrated approach to feral herbivore management can contribute to both production and biodiversity benefits.

In developing this regional plan, the Board is endeavouring to promote and incorporate these concepts in a practical and effective way. Linkages between targets, programs, etc are highlighted where relevant.

2.2 **RISK ASSESSMENT**

In developing its Strategic Plan and Business Plan, the Board has applied a risk assessment framework to help focus and prioritise actions within each of its programs. In broad terms this involves an appraisal of the natural resources assets of the region and an assessment of the degree of risk or threat posed to those assets by various factors.

Several other factors then apply in determining how (or whether) to address those risks. These include:

- » Whether the risk could threaten an increasing array or area of natural resources
- » The impact or potential impact associated with the risk factor
- » Whether practices (eg technology or technical skills) are available to address the risk
- » The costs and benefits of potential responses
- » Obligations associated with legislation, agreements etc
- » The wishes of the regional community and other interest groups
- » The financial and other resources available.

As an illustration **Table 9** has been prepared based upon the assets and risks for this region as identified in the state of the region component of this plan (Part 2).

It is not considered appropriate to use **Table 9** to define clear priorities for NRM in the SAAL NRM Region. A risk factor that is regarded as of high importance against three regional assets is not necessarily of lower priority than a risk factor that rates of high importance against six regional assets. Assets and risks all have different values and levels. However, **Table 9** does demonstrate that most risk factors are highly relevant to many categories of regional assets. It thus highlights the importance of an integrated approach to NRM programs.

ASSET	RISK FACTOR	Excessive total grazing pressure	Terrestrial pest plants	Terrestrial pest animals	Aquatic pests	Soil erosion	Reduced groundwater pressure level	Disruption of natural river flows	Decline in water quality	Inappropriate vehicle access	Inappropriate or poorly maintained infrastructure	Inadequate response to climate change
Soils												
Natural ten ecosystem	restrial 1s											
Natural aq ecosystem	uatic 1s											
GAB & oth g'water rese	ner ources											
Surface w resources	ater											
Cultural features												
Geologica features	l											
lconic landscape	s											
Industry												
Infrastruct	ure											
LEGENI	D: Pot Fac	ential In tor on A	npact of Asset:	f Risk	н	GH		MEDIUN	Λ	LC	OW/NIL	

Table 9. Risk Assessment Matrix for Major NRM Assets in the SAAL NRM Region

2.3 ESTABLISHING RESOURCE CONDITION (TEN-YEAR) TARGETS

In 2007, the Board convened workshops to help formulate Resource Condition Targets (RCTs) for the region. RCTs are generally medium to long term targets that are expressed in terms of the condition or status of natural resources, for example, "achieve a 10% improvement in native vegetation cover by 2020" or "reduce mean nutrient levels in surface waters by 10% by 2020".

In setting its RCTs, the Board has been mindful of the need to follow the 'SMART' criteria, that is, the targets need to be Specific, Measurable, Achievable, Realistic and Timely. The following further comments are particularly relevant to targets in the SAAL NRM Region:

- The region is subject to what has been described as the 'boom or bust' phenomenon: there are very wide and sometimes sudden fluctuations in conditions. There may be times, for example, when native vegetation biodiversity is naturally low as a result of prolonged drought – when short-lived species have died out pending further rains to promote germination. It is not particularly meaningful, therefore, to set a target such as "achieve a 20% increase in native plant diversity by 2020". The target needs to be tailored more to the natural conditions that apply at a particular time.
- » Currently there is relatively little information available to quantify the status of natural resources at a regional scale. Where this is the case, a target expressed in terms of "achieve a 20% improvement by 2020" will not be measurable if the baseline to measure against does not exist.
- » Reflecting this lack of baseline data, several of the RCTs in the table following are couched in terms of general (rather than specific) improvement in the condition of natural resources.

Further, the Board has also been mindful of the need to demonstrate the linkages between RCTs and the Board's three broad goals, as set out above. Inevitably, there is a significant degree of overlap with some targets having relevance to all three goals.

Table 10 lists the RCTs against the goals to which they primarily relate. Desired outcomes and the alignment of targets to milestones in the State NRM Plan are also shown. The RCTs relate closely to those developed during 2007, but have been further refined through consultation and ongoing analysis.

This ten-year Strategic Plan is structured around the framework set by these goals and RCTs. For the sake of providing a clearer focus, the three goals are treated as three broad program areas, as follows:

Program 1: Functioning Ecosystems Program

This addresses **Goal 1**: Adaptive landscape-scale management which maintains and strengthens the natural functioning of the region's ecological systems.

Program 2: Sustainable Use Program

This addresses **Goal 2**: Vibrant communities and industries using and managing natural resources within ecologically sustainable limits.

Program 3: Active Communities Program

This addresses **Goal 3**: Vibrant communities, governments and industries working together with the capability, commitment and connections to manage resources in an integrated way.



SAAL NRM GOALS	DESIRED OUTCOMES	RESOURCE CONDITION / 10-YEAR TARGETS TO 2020	EXPLANATION OF TARGETS	ALIGNMENT TO STATE NRM PLAN RCTS & MILESTONES
Goal 1 Adaptive landscape scale management which maintains	The extent and condition of native vegetation is improved (taking naturally expected variations into account)	 The average extent and condition of native vegetation (species composition, structure and cover) is improved 	This target relates strongly to the Pastoral Assessment Program, where native vegetation parameters are monitored over ~8,000 sites. It is also important that natural variations be taken into account, given the 'boom or bust' nature of the region. Therefore, monitoring and evaluation will take into account natural variation associated with seasonal factors. See section 4 for more discussion.	Alignment with RCT L1, B3, B4 Milestones 1.2, 4.1, 4.2
and strengthens the natural functioning of the region's ecological systems.	All mative fauna and associated ecosystems are improved in condition and status with reduced impact from pest animals and plants Aquatic ecosystems are maintained through	 50% of species and ecological communities in each of the identified risk categories have moved to a lower risk category and no species or ecological communities have moved to a higher risk category 	Assessment of species and communities in terms of population size, extent etc is problematic. The overall risk rating for species & communities is reviewed periodically and this is regarded as the most appropriate target given the nature of the region. At the same time, it is recognised that categorisation can change simply as a result of new information – not necessarily because of an on-ground change. The 50% target figure is not rigorously based but has been discussed with DEH personnel and is considered to be reasonable. As with the other RCTs this target will be reviewed over time. Risk categories here are as under the <i>EPBC Act 1999</i> and <i>NPWL Act 1972</i> .	Alignment with RCT B1, B2 Milestones 1.2, 4.1, 4.2
	in groundwater regimes surface water systems Significant cultural features associated with natural resources are protected from disturbance Natural ecosystems buffered against the effects of anthropogenic climate change	 The extent and condition of at least 50% of priority aquatic ecosystems is improved and other priority aquatic ecosystems are at least maintained in extent and condition 	For the purpose of this plan, priority aquatic ecosystems include those identified by Neagle (2003) [(<i>a</i>) <i>Ecological communities</i> associated with major drainage lines and floodplains considered to be threatened; (b) wetlands rated as "important wetlands in Australia" (Table 28); and (c) wetlands rated as "important wetlands in Australia" (Table 28); and (c) other significant wetlands in the region (Table 29)]. Other priority aquatic ecosystems will also be reviewed from the results of more recent work (eg studies through the National Water Initiative). As with RCT 1, there is a need for monitoring and evaluation to take into account natural fluctuations associated with seasonal factors. The Board is also mindful that there are other important aquatic ecosystems in the region that are not yet on a priority list – in some cases simply because of the lack of data. Again, the 50% target is considered, in consultation with DEH personnel, to be reasonable.	Alignment with RCT W1, W2, W3 Milestones 1.2, 4.1, 4.2
		 At least 50% of documented areas and sites of particular cultural significance that are suffering from disturbance are in improved condition 	Many sites of particular cultural significance are affected by disturbance. Reference documents such as SADEP (1985)will be used to identify key sites and areas with this information supplemented through consultation with Aboriginal communities, the Department of Aboriginal Affairs and Reconcliation, DEH and others. There are also some situations where the feature of cultural significance is impacting upon natural resources, for example, soil erosion is associated with parts of the old Ghan railway embankment. The Board will seek to reduce those impacts. The 50% target is seen to be reasonable but may be subject to review as further information is gathered and prioritised.	Alignment with RCT L1 Milestone 1.2

Table 10: Resource Condition Targets for the SAAL NRM Region

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SAAL NRM GOALS	DESIRED OUTCOMES	RESOURCE CONDITION / 10-YEAR TARGETS TO 2020	EXPLANATION OF TARGETS	ALIGNMENT TO STATE NRM PLAN RCTS & MILESTONES
Goal 2 Vibrant communities and industries using and managing natural resources	Land and water resources are used sustainably for community, industry and environmental benefit	5. The incidence of human-induced soil erosion is reduced	As soil erosion can be caused by grazing pressure, the soil condition will be measured through the Pastoral Assessment Program with over ~ $8,000$ sites. As with other targets, soil erosion may occur largely as a result of seasonal conditions (eg prolonged drought) and monitoring and evaluation will take this into account. Erosion associated with roads, embankments and other infrastructure is also an issue for the SAAL NRM Region.	Alignment with RCT L1 Milestones 1.2, 4.2
within ecologically sustainable limits.	The soils of the region are exhibiting reduced erosion or other land degradation attributable to inappropriate land use or land management practices Profitable natural resource industries are	6. The ecological sustainability of natural resource-based industries in the region is maintained or improved.	This target promotes ecologically sustainable development and the compliance of industry with the Principles of Ecologically Sustainable Development will be used as a measure of its success. Key principles against which this target will be measured are: a. Integrating economic and environmental goals in policies and activities b. Ensuring that environmental assets are properly valued c. Providing for equity within and between generations d. Dealing cautiously with risk and irreversibility.	Alignment with RCTL1, P1, Milestones 1.2, 2.1, 4.2
	maintained or improved within the capacity of natural ecosystems The average quality and pressure of groundwater systems is maintained or	7. The average quality, pressure and level of groundwater are maintained or improved	Measurement against this target will rely, in the short term, on continued monitoring at existing monitoring sites and extrapolation of that data to other areas. As discussed in section 4, opportunities will be explored for progressive expansion of this monitoring network. Again, the potential for significant natural fluctuations needs to be taken into account in the evaluation of the data.	Alignment with RCT W2 Milestones 1.2, 1.3, 2.4
	improved Natural flow regimes and water quality in surface water systems are maintained or improved	 Flow regimes and water quality in surface water systems are maintained or improved 	As for Target 7 above. Water quality may relate to a range of parameters, including salinity, nutrients, suspended solids or, potentially, contaminants associated with urban or industry development.	Alignment with RCT W2, W4, Milestones 1.2, 1.3, 2.4
		See also vegetation target, RCT 1	Given the reliance of key industries upon sustained native vegetation cover, RCT 1 is a vital component in achieving Goal # 2.	

ALIGNMENT TO STATE NRM PLAN RCTS & MILESTONES	Alignment with RCT P1, Milestones 3.1, 3.2, 3.4			
EXPLANATION OF TARGETS	This target focuses on promoting information, knowledge and skills amongst all natural resources managers, including community and industry people and others. It links particularly with the programs associated with this NRM Plan. Measurement against the target will rely upon clear recognition of natural resources managers, tailoring of extension and training programs for the needs of those managers and ongoing assessment of the effectiveness of this process. This target is about involvement in natural resources management and ensuring that the majority of land managers are working in a way that supports achievement of the Board's goals. As with all of the Resource Condition Targets, see section 4 for more discussion.			
RESOURCE CONDITION / 10-YEAR TARGETS TO 2020	 All people who are actively involved in the management of natural resources in the region have the information, knowledge and skills needed to support the achievement of natural resources management priorities identified in the regional NRM plan The number of people actively involved in the management of natural resources and applying practices that support the achievement of the priorities identified in the regional NRM Plan is increased by 30% 			
DESIRED OUTCOMES	All regional land managers, ndustrial groups, community beople and other stakeholders have the information, confidence and skills to deliver NRM outcomes, are contributing to effective and sustainable NRM and are minimising any negative impacts upon natural esources in the region			
SAAL NRM GOALS	Goal 3 Vibrant communities, governments and industries working together with the capability, commitment and connections to manage resources in an integrated way.			

Table 10: Resource Condition Targets for the SAAL NRM Region continued

3. NRM STRATEGIES AND MANAGEMENT ACTION TARGETS TOWARDS 2020

This section considers what is needed to achieve the region's goals and ten-year RCTs and importantly how we should measure (monitor and evaluate) our progress towards the targets.

As discussed in 2.3, this section is framed in terms of three program areas that relate to the Board's three goals. At the same time there is considerable overlap across programs and this is highlighted where relevant. For example:

- The pastoral industry is entirely dependent upon the sustenance of a healthy native vegetation cover and of water resources. There is enormous scope for ongoing partnerships between the pastoral sector, the Board and other relevant stakeholders such as DEH, DWLBC and the regional community in managing these resources for multiple benefits.
- The tourism industry is partly based upon human endeavours (eg experiencing opal mining areas) but, more broadly, is focussed on enjoyment of the natural landscapes and features. Healthy natural resources are good for tourism and, conversely, financial returns from tourism can contribute in various ways to healthy natural resources.

For each program, strategic directions are set out in relation to each of the RCTs. The strategic directions then guide the expression of Management Action Targets (MATs), which have a time-frame of up to five years.



MATs are discussed against each of the RCTs below. A consolidated listing of the MATs is provided on pages 162 to 167. It should be noted that these MATs apply to all perceived natural resources management priorities in the SAAL NRM Region – not just those that are the Board's responsibility. Those MATs, in relation to which the Board has a role, are carried through to and reflected in the Board's Business Plan.

Often one or more MATs will be relevant to more than one strategic direction. In this case the relevant MATs are repeated for easy reading but the unique numbering system is maintained.

Before considering the proposed strategies and targets in more detail, it is relevant to make two further comments:

- The Australian Government's *Caring for our Country* program is clearly a major program supporting natural resources management. A number of priority outcomes have been described under that program and these are reflected also in the *Caring for our Country Business Plan for 2009/10*. Some of these outcomes and priorities have particular relevance for the SA Arid Lands and other remote areas in Australia. In developing its strategic directions and targets, as below, the Board has worked from first principles and not necessarily from the perspective of matching the *Caring for our Country* priorities. Nevertheless, the Board's process has indeed confirmed that many of its targets do link closely with *Caring for our Country* priorities and these are highlighted in the text below.
- The engagement and involvement of Aboriginal communities in the region's NRM programs is recognised as an extremely important objective in this planning process. The use of Aboriginal traditional knowledge and experience is critical to effective land and biodiversity management and Aboriginal communities are important partners and participants in contemporary land management. While some of the strategic directions and targets below relate specifically to Aboriginal communities and their cultural heritage, it is important to note that the vast majority of all of the targets are intended to relate to Aboriginal people as part of the broader regional community.

3.1 FUNCTIONING ECOSYSTEMS PROGRAM

GOAL	RESOURCE CONDITION TARGET
Adaptive landscape- scale management which maintains and strengthens the natural functioning of the region's ecological	 By 2020 1. The average extent and condition of native vegetation (species composition, structure, cover) is improved 2. 50% of species and ecological communities in each of the identified risk categories have moved to a lower risk category and no species or ecological communities have moved to a higher risk category.
systems.	 The extent and condition of at least 50% of priority aquatic ecosystems is improved and other priority aquatic ecosystems are at least maintained in extent and condition At least 50% of documented natural ecosystems of particular cultural.
	significance that are suffering from disturbance are in improved condition

Goal and Resource Condition Targets

3.1.1 Strategic Directions and Management Action Targets Towards Resource Condition Target 1

Resource Condition Target 1

By 2020, the average extent and condition of native vegetation (species composition, structure and cover) is improved

The main aspects to be addressed in achieving this target are:

- » Management of total grazing pressure
- » Control of pest plants
- » Improving knowledge and information.

Several other management factors are also relevant but are dealt with under other RCTs following.

In the past, these areas have been primarily the concern of individual land managers with guidance and regulation through the Pastoral Board, the District Soil Conservation Boards and the Animal and Plant Control Commission. There have been significant advances in grazing management and pest control but the nature of these issues means that ongoing efforts are needed. In the case of pest management, coordination across regional boundaries is also important.

3.1.1.1 Total Grazing Pressure

This term describes the overall grazing pressure exerted by stock (sheep and cattle), by introduced herbivores (eg rabbits, goats, camels, horses, donkeys) and by native herbivores such as kangaroos.

(a) Grazing by Stock

For the most part, grazing by sheep and cattle occurs on pastoral leases established under the *Pastoral Land Management and Conservation Act 1989*. This is administered by the Pastoral Board and its support staff in the DWLBC. Activities in this program include pastoral inspection, assessment and monitoring aimed at maintaining or improving the condition of pastoral leasehold land.

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Define priority at- risk areas (including ecological, cultural and production-related) and implement program to protect from negative stock impacts	<u>MAT 1</u> . Develop register of regionally significant sites and areas that warrant specific protection measures and develop policies for management and protection by 2014 and ensure on- ground protection of priority sites/areas is under way by 2016	Regional and cross-border, in collaboration with neighbouring NRM bodies and other relevant organisations	Milestone 1.3; Strategies 1.3.2, 1.3.7
Ensure Pastoral Board and Pastoral Program of DWLBC is adequately resourced to maintain its assessment program in a timely and effective manner	<u>MAT 2</u> . Review resource requirements associated with the Pastoral Assessment Program and ensure adequate resourcing by 2014	Areas under Pastoral Lease	Milestone 2.1; Strategies 2.1.2, 2.1.12
Ensure pastoralists and all other land managers have relevant up-to-date information regarding biodiversity conservation priorities	<u>MAT 3</u> . Ensure that 100% of land managers have sufficient information to incorporate biodiversity stewardship into enterprise decision-making by 2014	Regional	Milestone 2.1; Strategy 2.1.11
Ensure water point placement does not contribute to biodiversity decline	<u>MAT 4</u> . Develop a revised methodology and format for the timely production of land management plans, that avoid biodiversity decline, for the installation of new water points by 2013	Areas under Pastoral Lease	Milestone 2.1; Strategies 2.1.2, 2.1.3
Ensure pastoral lessees have adequate information and skills to manage land in accordance with conservation objectives	<u>MAT 5</u> . Develop best practice guidelines and related extension programs for sustainable grazing management – taking into account land system type and drought responsiveness – by 2014	Areas under Pastoral Lease	Milestone 2.1; Strategies 2.1.2, 2.1.3, 2.1.4
Support initiatives that promote drought preparedness and responsiveness	<u>MAT 6</u> . Ensure that at least 50% of pastoralists are engaged in best practice management programs by 2014		

While MAT 1 is presented above in the context of protecting significant areas from stock impacts, it is clearly much broader than that. It is about appropriate protection of the region's most important features, including sites of Aboriginal cultural importance. As such, it links well with the Australian Government's *Caring for our Country* five-year outcome of increasing the area of native habitat and vegetation that is managed to reduce critical threats to biodiversity.

(b) Grazing by Pest Herbivores

As discussed in Part 2, the impact of rabbits, camels, goats, horses and donkeys is significant. Management of declared pest animals is primarily the responsibility of land managers, with support and coordination through the SAAL NRM Board. The Board has developed a pest management strategy to help address issues associated with declared pests and non-declared pests that pose a significant problem. In relation to camels, the Board's strategic directions and targets (see below) link well with the priority identified in the Australian Government's *Caring for our Country Business Plan 2009/10* (to reduce the density of camel populations over the next two years).

The strategic directions and MATs in this plan are pitched at a relatively high level. Accordingly, the broad targets for pest management are essentially the same, whether they are for pest herbivores, other pest animals or pest plants. The set of strategic directions and MATs 1 and 7 to 13 following therefore covers the broad range of pest management issues, not just pest herbivores.

It is also important to note that the management of pest species cannot just be considered in a regional context. For many pest species, cross-boundary/border collaboration is essential for a comprehensive approach to pest management. The management of camels, for example, is an issue for inland Australia in general, not just for the SAAL NRM Region.

3.1.1.2 Control of Pest Plants

Pest plant management in the SAAL NRM Region has been limited, but most declared species are not yet widespread. Nevertheless, pest plants have the capacity to impact significantly on native vegetation extent and condition. The Board has a central role in promoting, supporting and coordinating management of pest animals and plants and, as noted above, has developed a pest management strategy.

Proposed Strategic Directions and MATs

See table opposite.

3.1.1.3 Improved Knowledge and Information

Improved knowledge and information is needed in many areas of pest management. This includes the need for more information on pests and their distribution within the region (ie region-specific information) and improved information regarding control and management (which may be state-level or cross-regional information).

The potential impact of climate change is an important aspect relating to pest management. Some pest species may be advantaged by climate change and forward planning needs to address this. Pest management may become particularly problematic if pastoral lessees and other land managers leave the land if climate change renders their businesses uneconomic. Climate change is also likely to have implications for native species and natural ecosystems, as well as other areas of natural resources management such as water resources management. In view of this, MAT 10 opposite is expressed in broad terms.

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Define priority at- risk areas (including ecological, cultural and production-related) and implement program to protect from negative impacts from pest animals & plants	<u>MAT 1</u> . Develop register of regionally significant sites and areas that warrant specific protection measures and develop policies for management and protection by 2014 and ensure on-ground protection of priority sites/areas is under way by 2016	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 1.3; Strategies 1.3.2, 1.3.7
Map existing pest distributions and prioritise for control	MAT 7. Complete initial mapping of pest distributions and determine priorities for control, and establish process for updating of mapping data by 2014	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.2; Strategy 4.2.1
Develop and implement plans for control of existing pest animals and plants	<u>MAT 8</u> . Ensure programs are in place aimed at achieving reductions in the distribution and numbers of identified priority pests by 2014	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.2; Strategies 4.2.1, 4.2.2
Develop and implement policies to prevent new incursions	MAT 9. Ensure high risk potential pathways for the introduction of pest animals and plants are identified; high risk and vulnerable sites are being monitored regularly; and a framework for eradication or management of potential new incursions is in place by 2014	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.1; Strategies 4.1.1, 4.1.3, 4.1.4, 4.1.5
Consider implications of climate change for pest management and natural resources management in general	 MAT 10. Undertake risk assessment process to identify: » pest species that could be advantaged by climate change » native species and ecological communities that may be vulnerable to climate change » potential implications of climate change for water resources management » other potential implications of climate change for natural resources management by 2015 	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestones 1.1, 1.4, 4.2; Strategies 1.1.1, 1.1.2, 1.4.2, 4.2.1
Implement program of technical support and advice	<u>MAT 11</u> . Ensure all relevant land managers are engaged and supported in pest control programs by 2014	Regional	Milestone 4.2; Strategies 4.2.5, 4.2.9
Foster partnerships with adjacent regions	<u>MAT 12</u> . Develop cross boundary protocols and guidelines regarding pest control with adjoining NRM boards and equivalent adjoining interstate bodies by 2014	Cross boundary/ border	Milestone 4.2; Strategy 4.2.6
Support surveys, mapping and research regarding pest animals and plants and pest control/management strategies	MAT 13. Ensure research needs in support of MATs 7 to 12 are identified by 2011 and that priority research is underway by 2014	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.2; Strategies 4.2.1, 4.2.2

Proposed Strategic Directions and Management Action Targets

3.1.2 Strategic Directions and Management Action Targets Towards Resource Condition Target 2

Resource Condition Target 2

By 2020, 50% of species and ecological communities in each of the identified risk categories have moved to a lower risk category and no species or ecological communities have moved to a higher risk category

The general intent of this target is very much in line with State biodiversity conservation policy, such as under the *No Species Loss* and *NatureLinks* policies/programs. Past programs, particularly involving DEH, have gathered substantial information on the biodiversity of the region and there have been targeted programs, particularly involving pest control, that have supported biodiversity conservation. Specific projects such as Arid Recovery near Roxby Downs, have assisted in the conservation of significant species and ecological communities. However, the vulnerability of native biodiversity to pest species and other factors means that ongoing and expanded efforts are needed.

The main aspects to be addressed in achieving this target are:

- » Managing total grazing pressure
- » Controlling pest animals and plants
- » Maintaining or improving GAB pressure
- » Improving knowledge and information
- » Adapting to climate change.

3.1.2.1 Managing Total Grazing Pressure

The management of total grazing pressure is an important factor in maintaining or improving the conservation status of native species and communities. Strategic directions and MATs are discussed under RCT 1. MATs 1 to 6 are particularly applicable.

3.1.2.2 Controlling Pest Plants and Animals

The management of pest herbivores and pest plants is discussed in RCT 1. In addition to those, pest predators such as foxes, cats and wild dogs, have serious impact upon native fauna. Strategic directions for management and MATs 7 to 13 are applicable.

3.1.2.3 Maintaining or Improving GAB Pressure.

It is noted that the springs of the Great Artesian Basin are classified as threatened communities under the *Environment Protection and Biodiversity Conservation Act 1999*. Conservation of GAB springs is therefore relevant to RCT 2. However, the conservation of aquatic ecosystems associated with the GAB and with surface water systems is considered to be sufficiently important to warrant a separate RCT. These aspects are therefore covered under RCT 3, following.

3.1.2.4 Improving Knowledge, Information and Program Development

The *SAAL Biodiversity Strategy* has identified a number of information gaps and conservation priorities that need to be addressed. The broad nature of RCT 2 reflects the lack or inadequacy of information regarding the status of many species and ecological communities and regarding ecosystem function and services.

It is also important to note that some native species and ecological communities have distributions that cross regional and state boundaries. A cross boundary/border approach is therefore needed for much biodiversity research.

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Undertake surveys and research to improve the information base and develop programs	<u>MAT 14</u> . Complete surveys and mapping of regional ecosystems, including environmental water requirements by 2016	Regional and cross-border, in collaboration with adjoining NRM	Milestones 1.3, 2.4; Strategy 1.3.3
biodiversity conservation	MAT 15. Develop programs to support the management and recovery of 50% of the conservation priorities identified within the SAAL Biodiversity Strategy by 2016	Boards and relevant interstate bodies	Milestone 1.3; Strategies 1.3.3, 1.3.4, 1.3.5, 1.3.6, 1.3.7
	MAT 16. Determine the current status and potential for decline of 50% of species, ecological communities and ecological processes not currently identified as conservation priorities by 2016		Milestone 1.3; Strategies 1.3.1, 1.3.5
	MAT 17. Commence research to improve knowledge regarding ecosystem function and services for priority ecosystems by 2014		Milestones 1.1, 1.3; Strategy 1.1.1

These MATs link well with the *Caring for our Country* five-year outcomes proposed for Biodiversity and Natural Icons and for Northern and Remote Australia.

3.1.2.5 Adapting to Climate Change

Climate change has the potential to impact significantly upon natural ecosystems. Altered climatic conditions may mean that some species and ecological communities are no longer well adapted to areas that would otherwise be regarded as 'natural habitat'. It is possible that the SAAL NRM Region may be more buffered against this than most other regions in SA where native vegetation and habitat are highly fragmented. However, localised and/or isolated populations may be at risk and climate change could place increased pressure on species and communities that are already in a state of decline due to other factors.

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Identify species, ecological communities and processes that will be particularly vulnerable to climate change	 MAT 10. Undertake risk assessment process to identify: » pest species that could be advantaged by climate change » native species and ecological communities that may be vulnerable to climate change » potential implications of climate change for water resources management » other potential implications of climate change for natural resources management by 2015 	Regional and cross- border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestones 1.1, 1.4, 4.2; Strategies 1.1.1, 1.1.2, 1.4.2, 4.2.1
Further develop the public, private and indigenous protected areas network to provide additional safeguards against the effects of climate change	<u>MAT 18</u> . Improve the capacity of terrestrial and aquatic ecosystems to adapt to climate change through the enhancement of the public, private and indigenous protected areas network and sympathetic land management programs within 80% of all IBRA sub-regions by 2017		Milestone 1.3; Strategies 1.3.2, 1.3.4

MAT 18 links strongly with the five-year outcomes under *Caring for our Country* proposed for Australia's National Reserve System, Biodiversity and Natural Icons and Northern and Remote Australia.

3.1.3 Strategic Directions and Management Action Targets Towards Resource Condition Target 3

Resource Condition Target 3

By 2020, the extent and condition of at least 50% of priority aquatic ecosystems is improved and other priority aquatic ecosystems are at least maintained in extent and condition

The main aspects to be addressed in achieving this target are:

- » Managing total grazing pressure
- » Controlling pest animals and plants
- » Maintaining or improving pressure in the GAB and in other groundwater systems
- » Maintaining natural surface water regimes
- » Protecting, managing and rehabilitating sites of particular significance
- » Improving knowledge and information.

There has already been a range of activities to protect aquatic ecosystems in the region, such as through reservation under the *National Parks and Wildlife Act 1972*, development of stock management agreements relating to wetlands in Regional Reserves, community actions to protect wetlands and waterholes, and Government efforts to fence GAB springs. These have been significant advances but, given the particular vulnerability of aquatic ecosystems to excess grazing pressure, pest species and changes to hydrology, there is still much to be done.

3.1.3.1 Managing Total Grazing Pressure

Total grazing pressure is a particular issue for the GAB springs and other aquatic ecosystems. The more or less permanent vegetation and intermittent or permanent water availability means that these areas are a focus for attention.

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Protect priority GAB springs and other aquatic ecosystems from total grazing pressure	<u>MAT 19</u> . Identify GAB springs that warrant priority in protection from total grazing pressure by 2012 and ensure that 50% of those are protected by 2018	Marla-Oodnadatta and Marree-Innamincka Group Areas	Milestones 1.3, 2.4; Strategies 1.3.3, 1.3.7
	MAT 20. Identify other aquatic ecosystems that warrant priority in protection from total grazing pressure by 2014 and ensure that 50% of those are protected by 2018	Regional	Milestones 1.3, 2.4; Strategies 1.3.3, 1.3.7

The strategic directions and MATs under RCT 1 previously are therefore applicable. *In addition*, the following is proposed.

3.1.3.2 Controlling Pest Animals and Plants

Likewise, pest animals and plants are a significant issue for aquatic ecosystems. The strategic directions and MATs under RCT 1 (MATs 7 to 13) are therefore applicable. *In addition*, the following is proposed.

The control of pests in surface water systems needs to take into account that major river systems in the SAAL NRM Region have their headwaters interstate (eg Cooper and Diamantina in Queensland and Finke in the Northern Territory). The Alberga River has its headwaters in the Alinytjara Wilurara NRM Region. The control of pests in these systems needs a cross-border approach. Bodies such as the Lake Eyre Basin Ministerial Forum and its Community Advisory Committee and Scientific Advisory Panel have a role in coordinating these programs.

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Control pest plants and animals in GAB springs and other aquatic ecosystems	<u>MAT 21</u> . Develop a regional action plan for the control of animal and plant pests in aquatic ecosystems in the SAAL NRM Region by 2014	Regional and cross- border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestones 1.3, 2.4, 4.2; Strategies 1.3.7, 4.2.1, 4.2.2, 4.2.5



3.1.3.3 Maintaining or Improving Pressure and Water Levels in the GAB and in other Groundwater Systems

Given the historic loss of GAB springs due to decreased pressure, maintenance or improvement of pressure is vital to the ongoing conservation of remaining GAB springs and to the restoration of priority springs. This is also vital to the maintenance of sustainable industries and communities in the region. Adoption and implementation of the Water Allocation Plan (WAP) for the Far North Prescribed Wells Area is an important step. There are also issues with leaking artesian bores. More broadly, the sustainability of the GAB is very much dependent upon a national approach, particularly involving NSW and Queensland along with SA.

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Implement Water Allocation Plan for the Far North Prescribed Wells Area	MAT 22. Ensure that the Water Allocation Plan for the FNPWA is being fully implemented by 2014	Marla-Oodnadatta and Marree-Innamincka Group Areas	Milestones 1.2, 2.4, 2.6; Strategies 1.2.3, 2.6.1
Address the problem of leaking artesian bores and monitor effects of bore rehabilitation scheme	MAT 23. Ensure that a sustainable program for monitoring and repair of leaking artesian bores is in place by 2014		Milestone 2.4
Review status of currently flowing artesian bores and develop and implement management/rehabilitation programs as deemed necessary	MAT 24. Ensure that a management/rehabilitation plan for currently flowing artesian bores is completed by 2012 and implemented by 2016		Milestone 2.4
Work with other States to develop and implement integrated policies and programs to protect GAB and its associated ecosystems	<u>MAT 25</u> . Ensure the policies and actions to sustain the GAB in the SAAL NRM Region are integrated within national policies and actions by 2014	Marla-Oodnadatta and Marree-Innamincka Group Areas, with strong links with GAB areas in NSW and Queensland	Milestone 1.2; Strategies 1.2.3, 1.2.6

3.1.3.4 Maintaining Natural Surface Water Regimes

The maintenance of the variable flow regime in arid river systems controls the structure and availability of habitat and mediates the exchange of organisms. As well as flooding, the maintenance of low flows is of critical importance. Water extraction or interception in upstream catchments of the drainage systems which feed into Lake Eyre has the potential to negatively impact on water dependent ecosystems. Significant features such as wetlands and waterholes are an essential component of inland river systems and their ability to support diverse ecosystems is critically linked to the hydrological regime. A whole of catchment perspective will recognise the interdependencies between the complex elements of arid river systems and help to protect ecologically significant sites including the Ramsarlisted Coongie Lakes.

As already noted, several of the major river systems that feed into Lake Eyre have headwaters interstate. The sustainability of these systems is heavily reliant on achievement of the goals of the *Lake Eyre Basin Intergovernmental Agreement* – in particular, sustainable management to avoid downstream impacts. This Agreement was signed by the Australian, South Australian and Queensland Governments in 2000, and by the Northern Territory Government in 2004.

The Board is already a participating stakeholder in efforts to maintain natural flow regimes in the rivers of the Lake Eyre Basin. Within the SAAL NRM Region, the primary mechanism for supporting natural flows is through the Water Affecting Activities provisions of this plan (see Part 4). There is a need to ensure that Water Affecting Activities are described and managed in a way that is consistent with the maintenance of natural flow regimes in the region.

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Ensure that water extraction does not exceed sustainable levels	MAT 26. Develop guidelines for water extraction from surface water systems for stock, domestic and other uses by 2014	Regional	Milestone 2.4
Manage and regulate water affecting activities (WAA) in order to maintain natural water regimes	<u>MAT 27</u> . Ensure that administrative processes re Water Affecting Activities are in place and that relevant land managers are aware of their responsibilities by 2011	Marla-Oodnadatta and Marree-Innamincka Group Areas	Milestones 2.4, 2.6; Strategy 2.6.2
Ensure that new structures and other developments along the river systems of the SAAL NRM Region do not have significant impact upon flow regimes or dependent ecosystems	MAT 28. Review the Water Affecting Activities set out in Part 4 of this plan, to ensure that they are consistent with the objectives of maintaining natural flow regimes in the SAAL NRM Region by 2014	Marla-Oodnadatta and Marree-Innamincka Group Areas, with strong links with associated catchments in Queensland and the NT	Milestones 2.4, 2.6; Strategy 2.6.2

3.1.3.5 Protecting, Managing and Rehabilitating Aquatic Ecosystems of Particular Significance to Regional Communities

A number of aquatic ecosystems have already been protected in recognition of their particular importance. These include Dalhousie Springs, other GAB springs and areas associated with surface water systems. In some cases, rehabilitation has been needed – for example, through removal of date palms at Dalhousie.

To a large extent, degradation of aquatic ecosystems is associated with total grazing pressure, pest plants and animals and disturbance of natural water regimes. In this respect, MATs 7-12, 19-24, 26 and 27 should include priority aquatic ecosystems. However, these MATs will not necessarily pick up all scenarios involving significant aquatic ecosystems. For example, support for Aboriginal communities in caring for rock-holes may not fit comfortably within the above MATs.

The Board considers that there should be opportunities through this NRM plan to provide general support to the community in the protection, management and rehabilitation of aquatic ecosystems of particular significance. The following relatively broad MAT is therefore included, particularly to complement MATs 19 and 20.

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Support community actions for the protection, management and rehabilitation of aquatic ecosystems of particular significance	<u>MAT 29</u> . Implement protection, management and/or rehabilitation measures in at least ten priority aquatic ecosystems (priority at local / community level) by 2016	Regional	Milestones 1.3, 3.4; Strategies 1.3.3, 1.3.4, 1.3.7, 3.4.3, 3.4.4

3.1.3.6 Improving Knowledge and Information

The information base relating to the conservation, management and sustainable use of groundwater and surface water resources in the SAAL NRM Region is relatively poor. This has been highlighted particularly in the *State of the Catchment* report prepared for the SAAL NRM Board by the former Arid Areas Catchment Water Management Board.

The *GABSI, Aridflo* and *NWI* programs are assisting in addressing some of these information gaps.

Climate change is another potentially important factor in water resources management and this needs attention in terms of implications for the SAAL NRM Region.

STRATEGIC DIRECTIONS	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS	
Conduct research into the nature, extent and sustainability of shallow groundwater systems and their ecosystems Further investigate groundwater-surface water interactions in the region Implement more comprehensive programs	MAT 30. Develop a regional water resources research register, highlighting information gaps, priorities, responsibilities and potential funding sources by 2012 MAT 31. Ensure that high research priorities are being addressed by 2014 Ranges, No Flinders and North East NRM Group areas	MAT 30.Develop a regional water resources research register, highlighting information gaps, priorities, responsibilities and potential funding sources by 2012Regional but with some focus on heavily under- researched areas such as shallow groundwaterMilesto 2.4; this some this some 	ional Regional but Miles ch with some 2.4; focus on Strat- ties, heavily under- ential researched 2 areas such as shallow gh groundwater	Milestones 1.1, 2.4; Strategies 1.1.1, 1.1.2
to measure water quality and flow data for surface water systems Conduct further investigations re current water use and sustainable yields		systems and the Gawler Ranges, North Flinders and North East NRM Group areas		
Gather information regarding active bore drains and their management/closure/ retention				
Gather information regarding waterholes, rock- holes and threatening processes				
Develop region-scale mapping of wetland and floodplain systems				
Undertake further investigations into the environmental water requirements of groundwater and surface water ecosystems				
Further investigate the ecology and requirements of salt lakes in the region				
Develop more comprehensive information base re the nature, ecology and requirements of water resources in the Gawler Ranges, North East and Flinders sub-regions				
Investigate potential implications of climate change for water resources management in the SAAL NRM Region	 MAT 10. Undertake risk assessment process to identify: » pest species that could be advantaged by climate change » native species and ecological communities that may be vulnerable to climate change » potential implications of climate change for water resources management » other potential implications of climate change 	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies		

3.1.4 Strategic Directions and Management Action Targets Towards Resource Condition Target 4

Resource Condition Target 4

By 2020, at least 50% of documented natural ecosystems of particular cultural significance that are suffering from disturbance are in improved condition

The protection of cultural features is relevant to several of the goals and targets set out in this plan. However, cultural features have been given a specific RCT because of their importance to the region and its community. They are included under the Functioning Ecosystems Program because, for the most part, the cultural features relevant to this plan are natural features. In broad terms, relevant cultural features are considered to include:

- » Sites, areas etc of significance to Aboriginal communities
- » Sites and areas with important links with 'European' settlement and development post-1836
- » Regional landscapes that, in the eyes of most, help define the region.

Sites of cultural significance have protection under Aboriginal heritage and State heritage legislation. Many also have legislative protection through their inclusion in national parks and reserves, while other sites have protection through local community conservation initiatives. While these programs have been effective to a significant extent, there are still issues with sites being disturbed through pest impacts, inappropriate access by visitors and other impacts.

Sites and areas of Aboriginal heritage significance almost invariably link with natural resources. Sites and areas of non-Aboriginal heritage significance do not always link clearly with natural resources but there usually is a link. One example is the Peake Repeater Station ruins which are of State heritage significance. Considered in isolation, the ruins may not have an obvious link with natural resources management. However, the ruins are where they are because of the adjacent Freeling (GAB) Springs, so they need to be considered (and protected) in the context of the springs.

Landscape assessment and protection can be a difficult and highly subjective topic. The SAAL NRM Region has a wide array of natural landscapes that are highly regarded because of their 'untouched' character. For example, the broad expanses of gibber plains, sandy deserts and ranges all have particular attraction because of their relatively undisturbed character. Many of the landscapes are unique to the region and are in semipristine condition. Intrusion of more developments, particularly involving infrastructure, into these areas could have significant visual impact. The development of a structured and comprehensive approach to landscape assessment is a relatively recent phenomenon, but significant progress in this has been achieved over the last decade. It is considered important that a philosophy and methodology for landscape assessment be developed for the SAAL NRM Region. Another aspect regarding sites and areas of cultural significance is the potential for culturally important features to impact upon natural resources. An example of this is the gully erosion associated with sections of the embankment of the former Ghan railway line. Although these historical natural resources management issues may not normally rate as a high priority, they do need to be recognised and considered as part of this regional planning process.

STRATEGIC DIRECTIONS	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Work with Aboriginal communities to ensure that sites and areas of cultural importance are not compromised by inappropriate land use	<u>MAT 32</u> . Work with Aboriginal people to establish an agreed process for their consultation and involvement in NRM planning and programs by 2014. Also address as a response to MAT 1	Regional	Milestone 3.4; Strategies 3.4.2, 3.4.3, 3.4.4, 3.4.5
Ensure that sites and areas of 'European' cultural importance linked with natural resources are not compromised by inappropriate land use	<u>MAT 1</u> . Develop register of regionally significant sites and areas that warrant specific protection measures and develop policies for management and protection by 2014 and ensure on- ground protection of priority sites/ areas is under way by 2016	Regional and cross-border, in collaboration with adjoining NRM Boards and other relevant interstate bodies	Milestone 1.3; Strategies 1.3.2, 1.3.7
Develop landscape assessment guidelines and protocols and apply to safeguard "iconic" landscapes in the region from inappropriate land use	MAT 33. Develop landscape assessment framework for the SAAL NRM Region by 2014 and ensure all development and best practice land management standards incorporate ESD principles by 2016	Regional	Milestones 1.1, 1.2; Strategies 1.2.1, 1.2.6, 1.2.9
Ensure that sites and areas of cultural importance are not impacting significantly upon natural resources	<u>MAT 34</u> . Review the extent and priority of impacts upon natural resources associated with features of cultural importance by 2016	Regional but with some focus on North Flinders, Marree- Innamincka and Marla-Oodnadatta NRM Group areas	No clear linkage

MAT 32 links closely with the *Caring for our Country Business Plan 2009/10*, which emphasises the need to support the continued use and reinvigoration of traditional ecological knowledge. This also forms part of the proposed five-year outcome for Community Skills, Knowledge and Engagement under *Caring for our Country*.

3.2 SUSTAINABLE USE PROGRAM

Goal and Resource Condition Targets

GOAL	RESOURCE CONDITION TARGET
Vibrant communities and industries using and managing natural resources within ecologically sustainable limits.	 By 2020 5. The incidence of human-induced soil erosion is reduced 6. The ecological sustainability of natural resource-based industries in the region is maintained or improved 7. The average quality and pressure of groundwater are maintained or improved 8. Flow regimes and water quality in surface water systems are maintained or improved * See also vegetation target RCT 1

3.2.1 Strategic Directions and Management Action Targets Towards Resource Condition Targets

Resource Condition Target 5

By 2020, the incidence of human-induced soil erosion is reduced

A broad range of factors can contribute to soil erosion. Some are natural, such as fire, drought and flood. However, land use and land management practices can be significant contributors. Maintaining vegetation cover is a key factor while, at a more localised level, inappropriate infrastructure or inadequately maintained infrastructure can contribute to soil disturbance. For example, there are instances where inadequate maintenance of Public Access Routes has led to soil disturbance through vehicles deviating from the main tracks because of the poor condition of the tracks.

There is a long history of soil conservation issues being coordinated through district soil conservation boards. All six soil conservation boards in the region had district soil conservation plans and applied a range of measures and programs to support land managers in property management. It can be said that, historically, the boards made a significant contribution to improved soil management in the region. However, in this region, with its boom or bust climatic variations and significant issues with pest herbivores, soil management will continue to need significant input of resources. The SAAL NRM Board's sub-regional NRM groups now have an important role in assessing soil conservation issues and in helping to coordinate soil management programs.

Currently the main responsibilities at the regional level rest with the SAAL NRM Board through the *NRM Act 2004*. However, apart from soil monitoring incorporated into the Pastoral Assessment Program, there is little baseline information to use as a reference point in assessing soil condition across the whole region.

STRATEGIC DIRECTIONS	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Establish a framework for assessment of soil condition at the regional level	<u>MAT 35</u> . Identify soil erosion priority areas and initiate on-ground management by 2014	Regional	Milestones 1.4, 2.1, 2.2; Strategies 1.4.1, 2.1.8
Maintain native vegetation cover	<u>MAT 2</u> . Review resource requirements associated with the Pastoral Assessment Program and ensure adequate resourcing by 2014	Areas under Pastoral Lease	Milestone 2.1; Strategies 2.1.2, 2.1.12
	<u>MAT 5</u> . Develop best practice guidelines and related extension programs for sustainable grazing management – taking into account land system type and drought responsiveness – by 2014	Areas under Pastoral Lease	Milestone 2.1; Strategies 2.1.2, 2.1.3, 2.1.4
	<u>MAT 7</u> . Complete initial mapping of pest distributions and determine priorities for control, and establish process for updating of mapping data by 2014	Regional and cross- border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.2; Strategy 4.2.1
	<u>MAT 8</u> . Ensure programs are in place aimed at achieving reductions in the distribution and numbers of identified priority pests by 2014	Regional and cross- border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.2; Strategies 4.2.1, 4.2.2
	<u>MAT 9</u> . Ensure high risk potential pathways for the introduction of pest animals and plants are identified; high risk and vulnerable sites are being monitored regularly; and a framework for eradication or management of potential new incursions is in place by 2014	Regional and cross- border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.1; Strategies 4.1.1, 4.1.3, 4.1.4, 4.1.5
	 MAT 10. Undertake risk assessment process to identify: » pest species that could be advantaged by climate change » native species and ecological communities that may be vulnerable to climate change » potential implications of climate change for water resources management » other potential implications of climate change for natural resources management by 2015 	Regional and cross- border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestones 1.1, 1.4, 4.2; Strategies 1.1.1, 1.1.2, 1.4.2, 4.2.1
	MAT 11. Ensure all relevant land managers are engaged and supported in pest control programs by 2014	Regional	Milestone 4.2; Strategies 4.2.5, 4.2.9
	<u>MAT 12</u> . Develop cross boundary protocols and guidelines regarding pest control with adjoining NRM boards and equivalent adjoining interstate bodies by 2014	Cross boundary/border	Milestone 4.2; Strategy 4.2.6
	MAT 13. Ensure research needs in support of MATs 7 to 12 are identified by 2011 and that priority research is underway by 2014	Regional and cross- border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.2; Strategies 4.2.1, 4.2.2

STRATEGIC DIRECTIONS	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Ensure that infrastructure does not	MAT 36. Establish consultative arrangements for the assessment of soil conservation implications of proposed new infrastructure by 2012	Regional	No clear linkage
contribute to soil erosion or disturbance through inappropriate siting or inadequate maintenance	<u>MAT 37</u> . Develop register of infrastructure sites associated with significant soil disturbance/ erosion and initiate on-ground management at priority sites by 2014	Regional	No clear linkage

Resource Condition Target 6

By 2020, the ecological sustainability of natural resource-based industries in the region is maintained or improved

The main activities in the SAAL NRM Region now, and most likely in the future, are pastoralism, mining and tourism. Broadly speaking, the management of these industries is two-fold: on the one hand establishing conditions to support and promote industry while, on the other hand, ensuring that environmental impacts are minimised and that, where possible, industries are sustainable. While mining cannot be classified as sustainable in the long term, there are opportunities for offsets to secure an overall environmental gain in terms of native vegetation improvement within the region. In general terms, there is considerable scope for increased partnerships between regional industry and the Board to achieve natural resources outcomes of mutual benefit.

Another industry of potential significance in the region is for production of sustainable energy, particularly geothermal industry. This may be largely reliant upon partnerships between industry and State and Australian governments but there may also be a role for the Board and other groups in providing support.

Natural resource factors affecting the sustainability of the pastoral industry are discussed previously in Program 1, Functioning Ecosystems. One aspect not addressed directly in Program 1 is the need for management of dingo and fox populations in order to support pastoral enterprises, particularly south of the Dog Fence.

As noted in Section 6.3.2, dingo populations are considered to fulfil a positive role in terms of regulating fox, cat and kangaroo numbers, thus providing land condition and biodiversity benefits. Reflecting this, the approach to dingo management north of the Dog Fence (ie in cattle country) is about regulation of dingo impacts rather than eradication of dingoes. However, to the south of the Dog Fence, where sheep enterprises are common and dingo impacts upon sheep can have serious economic consequences, the focus is more on eradication. The situation has become more complex through the introduction of wild dogs and the resultant 'contamination' of the dingo gene pool.

Mining activity (including petroleum and gas) in the SAAL NRM Region is a major contributor to the State's economy. While mining activities are usually localised, they inevitably impact upon natural ecosystems, soils and landscapes and potentially upon cultural features. The challenge is to minimise this impact and ensure processes are in place to minimise the impact of exploration and development and to rehabilitate disturbed sites. Offsets for any resultant damage to native vegetation can occur through the provisions of the *Native Vegetation Act 1991*.

Tourism is a vital industry for the region. However, inappropriate tourist activity, such as indiscriminate off-track driving and camping, can impact upon native vegetation and landscapes (as well as soil conservation). There is a link with infrastructure here as well. Inadequately maintained tracks can lead to off-track impacts as drivers head 'off-road' to avoid rough sections of track. This has been noted on the Halligan Bay Public Access Route and to some extent on the Peake Repeater Station Public Access Route. This situation should be considered in the implementation of MAT 35 (Identify soil erosion priority areas and initiate on-ground management by 2014).

As noted in **Table 10**, key principles for ecologically sustainable development against which this target will be measured are:

- » Integrating economic and environmental goals in policies and activities
- » Ensuring that environmental assets are properly valued
- » Providing for equity within and between generations
- » Dealing cautiously with risk and irreversibility
- » Recognising the global dimension.

With the above points in mind, the following strategic directions and MATs are proposed.

STRATEGIC DIRECTIONS	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Support the pastoral industry through programs to maintain vegetation cover, control pests etc	<u>MAT 2</u> . Review resource requirements associated with the Pastoral Assessment Program and ensure adequate resourcing by 2014	Areas under Pastoral Lease	Milestone 2.1; Strategies 2.1.2, 2.1.12
	<u>MAT 5</u> . Develop best practice guidelines and related extension programs for sustainable grazing management – taking into account land system type and drought responsiveness – by 2014	Areas under Pastoral Lease	Milestone 2.1; Strategies 2.1.2, 2.1.3, 2.1.4
	<u>MAT 7</u> . Complete initial mapping of pest distributions and determine priorities for control, and establish process for updating of mapping data, by 2014	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.2; Strategy 4.2.1
	<u>MAT 8</u> . Ensure programs are in place aimed at achieving reductions in the distribution and numbers of identified priority pests by 2014	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.2; Strategies 4.2.1, 4.2.2
	<u>MAT 9</u> . Ensure high risk potential pathways for the introduction of pest animals and plants are identified; high risk and vulnerable sites are being monitored regularly; and a framework for eradication or management of potential new incursions is in place by 2014	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.1; Strategies 4.1.1, 4.1.3, 4.1.4, 4.1.5
	 MAT 10. Undertake risk assessment process to identify: » pest species that could be advantaged by climate change » native species and ecological communities that may be vulnerable to climate change » potential implications of climate change for water resources management » other potential implications of climate change for natural resources management by 2015 	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestones 1.1, 1.4, 4.2; Strategies 1.1.1, 1.1.2, 1.4.2, 4.2.1
	MAT 11. Ensure all relevant land managers are engaged and supported in pest control programs by 2014	Regional	Milestone 4.2; Strategies 4.2.5, 4.2.9
	<u>MAT 12</u> . Develop cross boundary protocols and guidelines regarding pest control with adjoining NRM boards and equivalent adjoining interstate bodies by 2014	Cross boundary/ border	Milestone 4.2; Strategy 4.2.6
	MAT 13. Ensure research needs in support of MATs 7 to 12 are identified by 2011 and that priority research is underway by 2014	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.2; Strategies 4.2.1, 4.2.2

STRATEGIC DIRECTIONS	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Continue to support programs for dingo and fox management to assist sustainable pastoral production, taking into account the biodiversity and production benefits of dingoes and the different management approaches south and north of the Dog Fence	<u>MAT 38</u> . Ensure that 50% of pastoral and other broad-acre land managers are applying best practice measures for dingo and fox control and management by 2014	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestones 1.2, 4.2; Strategy 4.2.2
Manage over- abundant native species to avoid significant impacts upon pastoral productivity	<u>MAT 39</u> . Establish strategic response protocols regarding overabundant native species by 2014	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 4.2; Strategy 4.2.1, 4.2.2
Ensure that environmental offsets relating to SAAL mining activities are achieved in the SAAL NRM Region	MAT 40. Establish process for managing native vegetation clearance offsets in the SAAL NRM Region by 2014	Regional	Milestone 1.2
Develop and implement best practice guidelines etc for tourism to maximise the tourism experience while minimising impact	MAT 41. Develop best practice NRM guidelines relating to tourism by 2014 MAT 42. Ensure 50% of tourism operators are accredited for Environmentally Aware Tourism by 2014	Regional	Milestone 2.2; Strategy 2.1.2
Establish partnerships with industry to support sustainable management of natural resources	MAT 43. Review feasibility of expanded partnerships between the SAAL NRM Board and regional industry and identify priority areas/issues for partnerships by 2014	Regional	Milestone 2.1; Strategies 2.1.2, 2.1.4, 2.1.9, 2.1.10

MAT 5 links strongly with the five-year outcome for Northern and Remote Australia under the *Caring for our Country* program, relating to the increased uptake of sustainable grazing and land management practices.

Resource Condition Target 7

By 2020 the average quality, pressure and level of groundwater are maintained or improved

Industries and communities in the SAAL NRM Region are heavily reliant on sustainable groundwater supplies. As noted under Program 1 (Functioning Ecosystems Program), many aquatic ecosystems are similarly reliant on groundwater. The strategic directions and MATs set out under Program 1 are also relevant here and are referenced below.

There are indications that the GAB as a whole is currently not being used sustainably while its use in South Australia is somewhere near an equilibrium point. Very little information is available regarding the nature and sustainable yield of many of the shallower aquifers. Historically, there has been some tendency to regard groundwater as a limitless resource, but this is now clearly recognised as incorrect. Over the past 20 years there has been a major program to cap and control artesian bores and governments, industry and the community are proactive in exploring water conservation measures including, as one example, desalinised seawater for use at the processing plant at Olympic Dam.

The relationship between water use and industry (particularly the mining industry) in the region is complex. Some mining ventures (eg Olympic Dam) use large quantities of water in processing. It is considered important to look more closely at predictive water demand in the SAAL NRM Region to help guide planning for sustainable water use in the future.

In relation to water quality, the management of wastewater from urban and industrial activity requires ongoing attention to ensure that it is managed in a way that minimises disturbance of ground and surface water systems.

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Implement Water Allocation Plan for the Far North Prescribed Wells Area	<u>MAT 22</u> . Ensure that the Water Allocation Plan for the FNPWA is being fully implemented by 2014	Marla-Oodnadatta and Marree-Innamincka Group Areas	Milestones 1.2, 2.4, 2.6; Strategies 1.2.3, 2.6.1
Address the problem of leaking artesian bores and monitor effects of bore rehabilitation scheme	<u>MAT 23</u> . Ensure that a sustainable program for monitoring and repair of leaking artesian bores is in place by 2014	Marla-Oodnadatta and Marree-Innamincka Group Areas	Milestone 2.4
Review status of currently flowing artesian bores and develop and implement management/rehabilitation programs as deemed necessary	MAT 24. Ensure that a management/rehabilitation plan for currently flowing artesian bores is completed by 2012 and implemented by 2016	Marla-Oodnadatta and Marree-Innamincka Group Areas	Milestone 2.4
Work with other States to develop and implement integrated policies and programs to protect GAB and its associated ecosystems	MAT 25. Ensure the policies and actions to sustain the GAB in the SAAL NRM Region are integrated within national policies and actions by 2014	Marla-Oodnadatta and Marree-Innamincka Group Areas, with strong links with GAB areas in NSW and Queensland	Milestone 1.2; Strategies 1.2.3, 1.2.6

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Develop a clearer picture of likely future water demand in the SAAL NRM Region	<u>MAT 44</u> . Develop a predictive water demand model for the SAAL NRM Region by 2014	Regional	Milestone 2.4
Ensure that wastewater is managed in an environmentally sustainable way	MAT 45. Review policies and practices for management of wastewater by 2014	Regional	Milestone 1.2, 2.4, 2.8
Conduct research into the nature, extent and sustainability of shallow groundwater systems and their ecosystems	MAT 30. Develop a regional water resources research register, highlighting information gaps, priorities, responsibilities and potential funding sources by 2012 MAT 31. Ensure that high research priorities are being addressed by 2014	Regional but with some focus on heavily under- researched areas such as shallow groundwater systems and the Gawler Ranges, North Flinders and North East NRM Group areas	Milestones 1.1, 2.4; Strategies 1.1.1, 1.1.2
Further investigate groundwater-surface water interactions in the region			
Conduct further investigations re current water use and sustainable yields			
Gather information regarding active bore drains and their management/closure/retention			
Gather information regarding waterholes, rock-holes and threatening processes			
Undertake further investigations into the environmental water requirements of groundwater and surface water ecosystems			
Develop a more comprehensive information base re the nature, ecology and requirements of water resources in the Gawler Ranges, North East and Flinders sub-regions			
Investigate potential implications of climate change for groundwater management in the region	 MAT 10. Undertake risk assessment process to identify: » pest species that could be advantaged by climate change » native species and ecological communities that may be vulnerable to climate change » potential implications of climate change for water resources management » other potential implications of climate change for natural resources management by 2015 	Regional and cross- border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestones 1.1, 1.4, 4.2; Strategies 1.1.1, 1.1.2, 1.4.2, 4.2.1
Resource Condition Target 8

By 2020 flow regimes and water quality in surface water systems are maintained or improved

As noted in Program 1 (Functioning Ecosystems Program), surface water systems are highly significant in supporting aquatic ecosystems. From an industry and sustainable use viewpoint, surface waters in some parts of the region are important for the pastoral industry (primarily for stock water) but also plant growth and are important for attracting tourists (eg Lake Eyre in flood). Overall, the maintenance of natural or near natural ground flow regimes is critical to ongoing sustainability in the region.

As already noted under RCT 3, several of the major river systems that feed into Lake Eyre have headwaters interstate. The sustainability of these systems is heavily reliant on achievement of the goals of the *Lake Eyre Basin Intergovernmental Agreement* – in particular, sustainable management to avoid downstream impacts. This Agreement was signed by the Australian, South Australian and Queensland Governments in 2000, and by the Northern Territory Government in 2004. To date, more-or-less natural flow regimes have been maintained, although in recent months the Queensland Government has talked about a review of this situation.

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Ensure that water extraction does not exceed sustainable levels	MAT 26. Develop guidelines for water extraction from surface water systems for stock, domestic and other uses by 2014	Regional	Milestone 2.4
Manage and regulate Water Affecting Activities (WAA) in order to maintain natural water regimes	MAT 27. Ensure that administrative processes re Water Affecting Activities are in place and that relevant land managers are aware of their responsibilities by 2011	Marla-Oodnadatta and Marree-Innamincka Group Areas	Milestones 2.4, 2.6; Strategy 2.6.2
Ensure that new structures and other developments along the river systems of the SAAL NRM Region do not have significant impact upon flow regimes or dependent ecosystems	MAT 28. Review the Water Affecting Activities set out in Part 4 of this plan, to ensure that they are consistent with the objectives of maintaining natural flow regimes in the SAAL NRM Region by 2014	Marla-Oodnadatta and Marree-Innamincka Group Areas, with strong links with associated catchments in Queensland and the NT	Milestones 2.4, 2.6; Strategy 2.6.2

The strategic directions and MATs for RCT 8 (as in RCT 7 on ground water) are much the same as included under Program 1 and as relevant repeated below.

STRATEGIC DIRECTION	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Further investigate groundwater-surface water interactions in the region	MAT 30. Develop a regional water resources research register, highlighting information gaps, priorities, responsibilities and	Regional but with some focus on heavily under- researched areas such as shallow groundwater	Milestones 1.1, 2.4; Strategies 1.1.1, 1.1.2
Implement more comprehensive programs to measure water quality and flow data for surface water systems	<u>MAT 31</u> . Ensure that high research priorities are being addressed by 2014	Ranges, North Flinders and North East NRM Group areas.	
Conduct further investigations re current water use and sustainable yields			
Gather information regarding waterholes, rock- holes and on the processes that threaten them			
Develop region-scale mapping of wetland and floodplain systems			
Undertake further investigations into the environmental water requirements of groundwater and surface water ecosystems			
Further investigate the ecology and requirements of salt lakes in the region			
Develop more comprehensive information base re the nature, ecology and requirements of water resources in the Gawler Ranges, North East and Flinders sub-regions			
Investigate potential implications of climate change for surface water management in the region	 MAT 10. Undertake risk assessment process to identify: » pest species that could be advantaged by climate change » native species and ecological communities that may be vulnerable to climate change » potential implications of climate change for water resources management » other potential implications of climate change for natural resources management by 2015 	Regional and cross- border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestones 1.1, 1.4, 4.2; Strategies 1.1.1, 1.1.2, 1.4.2, 4.2.1

3.3 ACTIVE COMMUNITIES PROGRAM

Goal and Resource Condition Targets

GOAL	RESOURCE CONDITION TARGET
Vibrant communities, governments and industries working together with the capability, commitment and connections to manage resources in an integrated way	 By 2020 9. All people who are actively involved in the management of natural resources in the region have the information, knowledge and skills needed to support the achievement of natural resources management priorities identified in the regional NRM plan 10. The number of people actively involved in the management of natural resources and applying practices that support the achievement of the priorities identified in the regional NRM plan is increased by 30%

3.3.1 Strategic Directions and Management Action Targets Towards Resource Condition Targets

RCTs 9 and 10 are dealt with together in the following section.

Most of the strategic directions cited previously under the *Functioning Ecosystems and Sustainable Use Programs* are linked with community engagement, but usually with a focus on a specific aspect of natural resources management and often with a focus on particular categories of land managers.

The *Active Communities Program* therefore relates to virtually all aspects of natural resources management covered in this plan. However, the specific focus of this section is community engagement at a broad level: endeavouring to ensure that the whole community is aware of the importance of NRM and has the capacity to be involved. There are three main areas of focus in this:

- » To engage and support those directly and actively involved in land management and industry
- » To ensure that natural resources management has appropriate attention in school curricula
- » To engage community people who may not have a significant natural resources management focus in their day-to-day activities (eg townspeople).

A particularly important aspect of this is engagement of the Aboriginal communities in the region and ensuring that they are involved in natural resources management programs and projects as fully and appropriately as possible. Effective engagement of Aboriginal people is needed to ensure that traditional knowledge and land management practices are respected and included in NRM activities where appropriate.

The Board has attempted to be proactive in engaging and supporting Aboriginal people through a range of projects and through the employment of an Aboriginal Engagement Officer. These are considered to be steps in the right direction but much is still to be done in terms of genuine and effective engagement. MATs regarding more effective Aboriginal engagement are included opposite and more detailed discussion is included in Section 4, following.

Historically, community engagement regarding NRM at the regional or sub-regional has occurred through the district soil conservation boards, through community groups, government agencies, the former regional INRM group, and others. Industry groups (eg mining, pastoral and tourism) have also contributed to enhanced local awareness and involvement. The Board is now a focal point in coordinating this activity.

Another important aspect of this is the protection of culturally important sites and areas, as discussed in Program 1. This includes sites and areas of cultural importance to Aboriginal people and sites and areas of importance from a non-Aboriginal perspective. Active engagement of community people is vital for this. Accordingly, the strategic directions and MATs from Program 1 are also included opposite.

The provision and maintenance of adequate infrastructure (roads, water and other facilities) is also important for effective community engagement in natural resources management. Poor or absent infrastructure can be a barrier to effective engagement.

STRATEGIC DIRECTIONS	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Ensure that up-to-date information on regional natural resources management issues is readily available to the community	<u>MAT 46</u> . Ensure that programs are in place to provide up-to-date NRM information to all sectors of the community in accessible and digestible form by 2014	Regional	Milestone 3.1; Strategies 3.1.1, 3.1.2, 3.1.4, 3.1.6, 3.1,7, 3.1.8
Work with Aboriginal people and the broader regional community to ensure that sites and areas of cultural importance are not compromised by inappropriate land use	<u>MAT 1</u> . Develop register of regionally significant sites and areas that warrant specific protection measures and develop policies for management and protection by 2014 and ensure on- ground protection of priority sites/ areas is under way by 2016	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 1.3; Strategies 1.3.2, 1.3.7
Ensure that relevant Aboriginal communities are effectively consulted about and involved in all significant natural resources management programs and projects in the region	<u>MAT 32</u> . Work with Aboriginal people to establish an agreed process for their consultation and involvement in NRM planning and programs by 2014	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestone 3.4; Strategies 3.4.2, 3.4.3, 3.4.4, 3.4.5
Work with Aboriginal people to clearly identify their NRM priorities and to increase the level of their participation in projects that address those priorities	<u>MAT 47</u> . Develop a support program to increase the participation of Aboriginal people in natural resources management projects that link with Aboriginal priorities by 2013	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestones 2.1, 3.1, 3.3; Strategies 2.1.9, 3.1.1, 3.1.4, 3.1.6, 3.1.8, 3.3.6
Ensure that locally and regionally relevant natural resources information is included in school curricula	<u>MAT 48</u> . Establish ongoing dialogue with relevant educational bodies and ensure inclusion of regionally relevant NRM issues in local school programs by 2014	Regional	Milestones 3.1, 3.3; Strategies 3.1.1, 3.1.7
Ensure that community people have access to programs for skills development and clear opportunities for involvement in appropriate NRM activities	<u>MAT 49</u> . Review adequacy of current training programs and other opportunities for community skills development in NRM by 2012	Regional	Milestone 3.1; Strategies 3.1.1, 3.1.3, 3.1.4, 3.1.6, 3.1.8
Assess whether the level and standard of regional infrastructure (eg roads and other services) is having a significant effect upon the ability of the regional community to achieve NRM outcomes	<u>MAT 50</u> . Identify any significant barriers to effective natural resources management associated with infrastructure by 2014	Regional	No clear linkage
Ensure that sites and areas of 'European' cultural importance linked with natural resources are not compromised by inappropriate land use	<u>MAT 1</u> . Develop register of regionally significant sites and areas that warrant specific protection measures and develop policies for management and protection by 2014 and ensure on- ground protection of priority sites/ areas is under way by 2016	Regional	Milestone 1.3; Strategies 1.3.2, 1.3.7

STRATEGIC DIRECTIONS	MANAGEMENT ACTION TARGET	GEOGRAPHIC FOCUS	STATE NRM PLAN MILESTONES & STRATEGIES LINKED WITH MATS
Develop landscape assessment guidelines and protocols and apply them to safeguard 'iconic' landscapes in the region from inappropriate land use	<u>MAT 33</u> . Develop landscape assessment framework for the SAAL NRM Region by 2014 and ensure all development and best practice land management standards incorporate ESD principles by 2016	Regional	Milestones 1.1, 1.2; Strategies 1.2.1, 1.2.6, 1.2.9
Ensure that communities in the SAAL NRM Region are kept informed regarding the implications of climate change for the region and are supported in any adaptive management relating to climate change	 MAT 10. Undertake risk assessment process to identify: » pest species that could be advantaged by climate change » native species and ecological communities that may be vulnerable to climate change » potential implications of climate change for water resources management » other potential implications of climate change for natural resources management by 2015 MAT 48. As before 	Regional and cross-border, in collaboration with adjoining NRM Boards and relevant interstate bodies	Milestones 1.1, 1.4, 4.2; Strategies 1.1.1, 1.1.2, 1.4.2, 4.2.1

As already noted, MATs 32 and 47 link closely with *Caring for our Country* outcomes. Likewise, MAT 46 links strongly with the proposed five-year outcomes under the Community Skills, Knowledge and Engagement component of *Caring for our Country*. It is important to note that MAT 46 applies to all sectors of the community, including Aboriginal people.

4. ENSURING ABORIGINAL ENGAGEMENT IN NRM

As noted in Section 3, the engagement and involvement of Aboriginal people in the region's NRM programs is extremely important. The use of Aboriginal traditional knowledge and experience is critical to effective land and biodiversity management and Aboriginal people are important partners and participants in contemporary land management. Aboriginal people have an intimate knowledge of the land and its biodiversity and effective engagement of Aboriginal people is needed to ensure the success of natural resources management programs in the region.

The full range of MATs outlined previously is intended to apply to Aboriginal people as part of the broader regional community. However, it is recognised that Aboriginal people may have different needs in terms of NRM and are also able to offer skills, knowledge and involvement. It is therefore important to be clear about proposed programs to support Aboriginal engagement.

As discussed in Part 2, there has been some targeted consultation with Aboriginal people in the development of this plan and the Board has worked with Aboriginal people in a number of NRM projects. However, an effective engagement program that fully recognises the needs of Aboriginal people has not yet been established. This requires a dedicated program in its own right and this plan needs to establish a basis for such a program.

Communication with Aboriginal people during the preparation of this plan has highlighted a number of underpinning concepts that need to be recognised and respected. These include:

- » The fundamental difference in the approach of Aboriginal people to the land and the use of land
- » The fundamental difference in the social, cultural and environmental needs of Aboriginal people
- » The links of Aboriginal people to land through traditional knowledge and land management practices and the importance of maintaining these
- » The need for open and transparent communication
- » The need to recognise that:
 - » it may be difficult to identify Indigenous people who have the right to speak for a particular resource or area of country
 - » there may be family hierarchies or obligations that prevent an individual speaking on the management of certain resources or areas of land and water
 - » there are important differences between the roles and responsibilities of males and females in Aboriginal culture
- » The need for projects and project management (eg in terms of funding applications, reporting etc) to be tailored to the needs, knowledge and skills of Aboriginal people.

From the above, it is clear that effective engagement of Aboriginal people needs a specifically tailored and culturally appropriate framework.

In the development of this NRM Plan, there has been reference to the *Strategy for Aboriginal Managed Lands in South Australia* (SAMLISA). While some aspects of the 2000 SAMLISA report are of limited relevance in 2010, it nevertheless contains priorities that are still relevant such as:

- » Preservation of cultural practices and culturally important places
- » Restoration of degraded land and associated natural resources
- » Preventing any further degradation of land and waters and loss of plants and animals
- » Protection and re-establishment of healthy populations of plants and animals used for bush tucker, medicine, fuel wood and in art and craft production
- » Economic development and the use of the land for self-sufficiency
- » Aiming for sustainable agriculture, aquaculture and pastoralism
- » Management of public access
- » Development and maintenance of ecotourism for economic return and to build understanding and respect for culture and country.

Since the production of the SAMLISA document in 2000, new priorities for Aboriginal people have emerged. For example, camels, water management and, more broadly, climate change are now high priority issues.

Section 3 of this plan has worked through a series of strategic direction and short-term (Management Action) targets based upon the three main program areas and ten longer term (Resource Condition) targets. As noted above, most of the strategic directions and MATs are relevant to Aboriginal people just as they are for others within the region. The targets in Section 3 include three specific MATs which are repeated below.

MAT NO	MANAGEMENT ACTION TARGET
1	Develop register of regionally significant sites and areas that warrant specific protection measures and develop policies for management and protection by 2014. Ensure on-ground protection of priority sites/ areas is under way by 2016
32	Work with Aboriginal people to establish an agreed process for their consultation and involvement in agency NRM planning and programs by 2013
47	Develop a support program to increase the participation of Aboriginal people in natural resources management projects that link with Aboriginal priorities by 2013

MAT 1 includes the appropriate protection and management of sites and areas of cultural importance to Aboriginal people. MATs 32 and 47 focus more broadly on effective engagement of Aboriginal people in natural resources management.

Collectively, targets 32 and 47 seek to achieve the following:

- » Support for Aboriginal people in the implementation of NRM actions that link with Aboriginal priorities and encompassing skills development, skills recognition and on-ground works
- » Developing and implementing an agreed process for Aboriginal involvement in actions and programs undertaken by the Board and other agencies
- » More broadly, developing a clear and open process for general consultation with Aboriginal people re NRM to ensure that Aboriginal priorities are recognised and acted upon.

The Board believes that it has made, and is continuing to make, progress in these areas but accepts that there are still some fundamental hurdles to be overcome. The Board sees this situation as an opportunity to develop a regional model for Aboriginal engagement that sets a new and improved benchmark. It is important to note though, that while the Board has a lead role in this process, it will also need to involve a range of other NRM agencies and stakeholders (eg Aboriginal Statewide Advisory Committee of the NRM Council, State agencies such as the Division of Aboriginal Affairs and Reconciliation of the Department of Premier and Cabinet, DEH, DWLBC, SATC, PIRSA, Australian Government agencies, industry and, of course, local people).

The Board has already initiated steps to develop an improved Aboriginal engagement strategy. A draft report produced for the Board (Bromley et al 2009) sets out a number of factors to be considered, including the need for improved sharing of information, more encouragement for, and resourcing of, projects that meet Aboriginal priorities, increased attention to education and training, and a more flexible approach to communication and engagement, reflecting the cultural needs of Aboriginal people.

The Board intends to build on this work by leading a program that will aim to achieve the targets of the NRM plan in a way that recognises, respects and embraces the culture of Aboriginal people.

The following broad approach is proposed:

- » Work with the Aboriginal Statewide Advisory Committee, Aboriginal people, the NRM Council and others to:
 - » Develop agreed principles for Aboriginal engagement in NRM in the region
 - » Review the NRM priorities of Aboriginal people
 - » Identify and implement the most effective means of consulting Aboriginal people re NRM issues, recognising the need for a specifically tailored, culturally appropriate framework
 - » Identify and implement the most effective means of supporting skills development in NRM amongst Aboriginal people and supporting actions that, amongst other things, reflect traditional knowledge and land management practices
 - » Identify and implement, within the constraints of existing resources, Board structures and other relevant agency arrangements that will facilitate optimal Aboriginal engagement in NRM
 - » Implement programs to increase the cultural awareness of Board members and staff
 - Identify and address institutional and administrative barriers to effective engagement of Aboriginal people in NRM (eg the structure and language of funding programs)
 - » Encourage increased participation of Aboriginal people on Board groups and committees.

It is proposed that this work be a focus for attention in 2010/11 with a broad framework for ongoing action to be established in that time-frame. This should involve an open communication process to ensure that the revised engagement strategy meets the needs of Aboriginal people.

Importantly, this work should also be undertaken in collaboration with the adjoining Alinytjara Wilurara Natural Resources Management Board, recognising the close cultural links of Aboriginal people in the two NRM regions and the need for a coordinated approach.

5. MONITORING, EVALUATION, REPORTING AND IMPROVEMENT

The Board is responsible for monitoring, evaluating and reporting on progress towards the region's Strategic Plan and is directly responsible for monitoring, evaluation and reporting on the implementation of its Business Plan. This process provides an avenue for reviewing the effectiveness of actions and projects against timelines, targets and budgets. Equally importantly, it provides an information base which can be used in seeking ongoing improvement in natural resources management practices and processes.

The Board will lead development of a detailed monitoring, evaluation, reporting and improvement framework (MERI) for the region. In developing its MERI the Board will follow the *SA Monitoring, Evaluation and Reporting Framework for NRM* which should be finalised shortly and will complement a State Monitoring Plan that will address monitoring components in the region that are agreed to be at the State level of responsibility.

The Board's MERI framework will focus regional activity on the following questions:

- » To what extent has the region succeeded in implementing the NRM Plan and supporting plans?
- » To what extent has the region progressed towards the goals described in the Plan?
- » Is the condition of the natural resources within the region getting better or worse?
- » How can future activity adapt to improve progress towards the regions goals?

While the Board's approach is based upon the national and State frameworks, the Board is very aware of the special characteristics of the SAAL NRM Region. Thus the Board is well aware of the difficulty and cost of providing effective long term monitoring in this region, particularly given the uncertain effects of climate change, the effects of drought and floods on both activity outcomes and community engagement processes, and also the importance of the actions of other states upon the region's surface and underground water supply. Thus, in this region the implementation of projects and detecting their success is often dependent on climatic cycles, economic health of industries and increasingly on the actions of others outside the region.



The SAAL NRM Region's MERI framework is based upon long term monitoring of key environmental indicators at the regional scale that are directly related to the regional targets identified in the Plan. It is expected that much of the long term monitoring in the region will continue to be done by agencies other than the Board – in particular DEH, DWLBC and the Pastoral Board. In the near future the MERI framework will be refined and expanded, especially with more clarity around the MATs of the Board. The MERI framework will be integral to the periodic review of the NRM Strategy and the Business Plan, and as input to the adaptive management approach adopted by the Board.

Monitoring

Monitoring will be undertaken in accord with the evaluation framework, examining effort with regard to the 'means' (eg foundation planning and immediate activities), and the 'ends' (intermediate outcomes such as changed management and long-term improvements in the condition of natural resources). Existing agency monitoring programs will be the primary source of information, eg

- » Soils DWLBC Pastoral Lease Assessment Program
- » Water DWLBC Obswell Groundwater Monitoring
- » Vegetation DWLBC and DEH
- » Threatened species/ecological communities DEH.

Evaluation

Evaluation will concentrate on two factors:

- » Seeking to understand cause and effect, ie the impact of NRM programs on resource management practices and the subsequent impact in terms of resource condition
- » Disassociating seasonal or climate induced variation from long-term trends in resource condition.

The following chart records the key elements of the evaluation components of the MERI framework.

The Board's evaluation program will be consistent with the State NRM Planning and Evaluation model, as illustrated below.



Reporting

State of the Region Supplements will be released periodically, providing an update on resource condition and the achievement of targets. The reports will document the status of resources and changes in condition – and provide information on the influence of different strategies and actions. Some reports will be tailored for community or stakeholder audiences while others may be more administratively focused for the Board.



5.1 MONITORING PROGRESS TOWARDS RESOURCE CONDITION TARGETS

Initially, monitoring and evaluation against RCTs will relate strongly to existing monitoring sites and programs. This is necessary in order for progress against the targets to be measurable. In the immediate future, therefore, progress on a regional scale in improving resource condition will need to be extrapolated from existing monitoring programs.

At the same time, the current array of monitoring sites and programs does not necessarily provide a thorough coverage for the SAAL NRM Region. The Board will promote a progressive improvement in regional coverage of resource condition monitoring programs over time.

Sections 5.1.1 to 5.1.10 following discuss the monitoring requirements for each RCT. Monitoring Actions are included to summarise monitoring needs for each RCT. As a general comment, it can be noted that several of the RCTs have a very limited data set on which to assess status and trends at the regional level. Despite this, a number of qualitative conclusions can be drawn about the status of the region's natural resources and the effectiveness of management programs over the last two or three decades: For example:

- » GAB groundwater: very important advances through the bore-capping program, through other water conservation measures and through acquisition of information, but still concerns about sustainability at current levels of usage
- » Surface water systems: some information gathered to assist management and natural flow regimes have been maintained, although more work needed to safeguard this in terms of possible interstate activity
- » Natural biodiversity: some baseline information gathered to assist management and targeted pest control operations (eg *Bounceback*) have been effective; still many significant information gaps
- » Soils and vegetation cover: difficult to assess in light of periods of drought but there is evidence of improved management by landholders, particularly in association with the *Pastoral Management Program*.

The challenge for the region is to make best use of existing monitoring information and to improve on regional monitoring networks within the constraint of existing resources.

5.1.1 Monitoring of Resource Condition Target 1: Native Vegetation Extent and Condition

RCT 1

By 2020, the extent and condition of native vegetation (species composition, structure and cover) is improved

The Pastoral Board, through its DWLBC staff, has a program for pastoral lease assessment of the 218 pastoral runs in the region, with approximately 8,000 sites and 5,500 permanent photopoints established in the first round of assessment between 1990 and 2000. At each site, information on plant composition and abundance, grazing or other impacts or disturbance, soil erosion and soil surface cover is collected, together with detail on location of the site, GPS co-ordinates etc as an aid to future re-visits. There is a requirement for pastoral lease assessments to be undertaken at least every 14 years.

In addition, a project under the Australian Collaborative Rangelands Information System (ACRIS) aims to develop a reporting framework for rangelands condition. To help achieve this a pilot study has been completed in two of the earliest districts covered under the first round of assessments in SA. Similar-sized pilot regions were also selected in other States and Territories for this project in order to attempt to reach common ground on the parameters to be used in an overall reporting program. By reporting a sample of all photopoint measurements in the study area, it was possible, for the first time, to make general statements about changes which have occurred in the district over the 10 or so years since completion of the first (baseline) photopoint monitoring.

As part of its biological survey program across the State, DEH has established several hundred vegetation survey sites in the SAAL NRM Region. While these are not monitored on a regular basis, they provide a potential reference or baseline. Within the SAAL NRM Region, biological survey has established at least 3,275 sites. Species composition and community structure is more rigorously collected at these sites than at pastoral sites and survey sites are distributed through more land types and through areas of different grazing intensity. Monitoring sites have also been established in the region as part of threatened species programs, such as those for the kowari. Several years' data are available from some of these programs.

DEH is also collaborating with the University of Adelaide in a national program to establish a *National Reference Network for Rangelands*. South Australia will share a \$3 million national allocation for this program. This provides an excellent opportunity to establish a broad network of monitoring sites to complement the existing networks.

Strategic Direction for Monitoring of RCT 1

- » Use the DWLBC/Pastoral Board pastoral lease assessment monitoring and sites established in SA as part of the *National Reference Network for Rangelands* as a core network for monitoring RCT 1.
- » Consider opportunities for augmenting the core network for more comprehensive regional coverage, such as through reference to biological survey sites.

5.1.2 Monitoring of Resource Condition Target 2: Threatened Species and Ecological Communities.

RCT 2

By 2020, 50% of species and ecological communities in each of the identified risk categories have moved to a lower risk category and no species or ecological communities have moved to a higher risk category

Monitoring and evaluation of RCT 2 involves two main aspects: firstly monitoring the status of relevant species and communities across the region; and secondly reviewing the status of those species and communities in terms of the established risk categories.

As noted before, DEH has, over the years, established a large number of monitoring or reference sites as part of biological survey and threatened species work. In addition, as also noted, DEH is also participating in a new project to establish a *National Reference Network for Rangelands*. In order to measure against RCT 2, it is proposed that DEH use this collective network of sites to establish an adequate regional monitoring program.

At the State level, threatened species are listed under the *National Parks and Wildlife Act 1972:* Schedules 7 (endangered), 8 (vulnerable) and 9 (rare). Listing is reviewed on a regular basis. At the Australian Government level, threatened species and ecological communities are listed under the *Environment Protection and Biodiversity Conservation Act 1999.* Nominations for listing under this Act are reviewed by the Threatened Species Scientific Committee with recommendations then referred to the Australian Government's Environment Minister.

Strategic Direction for Monitoring of RCT 2

» Use existing and new biodiversity reference sites to review the conservation status of selected indicator species by 2020.



5.1.3 Monitoring of Resource Condition Target 3: Extent and Condition of Aquatic Ecosystems

RCT 3

By 2020, the extent and condition of at least 50% of priority aquatic ecosystems is improved and other priority aquatic ecosystems are at least maintained in extent and condition

As noted in **Table 10** previously, priority aquatic ecosystems include those identified by Neagle (2003). Other priority aquatic ecosystems will also be reviewed from the results of more recent work. For example, a considerable amount of information has been collected for the GAB springs of the region, particularly through the NWI project jointly run by the Board, DEH and DWLBC. The following information has been collected:

- » Multi-spectral imagery of GAB springs
- » Spatial data re the springs has been lodged into the SA Geodata system as a central repository: data dating back to the 1970s has been included
- » Elevation surveys have been conducted.

In addition, earlier work (SA Department of Environment and Planning 1985) has defined priorities amongst the GAB springs. A number of fenced GAB springs have been monitored by DEH and DWLBC since the mid 1980s. In relation to other aquatic ecosystems, a considerable amount of baseline data has been collected by DWLBC and others through the *Aridflo* and other programs.

The above information will be consolidated to define the priority aquatic ecosystems that form the focus of this target. Existing monitoring at identified priority sites will be maintained and monitoring will be extended to other priority sites not covered by existing programs.

Strategic Direction for Monitoring of RCT 3

» Define priority aquatic ecosystems and establish/maintain a monitoring program that builds upon existing baseline knowledge to gauge extent and condition over time.

5.1.4 Monitoring of Resource Condition Target 4: Natural Ecosystems of Particular Cultural Significance.

RCT 4

By 2020, at least 50% of documented natural ecosystems of particular cultural significance, which are suffering from disturbance, are in improved condition

Natural ecosystems of particular cultural significance have been well documented in some areas, less well in others. For example, the cultural values associated with the GAB springs have been well documented through the 1985 DEP report referred to previously. This and other information to be sourced through agencies such as DEH and the Division of Aboriginal Affairs and Reconciliation will be consolidated into a priority listing. Disturbance factors at these sites will be clarified, along with indicators to be assessed as management programs are implemented.

Strategic Direction for Monitoring of RCT4

» Determine a listing of priority natural ecosystems of particular cultural significance, identify key disturbance factors and monitor relevant indicators over time.

5.1.5 Monitoring of Resource Condition Target 5: Soil Erosion

RCT 5 By 2020, the incidence of human-induced soil erosion is reduced

There are two aspects to this RCT: the first relating to soil erosion on pastoral lands, as assessed through the Pastoral Assessment Program; and the second linked with infrastructure. An example of the latter is erosion gullying associated with the embankment that carried the former Ghan railway line.

As noted before (re monitoring of RCT 1) the Pastoral Assessment Program encompasses around 8,000 sites. One of the parameters measured relates to soil erosion and it is proposed that this be the basis for monitoring of portion of RCT 5. However, there is also a need to consider other tools and methods available for broad-scale monitoring of soil condition. Remote sensing techniques, such as satellite imagery, can be an effective method for region or district-scale soil condition monitoring.

In relation to soil erosion associated with infrastructure, there are many known instances of this but not a coordinated listing of priority sites.

Strategic Direction for Monitoring of RCT 5

» Maintain the monitoring of soil erosion through the Pastoral Assessment Program but investigate increased use of other monitoring techniques such as satellite imagery; establish a register of priority erosion sites associated with infrastructure and assess relevant indicators over time as management programs are implemented.

5.1.6 Monitoring of Resource Condition Target 6: Capable and Sustainable Industries

RCT 6

By 2020, the ecological sustainability of natural resource-based industries in the region is maintained or improved

This is, clearly, a very broad target. As noted in **Table 10**, it will focus on industry trends and practices relating to the following main principles associated with ecologically sustainable development:

- » Integrating economic and environmental goals in policies and activities
- » Ensuring that environmental assets are properly valued
- » Providing for equity within and between generations
- » Dealing cautiously with risk and irreversibility
- » Recognising the global dimension.

The Board will assess business activities and practices against these principles through a process combining field observations and assessments and surveys relating to business practices and attitudes. Monitoring associated with other targets will also feed into this – eg the Pastoral Assessment Program's monitoring of native vegetation cover etc.

Strategic Direction for Monitoring of RCT 6

» Apply a mix of project assessment, other regional resource condition monitoring and stakeholder surveys to assess business practices and attitudes against key principles of Ecologically Sustainable Development.

5.1.7 Monitoring of Resource Condition Target 7: Groundwater Quality and Pressure

RCT 7

By 2020, the average quality, pressure and level of groundwater are maintained or improved

Groundwater monitoring currently falls into three main categories:

- » Monitoring undertaken by DWLBC (Obswell program)
- » Monitoring undertaken by mining companies (eg BHP Billiton) associated with legal requirements
- » Monitoring by SA Water of water quality, pressure, yields and levels for those aquifers used for town water supplies, as managed by SA Water.

The *Obswell* network in the SAAL NRM Region is very sparse and the mining networks are restricted to relatively localised areas (eg the area of potential drawdown associated with water extraction).

In addition to direct monitoring of groundwater pressures, the area of wetland associated with GAB and other springs provides an indirect indicator of groundwater pressure. As noted under RCT 3 above, this type of measurement has been undertaken as part of the NWI project.

Strategic Direction for Monitoring of RCT 7

- » Maintain existing groundwater monitoring networks and expand the regional coverage of monitoring sites over time to provide adequate regional coverage.
- » Apply, where appropriate, surrogate measures such as spring wetland area as a de facto indicator of groundwater pressure.

5.1.8 Monitoring of Resource Condition Target 8: Surface Water Quality and Flow Regimes

RCT 8

By 2020, flow regimes and water quality in surface water systems are maintained or improved

Information from DWLBC indicates that there are currently 22 surface water sites monitored in the SAAL NRM Region. A further 20 sites have been monitored in the past, but this work has been discontinued. Some of these sites have been monitored for water level only, so are of limited relevance to monitoring of this RCT. There appears to be a clear need to review the current monitoring network as part of the development of the regional MERI framework and to work towards a network that provides an adequate regional representation.

Strategic Direction for Monitoring of RCT 8

» Maintain the existing surface water monitoring network, review the adequacy of the existing network in providing regional coverage and, if necessary, establish additional sites over time to provide adequate regional coverage.

5.1.9 Monitoring of Resource Condition Target 9: Information and Skills Development

RCT 9

By 2020, all people who are actively involved in the management of natural resources in the region have the information, knowledge and skills needed to support the achievement of natural resources management priorities identified in the regional NRM plan

There are two main aspects to the achievement of this target:

- » Developing information and, where needed, training packages that match the relevant priorities identified in the SAAL Regional NRM Plan
- » Ensuring that all sectors of the community have access to the packages.

Strategic Direction for Monitoring of RCT 9

» Develop a register of information and training requirements for implementation of the SAAL Regional NRM Plan and monitor the completion, dissemination and uptake of relevant information and training packages.

5.1.10 Monitoring of Resource Condition Target 10: Community Engagement/Participation

RCT 10

By 2020, the number of people actively involved in the management of natural resources and applying practices that support the achievement of the priorities identified in the regional NRM plan is increased by 30%

All people are involved in natural resources management to some extent but measuring the degree of involvement is problematic.

Measurement of progress against this target will involve a process similar to that for RCT 6 (re ecological sustainability of industries). This will include the following:

- » Assessment of relevant data from other RCT monitoring programs
- » Assessment of relevant information from specific projects and activities
- » Targeted surveys.

Strategic Direction for Monitoring of RCT 10

» Apply a mix of project assessment, other regional resource condition monitoring and stakeholder surveys to assess community involvement and attitudes.



6. SUMMARY OF CROSS NRM BOUNDARY ARRANGEMENTS

Section 3 sets out a number of cross-boundary linkages associated with many of the Resource Condition and Management Action Targets. This section summarises those linkages. As a background, it is noted that the SAAL NRM Region borders on eight other NRM or catchment management regions, as follows:

- » Within SA
 - » Alinytjara Wilurara NRM Region
 - » Eyre Peninsula NRM Region
 - » Northern and Yorke NRM Region
 - » SA Murray Darling Basin NRM Region
- » Within the Northern Territory
 - » Northern Territory NRM Region
- » Within Queensland
 - » Desert Channels Queensland
- » Within NSW
 - » Western Catchment Management Authority Region
 - » Lower Murray Darling Catchment Management Authority Region.

Natural resources issues in these regions are coordinated through regional NRM bodies, catchment management authorities and government agencies. The Board has played a lead role in the establishment of the National NRM Rangelands Alliance, with the aim of helping to coordinate an integrated approach to cross-boundary issues.

Some actions, such as for pest control, may require a joint approach across NRM boundaries. For other actions, such as for community engagement, a complementary approach will be important in some situations. In addition, there will be actions, such as relating to some areas of research, where information exchange across NRM boundaries may be the main priority. Cross-boundary integration and cooperation will also be important in regional monitoring and evaluation.

Table 11 following provides a summary of what are perceived to be the main crossboundary linkages relating to relevant MATs set out in Section 3 and relating to the monitoring and evaluation framework discussed in Section 5. The table also highlights where some form of national coordination is applicable.

Table 11. Summary of Cross-Boundary Linkages for Management Action Targets and Resource Condition Targets

MA	NAGEMENT ACTION TARGET	CROSS-BORDER COLLABORATORS	NATURE OF COLLABORATION ¹
1	Develop register of regionally significant sites and areas that warrant specific protection measures and develop policies for management and protection by 2014 and ensure on-ground protection of priority sites/areas is under way by 2016	All NRM neighbours and relevant Aust and State Government agencies	1,2,3
7	Complete initial mapping of pest distributions and determine priorities for control, and establish process for updating of mapping data by 2014	All NRM neighbours, subject to pests in focus	1,2,3
8	Ensure programs are in place aimed at achieving reductions in the distribution and numbers of identified priority pests by 2014	All NRM neighbours, subject to pests in focus	1,2,3
9	Ensure high risk potential pathways for the introduction of pest animals and plants are identified; high risk and vulnerable sites are being monitored regularly; and a framework for eradication or management of potential new incursions is in place by 2014	All NRM neighbours, subject to pests in focus	1,2,3
10	 Undertake risk assessment process to identify: » pest species that could be advantaged by climate change » native species and ecological communities that may be vulnerable to climate change » potential implications of climate change for water resources management » other potential implications of climate change for natural resources management by 2015 	All NRM neighbours, with national and state- level input	1,2,3
12	Develop cross boundary protocols and guidelines regarding pest control with adjoining NRM boards and equivalent adjoining interstate bodies by 2014	All NRM neighbours	1,2
13	Ensure research needs in support of MATs 7 to 12 are identified by 2011 and that priority research is underway by 2014	All NRM neighbours	1,2,3
14	Complete surveys and mapping of regional ecosystems, including environmental water requirements by 2016	All NRM neighbours	1,2,3
15	Develop programs to support the management and recovery of 50% of the conservation priorities identified within the SAAL Biodiversity Strategy by 2016	All NRM neighbours	1,2,3
16	Determine the current status and potential for decline of 50% of species, ecological communities and ecological processes not currently identified as conservation priorities by 2016	All NRM neighbours	1,2,3
17	Commence research to improve knowledge regarding ecosystem function and services for priority ecosystems by 2014	All NRM neighbours	1,2,3
18	Improve the capacity of terrestrial and aquatic ecosystems to adapt to climate change through the enhancement of the public, private and indigenous protected areas network and sympathetic land management programs within 80% of all IBRA sub-regions by 2017	All NRM neighbours	2,3

МА	NAGEMENT ACTION TARGET	CROSS-BORDER COLLABORATORS	NATURE OF COLLABORATION ¹
21	Develop a regional action plan for the control of animal and plant pests in aquatic ecosystems in the SAAL NRM Region by 2014	Desert Channels Old, NT NRMB and Western CMA (NSW)	1,2,3
25	Ensure the policies and actions to sustain the GAB in the SAAL NRM Region are integrated within national policies and actions by 2014	Desert Channels Qld, NT and Western (NSW), with national and state input	3
28	Review the Water Affecting Activities set out in Part 4 of this plan, to ensure that they are consistent with the objectives of maintaining natural flow regimes in the SAAL NRM Region, by 2014	Desert Channels Old, NT NRMB and Western CMA (NSW), with national and state input	3
32	Work with Aboriginal people to establish an agreed process for their consultation and involvement in agency NRM planning and programs by 2013	All NRM neighbours, but particular link with Alinytjara Wilurara NRM Region	1,2,3
39	Establish strategic response protocols regarding overabundant native species by 2014	All NRM neighbours	1,3
47	Develop a support program to increase the participation of Aboriginal people in natural resources management projects that link with Aboriginal priorities by 2013	All NRM neighbours, but particular link with Alinytjara Wilurara NRM Region	1,2,3
со	LLABORATION IN MONITORING AND EVALUATION AGAINST RCTS		
RE	SOURCE CONDITION TARGET		
1	By 2020, the extent and condition of native vegetation (species composition, structure and cover) is improved	All NRM neighbours	2,3
2	By 2020, 50% of species and ecological communities in each of the identified risk categories have moved to a lower risk category and no species or ecological communities have moved to a higher risk category	All NRM neighbours	2,3
3	By 2020, the extent and condition of at least 50% of priority aquatic ecosystems is improved and other priority aquatic ecosystems are at least maintained in extent and condition	Desert Channels Old, NT NRMB and Western CMA (NSW)	2,3
4	By 2020, at least 50% of documented natural ecosystems of particular cultural significance, which are suffering from disturbance, are in improved condition	All NRM neighbours	2,3
5	By 2020, the incidence of human-induced soil erosion is reduced	All NRM neighbours	2,3
6	By 2020, the ecological sustainability of natural resource-based industries in the region is maintained or improved	All NRM neighbours	3
7	By 2020, the average quality, pressure and level of groundwater are maintained or improved	Desert Channels Old, NT NRMB and Western CMA (NSW)	2,3
8	By 2020, flow regimes and water quality in surface water systems are maintained or improved	Desert Channels Old, NT NRMB and Western CMA (NSW)	2,3

7. SUMMARY OF MANAGEMENT ACTION TARGETS

Table 12 provides a summary of the MATs set out previously. The table also shows program and Resource Condition Target linkages, along with possible indicators for use in monitoring and evaluation and potential partnerships.

Table 12. Summary of Management Action Targets, Indicators and Potential Partners for SAAL NRM Region.

MA	NAGEMENT ACTION TARGET	PROGRAM ADDRESSED	RCT ADDRESSED	PROPOSED INDICATORS	POTENTIAL PARTNERS & LEAD AGENCIES ^{2,3}
1	Develop register of regionally significant sites and areas that warrant specific protection measures and develop policies for management and protection by 2014. Ensure on-ground protection of priority sites/areas is under way by 2016	1,2	1-6	Status of register & policies, degree of protection	SAAL NRMB, DEH, DAAR, community
2	Review resource requirements associated with the Pastoral Assessment Program and ensure adequate resourcing by 2014	1, 2	1, 5, 6	Status of review; level of resourcing	<u>DWLBC,</u> <u>Pastoral Board,</u> SAAL NRM, industry
3	Ensure that 100% of land managers have sufficient information to incorporate biodiversity stewardship into enterprise decision-making by 2014	1,2	1,2,6	Level of biodiversity input	<u>DWLBC,</u> <u>Pastoral Board,</u> <u>DEH</u>
4	Develop a revised methodology and format for the timely production of land management plans, that avoid biodiversity decline, for the installation of new water points by 2013	1	1	Level of bio assessment	<u>DWLBC,</u> <u>Pastoral Board,</u> DEH
5	Develop best practice guidelines & related extension programs for sustainable grazing management - taking into account land type and drought responsiveness - by 2014	1, 2	1, 5, 6	Status of guidelines & extension	SAAL NRM, DWLBC, Pastoral Board, industry/ research orgs
6	Ensure that at least 50% of pastoralists are engaged in best practice management programs by 2014	1, 2	1, 5, 6	% engaged	<u>DWLBC,</u> <u>Pastoral Board,</u> SAAL NRMB

² See Glossary at end of Table for explanation of acronyms

MA	NAGEMENT ACTION TARGET	PROGRAM ADDRESSED	RCT ADDRESSED	PROPOSED INDICATORS	POTENTIAL PARTNERS & LEAD AGENCIES ^{2,3}
7	Complete initial mapping of pest distributions and determine priorities for control, and establish process for updating of mapping data by 2014	1,2	1,2,3,5,6	Extent of mapping, status of updating	SAAL NRMB, DWLBC, industry, community, Pastoral Board
8	Ensure programs are in place aimed at achieving reductions in the distribution and numbers of identified priority pests by 2014	1,2	1,2,3,5,6	Pest numbers	SAAL NRMB, DWLBC, DEH, industry, community, Pastoral Board
9	Ensure high risk potential pathways for the introduction of pest animals and plants are identified; high risk and vulnerable sites are being monitored regularly; and a framework for eradication or management of potential new incursions is in place by 2014	1,2	1,2,3,5,6	Status of monitoring; new pest incursions	<u>SAAL NRMB,</u> DWLBC, adj Boards, industry
10	 Undertake risk assessment process to identify: » pest species that could be advantaged by climate change » native species and ecological communities that may be vulnerable to climate change » potential implications of climate change for water resources management » other potential implications of climate change for natural resources management by 2015 	1,2	1,2,3,5,6	Status of process; relevant risks identified	SAAL NRMB, DWLBC, DEH, adj Boards, industry, tertiary institutions, research orgs
11	Ensure all relevant land managers are engaged and supported in pest control programs by 2014	1,2,3	1,2,3,5,6,9,10	Number/proportion engaged; extent of on-ground outcomes	<u>SAAL NRMB</u> , DWLBC, DEH, industry, community
12	Develop cross boundary protocols and guidelines regarding pest control with adjoining NRM boards and equivalent adjoining interstate bodies by 2014	1,2	1,2,3,5,6	Status of protocols & guidelines	<u>SAAL NRMB</u> , DWLBC, adj Boards, industry, NRM Council
13	Ensure research needs in support of MATs 7 to 12 are identified by 2011 and that priority research is underway by 2014	1,2	1,2,3,5,6	Research identified; initiation of priority research	SAAL NRMB, DWLBC, adj Boards, industry, tertiary institutions, research orgs

SA ARID LANDS REGIONAL NATURAL RESOURCES MANAGEMENT PLAN

MA	NAGEMENT ACTION TARGET	PROGRAM ADDRESSED	RCT ADDRESSED	PROPOSED INDICATORS	POTENTIAL PARTNERS & LEAD AGENCIES ^{2,3}
14	Complete surveys and mapping of regional ecosystems, including environmental water requirements by 2016	1,2	1,2,3,6,7,8	Coverage of surveys & mapping	<u>DEH</u> , DWLBC, SAAL NRMB, tertiary institutions, research orgs
15	Develop programs to support the management and recovery of 50% of the conservation priorities identified within the SAAL Biodiversity Strategy by 2016	1,2,3	1,2,3,6	Status of programs; degree of recovery	DEH, SAAL NRMB, DWLBC, industry, community
16	Determine the current status and potential for decline of 50% of species, ecological communities and ecological processes not currently identified as conservation priorities by 2016	1,2	1,2,3,6	Status of programs; species, communities and actions identified	<u>DEH</u> , DWLBC, SAAL NRMB, tertiary institutions, research orgs
17	Commence research to improve knowledge regarding ecosystem function and services for priority ecosystems by 2014	1,2	1,2,3,6	Status of research; ecosystem services clarified	<u>DEH</u> , DWLBC, SAAL NRMB, tertiary institutions, research orgs
18	Improve the capacity of terrestrial and aquatic ecosystems to adapt to climate change through the enhancement of the public, private and indigenous protected areas network and sympathetic land management programs within 80% of all IBRA sub- regions by 2017	1	1,2,3	Priorities identified	DEH, DWLBC, SAAL NRMB, community
19	Identify GAB springs that warrant priority in protection from total grazing pressure by 2012 and ensure that 50% of those are protected by 2018	1	1,2,3	Number of springs identified; proportion protected	DEH, DWLBC, SAAL NRMB, GABSI, industry, community
20	Identify other aquatic ecosystems that warrant priority in protection from total grazing pressure by 2014 and ensure that 50% of those are protected by 2018	1	1,2,3	Number of aquatic ecosystems identified; proportion protected	DEH , DWLBC, SAAL NRMB, industry, community, Pastoral Board
21	Develop a regional action plan for the control of animal and plant pests in aquatic ecosystems in the SAAL NRM Region by 2014	1,2	1,2,3,6	Status of action plan & of on-ground outcomes	SAAL NRMB, DWLBC, DEH, industry

MAN	AGEMENT ACTION TARGET	PROGRAM ADDRESSED	RCT ADDRESSED	PROPOSED INDICATORS	POTENTIAL PARTNERS & LEAD AGENCIES ^{2,3}
22	Ensure that the Water Allocation Plan for the Far North Prescribed Wells Area is being fully implemented by 2014	1,2	3,6,7	Status of implementation	<u>Min E&C,</u> <u>DWLBC, SAAL</u> <u>NRMB</u> , industry, community, SA Water
23	Ensure that a sustainable program for monitoring and repair of leaking artesian bores is in place by 2014	1,2	3,6,7	Status of program, no. of bores monitored & of leaking bores repaired	DWLBC, GABSI, SAAL NRMB, industry, SA Water
24	Ensure that a management/ rehabilitation plan for currently flowing artesian bores is completed by 2012 and implemented by 2016	1,2	3,6,7	Status of plan & of implementation	<u>DWLBC,</u> GABSI, SAAL NRMB, industry, Pastoral Board
25	Ensure the policies and actions to sustain the GAB in the SAAL NRM Region are integrated within national policies and actions by 2014	1,2	3,6,7	Regional policies and actions and their level of integration at the national level	SAAL NRMB, DWLBC, GABSI, Aust Gov't
26	Develop guidelines for water extraction from surface water systems for stock, domestic and other uses by 2014	1,2	3,6,8	Status of guidelines; degree of uptake	DWLBC, SAAL NRMB, DEH, industry, SA Water
27	Ensure that administrative processes re Water Affecting Activities are in place and that relevant land managers are aware of their responsibilities by 2011	1,2	3,6,7,8	Status of WAA processes & compliance	SAAL NRMB, DWLBC, industry
28	Review the Water Affecting Activities set out in Part 4 of this plan, to ensure that they are consistent with the objectives of maintaining natural flow regimes in the SAAL NRM Region by 2014	1,2	3,6,8	Role acknowledged	SAAL NRMB, DWLBC, LEBCAC, Aust Gov't
29	Implement protection, management and/or rehabilitation measures in at least ten priority aquatic ecosystems (priority at local/ community level) by 2016	1,2	3,7,8	Number protected etc	SAAL NRMB, industry, community, SA Water
30	Develop a regional water resources research register, highlighting information gaps, priorities, responsibilities and potential funding sources by 2012	1,2	3,6,7,8	Status of register	DWLBC, SAAL NRMB, DEH, industry, GABSI, LEBCAC, SA Water, tertiary institutions, research orgs
31	Ensure that high research priorities are being addressed by 2014	1,2	3,6,7,8	Number of priorities addressed; status of research	As above for MAT 30

SA ARID LANDS REGIONAL NATURAL RESOURCES MANAGEMENT PLAN

MANAGEMENT ACTION TARGET		PROGRAM ADDRESSED	RCT ADDRESSED	PROPOSED INDICATORS	POTENTIAL PARTNERS & LEAD AGENCIES ^{2,3}
32	Work with Aboriginal people to establish an agreed process for their consultation and involvement in agency NRM planning and programs by 2013	1,2,3	1,2,3,4,9,10	Proportion of communities actively engaged	<u>SAAL NRMB,</u> DAAR, ALT, DEH, community
33	Develop landscape assessment framework for the SAAL NRM Region by 2014and ensure all development and best practice land management standards incorporate ESD principles by 2016	1,2,3	4,6,9,10	Status of guidelines & protocols	SAAL NRMB, Planning SA, community
34	Review the extent and priority of impacts upon natural resources associated with features of cultural importance by 2016	1,2	1,4,5	Status of review, soil condition	<u>SAAL NRMB,</u> DEH, community
35	Identify soil erosion priority areas and initiate on-ground management by 2014	1,2	1,5	Areas identified; soil improvement	SAAL NRMB, industry, community, Pastoral Board
36	Establish consultative arrangements for the assessment of soil conservation implications of proposed new infrastructure by 2012	1,2	1,5	Status of arrangements	<u>SAAL NRMB,</u> DTEI, industry
37	Develop register of infrastructure sites associated with significant soil disturbance/ erosion and initiate on-ground management at priority sites by 2014	1,2	1,5	Status of register; condition of priority sites	<u>SAAL NRMB,</u> DTEI, industry
38	Ensure that 50% of pastoral and other broad-acre land managers are applying best practice measures for dingo and fox control and management by 2014	1,2	2,6	Status of dingo populations	SAAL NRMB, pastoral, industry, DEH, community
39	Establish strategic response protocols regarding overabundant native species by 2014	1,2	1,2,6	Status of potentially overabundant species	<u>DEH</u> , industry, SAAL NRMB, community
40	Establish process for managing native vegetation clearance offsets in the SAAL NRM Region, by 2014	1,2	1,6	Net improvement in native vegetation	NVC, DWLBC, SAAL NRMB, PIRSA, DTEI, industry
41	Develop best practice NRM guidelines relating to tourism by 2014	1,2	1,4,6	Status of guidelines	SAAL NRMB, industry, community

MANAGEMENT ACTION TARGET		PROGRAM ADDRESSED	RCT ADDRESSED	PROPOSED INDICATORS	POTENTIAL PARTNERS & LEAD AGENCIES ^{2,3}
42	Ensure 50% of tourism operators are accredited for Environmentally Aware Tourism by 2014	1,2	1,4,6	Extent of accreditation	<u>Industry</u> , SATIC, SAAL NRMB
43	Review feasibility of expanded partnerships between the SAAL NRM Board and regional industry and identify priority areas/issues for partnerships by 2014	1,2,3	Potentially all	Status and outcomes of partnerships	SAAL NRMB, PIRSA, industry
44	Develop a predictive water demand model for the SAAL NRM Region by 2014	1,2	2,3,6,7	Status of model	<u>SAAL NRMB,</u> <u>PIRSA, DWLBC,</u> industry, SA Water
45	Review policies and practices for management of wastewater by 2014	1,2	2,3,6,7	Status of review; degree of uptake of findings	SAAL NRMB, <u>PIRSA, DWLBC,</u> industry, SA Water
46	Ensure that programs are in place to provide up-to-date NRM information to all sectors of the community in accessible and digestible form by 2014	1,2,3	~All	Coverage and accessibility/ distribution of info	SAAL NRMB, industry, DWLBC, DEH, community
47	Develop a support program to increase the participation of Aboriginal people in natural resources management projects that link with Aboriginal priorities by 2013	1,2,3	Potentially all	Status of program; level of participation	SAAL NRMB, DAAR, Aboriginal people and groups, ALT
48	Establish ongoing dialogue with relevant educational bodies and ensure inclusion of regionally relevant NRM issues in local school programs by 2014	1,2,3	~All	Coverage of NRM within curricula	SAAL NRMB, DECS, community
49	Review adequacy of current training programs and other opportunities for community skills development in NRM by 2012	1,2,3	~All	Extent of relevant training opportunities	SAAL NRMB, DFEEST, industry, community
50	Identify any significant barriers to effective natural resources management associated with infrastructure by 2014	3	10	Nature & extent of any barriers identified	DTEI, SAAL NRMB, industry, community

Glossary of Acronyms in Potential Partners Column

ALT	Aboriginal Lands Trust
DAAR	(SA) Division of Aboriginal Affairs and Reconciliation
DECS	(SA) Department of Education and Children's Services
DFEEST	(SA) Department of Further Education, Employment, Science and Technology
DEH	(SA) Department for Environment and Heritage
DTEI	(SA) Department for Transport, Energy and Infrastructure
DWLBC	(SA) Department of Water, Land and Biodiversity Conservation
GABSI	Great Artesian Basin Sustainability Initiative
LEBCAC	Lake Eyre Basin Community Advisory Committee
MIN E & C	(SA) Minister for Environment and Conservation
NVC	Native Vegetation Council
PIRSA	Primary Industries and Resources SA
SAAL NRMB	SA Arid Lands Natural Resources Management Board
SACOME	SA Chamber of Mines and Energy
SATIC	SA Tourism Industry Council

8. ESTABLISHING PRIORITIES FOR ACTIONS

Part 3 of this Plan focuses on a ten-year strategy for natural resources management in the region, centring on targets (Resource Condition and Management Action) that will help to achieve the Vision and major Goals for the region. It also identifies lead agencies and potential partners to deliver on the MATs. Almost inevitably, the resources available to the region for implementation will not be sufficient to achieve all of the actions and projects that should ideally be undertaken. A prioritisation process and an implementation plan are needed to help determine those actions and projects that should be funded and how all stakeholders in the region can cooperate to deliver them most effectively.

The Board has taken the lead to develop an initial regional implementation plan. This regional implementation plan will be updated with regional stakeholders on a regular basis. This implementation plan is supported by a priority setting framework that centres on risk management.

Volume 2 of this plan, the Business Plan, focuses on actions and projects that the Board will fund and implement as its part of achieving the above targets for the following three years.





The Regulations and Policies to Help Us

1. INTRODUCTION

Natural resources management is the integrated and sustainable management of the State's natural resources and involves balancing the needs of our land, water resources, plants and animals with social and economic needs. Natural resources management is a shared responsibility, the benefits of which are shared by pastoralists, industry, residents and tourists. Sustained and effective natural resources management is important if we are to maintain the health of our environment, conserve our native species and ecological communities and continue to be a major agricultural producer and exporter.

The *Natural Resources Management Act 2004* provides specifically for the management and protection of land and water resources, and the control of animals and plants. Importantly, an owner of land (including lessees) and other persons are required to undertake certain activities in relation to land and water resources, and specified animals and plants, in accordance with the provisions of the *Act* and this plan. This part of the plan sets out the regulatory framework for the management of the South Australian Arid Lands Natural Resources Management Region's natural resources and includes a brief discussion of matters relevant to the *Native Vegetation Act 1991* and the *Development Act 1993*.



2. GENERAL STATUTORY DUTY

In addition to the regulatory framework for the management and protection of land and water resources and the control of animals and plants described below, section 9 of the *NRM Act 2004* provides that a person must act reasonably in relation to the management of natural resources within the State. In determining what is reasonable, regard must be had to the objects of the *Act* and to the following matters:

- a) The need to act responsibly in relation to the management of natural resources, and the potential impact of a failure to comply with the relevant duty
- b) Any environmental, social, economic or practical implications, including any relevant assessment of costs and benefits associated with a particular course of action, the financial implications of various measures or options, and the current state of technical and scientific knowledge
- c) Any degrees of risk that may be involved
- d) The nature, extent and duration of any harm
- e) The extent to which a person is responsible for the management of the natural resources
- f) The significance of the natural resources, including in relation to the environment and to the economy of the State (if relevant)
- g) The extent to which an act or activity may have a cumulative effect on any natural resources
- h) Any pre-existing circumstance, and the state or condition of the natural resources.

A person will be taken to have acted reasonably if he or she has acted in a manner consistent with any best practice methods or standards in the relevant industry or sphere of activity that are recognised as being acceptable by the South Australian Arid Lands Natural Resources Management Board.

3. THE BOARD'S APPROACH

The *Act* empowers the Minister for Environment and Conservation, the Board and certain other persons and bodies involved in the administration of the *Act* to regulate and enforce compliance with the *Act* and this plan. For example, the Board may serve notice on an owner of land on which an activity was undertaken in contravention of a condition of a permit (eg by contaminating water in a lake where a condition of the permit to drain or discharge water into the lake is that the activity must not contaminate the receiving waters) requiring the owner to remedy the breach.

Where the management of natural resources requires the taking of remedial action the Board will, insofar as is reasonably practicable and appropriate, encourage people to take such action before resorting to more formal processes and procedures under the *Act*.
4. WATER AFFECTING ACTIVITIES

4.1 INTRODUCTION

The landscape and ecosystems of the region are generally intact compared with other regions in the State. The arid character of the region means the maintenance of the health and integrity of water resources is especially critical to plants, animals and people that rely on them. This part of the Plan deals with the regulation of water affecting activities to protect the water resources and related natural assets of the region in order to sustain natural ecosystems and provide maximum benefits to the community.

4.2 WATER RESOURCES

The *Act* defines 'water resource' to mean "a watercourse or lake, surface water, underground water, stormwater (to the extent that it is not within a preceding item) and effluent". For the purposes of this plan, the *Act* includes the following definitions relevant to water resources:

- » 'Lake' means a natural lake, pond, lagoon, wetland or spring (whether modified or not)
- Wetland' means an area that comprises land that is permanently or periodically inundated with water (whether through a natural or artificial process) where the water may be static or flowing and may range from fresh water to saline water and where the inundation with water influences the biota or ecological processes (whether permanently or from time to time)
- Watercourse' means a river, creek or other natural watercourse (whether modified or not) in which water is contained or flows whether permanently or from time to time and includes—
 - (a) a dam or reservoir that collects water flowing in a watercourse
 - (b) a lake through which water flows
 - (c) a channel (but not a channel declared by regulation to be excluded from the ambit of this definition) into which the water of a watercourse has been diverted
 - (d) part of a watercourse
 - (e) an estuary through which water flows
- » 'Flood plain' of a watercourse means the land adjoining the watercourse that is periodically subject to flooding.

Water resources in the region are uniquely different to the common perception of rivers, creeks and lakes. Rivers and creeks in the region often consist of braided channels, waterholes and broad areas of floodplain, while lakes are usually dry salt beds, claypans or temporary waterholes situated along creek beds. For example, GAB springs and associated wetlands fall within the definition of 'lake' under the *Act* but would not be commonly considered to be a lake.

Extensive areas of the region, where cyclical flooding occurs, may also fall within the definition of 'wetland' and therefore be a lake for the purposes of the *Act*. Again, most people would not consider such areas to be a lake when considering some activity, which under the *Act* would be considered a water affecting activity. Requiring a permit for an activity in relation to a lake in the region would therefore apply the water affecting activity to large areas of the region. Consequently care has been exercised in the use of the term lake in water affecting activities.

For the purposes of this plan:

- » 'Waterhole' means a body of water that is a natural collection point in a drainage area, which retains water after flow for an extended period
- » 'Rockhole' means a place where water is permanently or for extended periods collected irrespective of how the water got there initially.

4.3 REGULATING WATER AFFECTING ACTIVITIES

Chapter 7 of the *Act* deals with the management and protection of water resources. Water affecting activities are activities that have the potential to affect water resources and, consequently, the people and ecosystems which rely on them. Pursuant to section 75(3)(k) of the *Act* this plan must set out the matters which the Board will consider when exercising its power to grant or refuse permits for water affecting activities.

Section 127(3) of the *Act* provides that a permit is required to undertake the following activities:

a) drilling, plugging, backfilling or sealing of a well

- b) repairing, replacing or altering the casing, lining or screen of a well
- c) draining or discharging water directly or indirectly into a well.

The relevant authority for the activities referred to in sections 127(3)(a), (b) and (c) is the Minister for Environment and Conservation. This means that an application to undertake any of these activities will need to be made to the Minister. The Minister will grant or refuse the application and take into account the provisions of this plan when considering any application.

Section 127(3)(e) provides that a permit is also required to undertake an activity of a kind referred to in section 127(5) that is identified in an NRM plan as being an activity for which a permit is required. Section 127(5) provides that a person must not undertake any of the following activities contrary to an NRM plan applying in the region in which the activity is undertaken:

- a) The erection, construction, modification, enlargement or removal of a dam, wall or other structure that will collect or divert, or collects or diverts, water flowing in a watercourse that is not in the Mount Lofty Ranges Watershed and that is not prescribed or flowing over any other land that is not in a surface water prescribed area or in the Mount Lofty Ranges Watershed
- b) The erection, construction or placement of any building or structure in a watercourse or lake or on the floodplain of a watercourse
- c) Draining or discharging water directly or indirectly into a watercourse or lake
- d) Depositing or placing an object or solid material in a watercourse or lake
- e) Obstructing a watercourse or lake in any other manner
- f) Depositing or placing an object or solid material on the floodplain of a watercourse or near the bank or shore of a lake to control flooding from the watercourse or lake
- g) Destroying vegetation growing in a watercourse or lake or growing on the floodplain of a watercourse
- h) Excavating or removing rock, sand or soil from
 - i) a watercourse or lake or the floodplain of a watercourse
 - ii) an area near to the banks of a lake so as to damage, or create the likelihood of damage to, the banks of the lake
- Using water in the course of carrying on a business in an NRM Region at a rate that exceeds the rate prescribed by an NRM plan if the water has been brought into the region by means of a pipe or other channel
- j) Using effluent in the course of carrying on a business in an NRM Region at a rate that exceeds a rate prescribed by an NRM plan
- k) An activity prescribed by the regulations.

Permits were required to undertake certain water affecting activities under the SAAL NRM Region's previous NRM plan. Any water affecting activity undertaken before the previous plan was adopted or undertaken during the duration of that NRM plan, and did not require a permit under that NRM plan, still does not require a permit.

The Board is of the view that is not necessary or practicable to require a permit for all of the activities identified in section 127(5) of the *Act*. Also many commercial activities are likely to be managed under other legislation (eg the *Development Act 1993*). The impacts of some water affecting activities may also be adequately managed by the requirement in section 9 of the *Act* that a person must act reasonably in relation to the management of natural resources.

Other activities, however, will require a higher level of control in order to:

- » Ensure sustainable use of water resources
- » Ensure equity among existing water users
- » Ensure heritage and cultural value is maintained
- » Ensure long-term integrity of ecological functions and water dependent ecosystems.

These are activities that may impact significantly on the quality or quantity of water resources or water dependent ecosystems. For the purposes of this plan, the following activities referred to in section 127(5) of the *Act* are activities for which a permit is required in the region under section 127(3)(e) of the *Act*. Pursuant to section 126(2)(d) of the *Act*, the Board is the relevant authority for the activities referred to in section 127(5) and listed in **Table 13** as requiring a permit. An application to undertake any of these activities will therefore need to be made to the Board.



Mayo Gorge, a large waterhole in the Flinders Ranges, is just one of a large array of springs, dams and waterholes in the Arid Lands region

<i>NRM ACT 2004</i> REFERENCE & WATER AFFECTING ACTIVITY	LOCATION IN REGION	PERMIT REQUIRED IF:	EXCLUSIONS (SEE 4.5)	RELEVANT AUTHORITY
Section 127(3)(a) Drilling, plugging, backfilling or sealing of a well	Everywhere	All situations	None	Minister for Environment and Conservation
Section 127(3)(b) Repairing, replacing or altering the casing, lining or screen of a well	Everywhere	All situations	None	Minister for Environment and Conservation
Section 127(3)(c) Draining or discharging water directly or indirectly into a well	Everywhere	All situations	None	Minister for Environment and Conservation
Section 127(5)(b The erection, construction or enlargement of a dam, wall or other structure that will collect or divert, or collects or diverts, water flowing in a watercourse that is not prescribed or flowing over any other land that is not in a surface water prescribed area	Everywhere	Dam capacity exceeds 10 megalitres	None	The Board
Section 127(5)(b) The erection, construction or placement of any buildings or structures	 a) in a watercourse b) in a lake c) in the floodplain of a watercourse 	 a) Activity prevents the passage of low flow b) In all situations except for a floodplain of a watercourse (see (c) below) c) Activity could lead to diversion of greater than 10 megalitres during one flow event 	Levees or channels will not require a permit if water is to be diverted directly from rock faces, and there is no significant down stream catchment, water use or users that would otherwise be affected by the diversion	The Board

Table 13. Water Affecting Activities, SAAL NRM Region

<i>NRM ACT 2004</i> REFERENCE & WATER AFFECTING ACTIVITY	LOCATION IN REGION	PERMIT REQUIRED IF:	EXCLUSIONS (SEE 4.5)	RELEVANT AUTHORITY
Section 127(5)(f) Depositing an object or solid material to control flooding	On the floodplain of a watercourse or near the bank or shore of a lake	If it will divert greater than 10 megalitres of water from its natural course during one flow event. This includes construction of roads or tracks or levee banks	None	The Board
Section 127(5)(c) Draining or discharging water directly or indirectly	Into a watercourse or lake	Volume greater than 1 megalitre	None	The Board
Section 127(5)(h) Excavating or removing rock, sand or soil	a) from the floodplain of a watercourse	a) if it diverts or impedes greater than 10 megalitres of water from its natural course in one flow event	None in all situations	The Board
	b) from a watercourse or lake	b) if the volume excavated significantly alters the geomorphology of the area from which the material is taken		
	c) from a waterhole or rock hole	c) all situations except for cleaning of rock holes in accordance with traditional Aboriginal practice		

Section 127(6)(a) of the *NRM Act 2004* provides that it is an offence to undertake any of the above activities without a permit.

4.4 GENERAL OBJECTIVES AND PRINCIPLES APPLICABLE TO WATER AFFECTING ACTIVITIES

The following objectives and principles apply to all water affecting activities in the region. All permit applications will be assessed against these general objectives and principles. Additional more detailed principles which apply to specific water affecting activities are set out in 4.6, following.

Objectives

- a) Preserve or enhance water quality
- b) Ensure that water is used within sustainable limits
- c) Ensure equitable sharing of the water available for consumptive use including equity of access by existing users
- d) Maintain natural hydrological systems and environmental water requirements
- e) Preserve water dependent ecosystems
- f) Protect against the risk of harm to public and private assets and public safety from flooding
- g) Monitor the potential impacts of water affecting activities.

Principles

A water affecting activity must not:

- a) Cause or increase soil erosion or bank destabilisation of a watercourse or lake, or erosion of a floodplain
- b) Be located in an ecologically sensitive area
- c) Have adverse impacts on water resources, other natural resources, and water dependent ecosystems or communities at both local and regional levels
- d) Have adverse impacts on biodiversity and habitat preservation
- e) Cause or exacerbate unnatural water logging
- f) Cause deterioration in the quality of surface water, groundwater or water in a watercourse or lake
- g) Create or exacerbate the incidence of local or regional flooding that increases risk to public and private assets, communities or individuals
- h) Have an adverse impact on authorised devices or activities designed for scientific purposes
- i) Must not adversely impact those downstream.

4.5 ACTIVITIES THAT DO NOT REQUIRE A PERMIT

A permit is not required to undertake the activities set out in section 129 of the NRM Act 2004. This includes certain activities which are required or authorised under the Development Act 1993, Environment Protection Act 1993, Native Vegetation Act 1991 and the Pastoral Land Management and Conservation Act 1989. For example, dams or watering points approved in a Water Point Development Plan under the Pastoral Land Management and Conservation Act 1989 do not require a permit.

Further the following principles apply to activities which would otherwise require a permit.

- 1. Subject to principle 2, a permit is not required to undertake a water affecting activity identified in this plan for which a permit is otherwise required where:
 - 1.1. The Board has endorsed Best Practice Operating Procedures in relation to the activity; and
 - 1.2. The person proposing to undertake the activity has obtained written approval from the Board to undertake the activity or activities in accordance with the Best Practice Operating Procedures; and
 - 1.3. The activity is undertaken in accordance with the Best Practice Operating Procedures.
- 2. Principle 1 does not apply to an activity referred to in section 127(3)(a), (b), (c), (d) or (f) of the *NRM Act 2004*.
- 3. To avoid doubt, a permit is required to undertake an activity if any of the conditions in principle 1 is not met.
- 4. An approval given by the Board in accordance with principle 1.2 is valid for 12 months from the date it was given, or for such other period of time specified by the Board, and will apply to any activities to which the Best Practice Operating Procedures relate which may be undertaken in that period.
- 5. An approval given by the Board in accordance with principle 1.2 may be cancelled by the Board where, in the Board's opinion, the person to whom the approval was given does not comply with Best Practice Operating Procedures or in any other circumstances as the Board thinks fit.
- 6. The Board may refuse to give an approval in accordance with principle 1.2 to a person who, in the Board's opinion, has contravened or failed to comply with Best Practice Operating Procedures or in any other circumstances as the Board thinks fit.

4.6 PRINCIPLES FOR ISSUING PERMITS

In addition to the general principles set out in 4.4 previously, the Board will consider the following principles when determining to grant or refuse a permit.

It is important to be aware that, in addition to requiring a permit for the activities set out in 4.3, a person must act reasonably in relation to the management of natural resources within the region.

- 1. The erection, construction or enlargement of a dam, wall or other structure that will collect or divert, or collects or diverts, water flowing in a watercourse or flowing over any other land must not adversely affect downstream water dependent ecosystems.
- 2. Dams and walls or other structures must allow low flow bypass, whether constructed on or off-stream.
- 3. Dams and walls or other structures must not be located in:
 - a) Areas where the structure could lead to increased erosion effects after rain events
 - b) Ecologically sensitive areas
 - c) Areas where they will negatively affect neighbouring properties by reducing and/or altering flows.
- 4. A building or structure must not be located where:
 - a) It is likely to adversely affect the migration of aquatic or other biota. In particular, the design, construction and location of levee banks and other similar structures must provide for the needs of ecosystem processes
 - b) It is likely to affect the natural flow of a watercourse or lake or the floodplain of a watercourse
 - c) There is a risk of watercourse, lake or floodplain erosion
 - d) There is a risk of causing flooding either up or downstream
 - e) It will inhibit recharge of local aquifers.
- 5. Draining or discharging water directly or indirectly into a watercourse or lake must not;
 - a) Cause erosion
 - b) Adversely affect ecosystems
 - c) Contaminate any receiving water
 - d) Alter the natural wetting and drying cycle.

The quality of the discharged water must be of a similar quality to the receiving water. Any potential contaminants must be treated and/or contained in an appropriate manner.

- 6. Obstructing a watercourse or lake, or depositing or placing an object or solid material in a watercourse or lake, must not adversely affect the:
 - a) Migration of aquatic biota
 - b) Natural flow regime
 - c) Surrounding area
 - d) Other users.
- 7. Depositing or placing an object or solid material on the floodplain of a watercourse or near the bank or shore of a lake must not adversely affect the:
 - a) Migration of aquatic biota
 - b) Natural flows.
- 8. Excavating or removing rock, sand or soil from a watercourse or lake or the floodplain of a watercourse must not result in any of the following:
 - a) Increased erosion
 - b) Increased flooding
 - c) Bed and bank instability
 - d) Downstream sedimentation
 - e) Loss of vegetation
 - f) Reduction in water quality
 - g) Alteration to the natural flow regime
 - h) Adverse impacts on the migration of aquatic biota.

A permit will be granted subject to conditions specified in the permit by the relevant authority based on the objectives and principles set out in this plan.

The objectives and principles in this section do not apply to a prescribed water resource to the extent that the relevant water allocation plan sets out the matters that the Board will consider when exercising its powers to grant or refuse permits under Chapter 7 Part 2 of the *NRM Act 2004*.

The Board will work with the relevant State Government Departments to ensure the Statement of Environmental Objectives required through the Mining and Petroleum Acts correspond with the Board's objectives for protection of water related assets in the area.

The Board will work with the community to raise awareness and improve people's understanding of water resources in the region. The Board will also monitor the effect of activities that do not require a permit on the natural resources in the region.



4.7 WATER AFFECTING ACTIVITIES PERMIT DECISION-MAKING PROCESS

Applicants can appeal refusal or conditions of approval to ER Court (refer to sec 202)

5. MANAGEMENT AND PROTECTION OF LAND

5.1. INTRODUCTION

Chapter 6 of the NRM Act 2004 deals with the management and protection of land.

Section 122(1) of the *Act* provides that the Board may require an owner⁹ of land to prepare an action plan (to address any breach of the general statutory duty), where the Board considers:

- a) That an owner of land has been, is, or is likely to be, in breach of the general statutory duty on account of land management practices or activities undertaken in relation to land for which the owner is responsible; and
- b) That those practices or activities have resulted in, or could reasonably be expected to result in, unreasonable degradation of land or an unreasonable risk of degradation of land.

The *Act* defines 'degradation' of land to mean "any change in the quality of land, or any loss of soil, that has an adverse effect on water, native vegetation or other natural resources associated with, or reliant on, land, any other aspect of the environment, or biological diversity".



Under the NRM Act the owner of land, amongst other things, also means a lessee of land.

5.2 MATTERS FOR CONSIDERATION

Before requiring an owner of land to prepare an action plan, the Board must (among other things) consider any relevant provisions of the *SAAL Regional NRM Plan*. Set out below are the matters that the Board will consider before taking any such action.

The Board will attempt to achieve the following:

1. Risk of land degradation minimised.

Land degradation can be caused by extreme weather events such as very windy conditions or intense storms. Erosion can occur even when land managers employ best management practices. Land degradation can never be regarded as eliminated or controlled – at best, land managers can minimise the risk of degradation through the use of appropriate practices.

2. Causes of degradation determined.

While land degradation, such as wind and water erosion, can often be easily seen, the reasons why it occurred cannot be determined from observation alone.

3. Remedial action undertaken.

When a land degradation problem is identified, there is a need to establish whether the problem is due to management or extraneous events. If it is determined that the problem occurred as a result of management factors, then it should be considered whether the management was inappropriate, and remedial action should be initiated.

6. CONTROL OF PEST ANIMALS AND PLANTS

6.1 THE BOARD'S ROLE

Chapter 8 of the *NRM Act 2004* deals with the control of animals and plants. Under that Chapter, the Minister for Environment and Conservation may declare that a specified provision of that Chapter applies to a specified class of animals or plants. As at the date of adoption of this plan, the Minister has declared, by notice published in the Government Gazette on 30 June 2005 at pages 2018-2060 (as amended), that certain provisions of Chapter 8 apply to specified classes of animals and plants.

The Board has the following statutory roles in relation to the control of declared animals and plants:

- » To enforce a landowner's responsibility to control or destroy declared pest animals and plants, while protecting native vegetation and habitats
- » To carry out proper measures for the destruction of certain declared animals and plants, and for the control of certain other declared animals and plants, on road reserves
- » To notify the Chief Officer of the presence of certain declared animals and plants.

Among other things, the Board may also:

- » Specify measures to be taken by an owner of land for the control of declared animals or plants that are, or may be, on that land
- » Specify measures requiring that land, or anything present on the land, be subjected to specified treatment
- » Exempt a person from taking any of the above measures, or exempt an owner of land from the requirement to destroy or control declared animals or plants on land
- » Cause to be carried out measures that appear to the Board to be appropriate in view of any failure on the part of an owner of land to prepare or implement an action plan, or engage a suitably qualified person to devise and implement measures to address the problem or problems
- » Issue a permit to a person authorising:
 - » The movement of certain declared animals or plants; or
 - » The keeping or possession of certain declared animals or plants; or
 - » The sale of certain declared animals or plants.

Land owners are also required to destroy or control certain declared pest animals and plants on their property.

In addition to its statutory roles the Board is responsible under the State NRM Plan for:

- » Strategic management of pest species in the region, in accordance with regional natural resources management plans and within the policy framework of the State NRM Plan
- » Cooperating with the State Government in implementing the *Biosecurity Strategy for South Australia 2005*
- » Ensuring landholders comply with requirements to control new incursions and existing pests in accordance with the *Act*
- » Proposing the declaration of pest animals and plants for the region, in consultation with the community, neighbouring regions and the State Government.

The Board has established a Pest Advisory Committee to provide it with expert advice. The Board has also established six NRM groups in the region to ensure that the community is involved in the development and implementation of natural resources management programs at the local level and to provide advice to the Board.



6.2 **PRINCIPLES**

As mentioned, the Board has certain obligations and powers under Chapter 8 of the *NRM Act 2004*. When exercising any of these functions or powers, the Board will take into account the following principles, which are based on the *Australian Pest Animal Strategy* and the *Australian Weeds Strategy*:

- 1. Plant management and pest animal management is an essential and integral part of the sustainable management of natural resources for the benefit of the environment, human health, the economy and amenity.
- 2. Combating pest animal and plant problems is a shared responsibility that requires all parties to have a clear understanding of their roles.
- 3. Good science underpins the effective development, monitoring and review of pest animal and plant management strategies.
- 4. Prioritisation of and investment in pest animal and plant management must be informed by a risk management approach.
- 5. Prevention and early intervention are the most cost-effective techniques for managing pest animals and plants.
- 6. Pest animal and plant management requires coordination among all levels of government in partnership with industry, land and water managers and the community, regardless of tenure.
- 7. Building capacity across government, industry, land and water managers and the community is fundamental to effective pest animal and plant management.
- 8. Management of established pest animals and plants should aim to address actual rather than perceived problems, and to reduce impacts rather than simply pest animal numbers.
- 9. Pest animal and plant management should be strategic in terms of determining where management should occur, timing of management, being proactive and using appropriate techniques.
- 10. Where there is a choice of methods in managing pest animals, there needs to be a balance between efficacy, humaneness, community perception, feasibility and emergency needs.
- 11. As part of an integrated pest animal management program commercial harvesting may offset management costs.
- 12. In delivering its responsibility for control pest plants and animals on road reserves the Board will implement the State policies according to regional priorities and make reference to regional pest plans that articulate these priorities.

6.3 **RISK ASSESSMENT**

When exercising any of its functions or powers under Chapter 8 of the *Act*, the Board will take into account a risk assessment approach as described in the *South Australian Pest Animal Risk Management System 2007*.

Initially this assessment considers the importance of a particular pest in terms of three main criteria: invasiveness, impacts and potential distribution.

- Invasiveness: takes into account how well the pest can establish, reproduce and disperse.
- » Potential impact: examines the environmental, economic and social effects of the pest.
- » **Potential distribution**: looks at what proportion of the region which is at risk from the pest in question, indicating what total area the pest could spread over.

The second critical component of the assessment system is the feasibility of containment. This is addressed using three main criteria: control costs, current distribution and persistence.

- » **Control costs**: considers the costs of detection, treatment and enforcement/education in managing the pest in a regionally-coordinated manner.
- » **Current distribution**: indicates how widespread the pest currently is within the region. It considers the proportion of the region infested and the overall pattern of infestations.
- Persistence: indicates how long it takes to eradicate localised occurrences of the pest. It considers the efficacy of targeted control treatments, reproductive age, longevity and likelihood of ongoing dispersal.

Based upon this risk assessment process the Board will adopt an appropriate management strategy for each pest animal and plant. These management strategies for pest animals and plants are summarised as follows:

Eradicate from Region

Aims to remove the pest animal and plant species from the region through:

- » Detailed surveillance and mapping to locate all populations
- » Destruction of all populations and infestations
- » Prevention of entry to the region and stopping the keeping/cultivating, movement and sale within
- » Consideration of animal quarantine provisions and removal of any cultivated plants
- » Monitoring of progress towards eradication.

Destroy Populations

Aims to significantly reduce the extent of the pest animal and plant species in the region through:

- » Detailed surveillance and mapping to locate all populations and infestations
- » Destruction of infestations, aiming for local eradication at feasible sites
- » Prevention of entry to region and stopping the keeping/cultivating, movement and sale within
- » Consideration of animal quarantine provisions
- » Monitoring of progress towards reduction.

Contain Spread

Aims to prevent the ongoing spread of the pest animal and plant species in the region through:

- » Surveillance and mapping to locate all infested properties
- » Enforced control of all animal populations, aiming for a significant reduction in pest animal density through high level initial control and sustained management
- » Control of all plant infestations, aiming for a significant reduction in pest plant density
- » Prevention of plant entry and animal entry, and the movement and keeping of animals may be controlled under permit conditions
- » Monitoring change in current distribution.

Protect Sites

Aims to prevent spread of the pest animal and plant species to key sites or assets of high economic, environmental or social value. Pest animal and plants may be of limited current distribution but only threaten limited industries or habitats. Or the pest may be more widespread but is yet to invade or impact upon many key sub-regional industries or habitats.

- » Surveillance and mapping to locate all infested sub-regions
- » Identification of key sites or assets in the region
- » Enforced control of populations in close proximity to key sites or assets, aiming for a significant reduction in pest density
- » Limits on pest plant movement and sale of species within region
- » Entry, movement and keeping of pest animals may be controlled under permit conditions
- » Monitoring the change in current distribution within and in close proximity to key sites or assets.

Manage Pest Animal Population

Aims to reduce the overall environmental, economic and social impacts of the pest species through targeted management through:

- » Research and development of integrated pest animal management and integrated plant management packages
- » Promotion of packages to landholders
- » Monitoring the decrease in pest impacts with improved management
- Identification of key sites or assets in the region and ensure adequate resourcing to manage the pest species.

Manage Sites

Aims to maintain the overall economic, environmental and/or social value of key sites or assets through improved general pest animal and plant management through:

- Promotion of general integrated pest management principles to landholders, including the range of control techniques maintaining competitive vegetation/crops/pastures and farm management practices
- » Identification key sites or assets in the region and ensure adequate resourcing to manage these to maintain their values
- » Broadening the focus beyond pest animals and plants to all threatening processes.

Monitor

Aims to detect any significant changes in pest animals and plants through:

» Monitoring the spread of the pest species and review any perceived changes in pest animal and plant invasiveness.

Limited Action

The pest animal and/or plant species is perceived to be of insufficient risk to warrant general investment in regional strategic management action.

Based upon its risk assessment the Board has identified management strategies for each pest plant and animal. The existing management strategies for each pest animal and plant are contained in the *Board's Pest Management Strategy 2005-2010* and *Strategic Review of the Pest Advisory Committee and Pest Management Function August 2008*. These reports are available from the Board or on its website. These strategies will be reviewed regularly as more information becomes available. In implementing these strategies the Board will apply the relevant State's declarations as published in the Government Gazette from time to time.

Overall the Board has identified four fundamental components for its pest plant and animal management. These are:

- » Prioritise and Plan: to reduce existing impacts
- » Incursion Management: to prevent new introductions and spread of existing pests
- » Stakeholders, Partners and Responsibilities: to contribute, commit and coordinate
- » Research, Information and Education: to improve decision making and address knowledge gaps.



The Arid Lands region supports a huge diversity of native plants (like this *Eremophila*) that are well adapted to the extreme climatic conditions

7 MANAGEMENT OF NATIVE VEGETATION UNDER THE NATIVE VEGETATION ACT 1991

In the 2007 the South Australian Government released *New Directions for Integrated Native Vegetation Management*. These new directions detailed a range of potential interactions between natural resources management boards and native vegetation management under the *Native Vegetation Act 1991*. Namely:

- » NRM boards will be invited to develop guidelines for native vegetation management to address regionally specific issues; and
- Policies and guidelines will be developed jointly by the Native Vegetation Council (NVC) and the regional NRM Boards to become part of the State and regional NRM plans. These will then be considered in native vegetation management decision-making; and
- » A way of achieving early consideration of native vegetation and biodiversity issues within the state development planning system will be investigated; as part of this, local government will be offered the opportunity to be delegated responsibility for processing applications to clear native vegetation for house sites.

As well as these new directions, Section 29(5) of the *Native Vegetation Act 1991* provides that the NVC must, before giving its consent to an application to clear native vegetation, consult the regional NRM board for the NRM Region where the native vegetation is situated and have regard to the Board's recommendations (if any) in relation to the application.

Section 29(6) of the *Native Vegetation Act 1991* also provides a link with the Pastoral Board in relation to pastoral leases, as follows:

29 (6) Where native vegetation that is the subject of an application for the Council's consent to clear under this Division is on pastoral land, the Council must, before giving its consent, consult the Pastoral Board and have regard to the Board's recommendations (if any) in relation to the application

In considering any application referred by the NVC, the Board will take into account the vision, goals and targets set out in this plan. The Board will also work closely with the Pastoral Board to achieve a common approach to native vegetation issues in the region.

8. **DEVELOPMENT**

Section 29 (1) (ea) of the *NRM Act 2004* provides that one of the functions of a regional NRM board is "to undertake an active role in ensuring –

- (i) that any Development Plan under the *Development Act 1993* that applies within its region promotes the objects of this *Act*; and
- (ii) insofar as is reasonably practicable, that those Development Plans and the board's regional NRM plan form a coherent set of policies."

Section 75 (3)(f) of the Act provides that a regional NRM plan must (among other things):

identify any policies reflected in a Development Plan under the *Development Act 1993* that applies within its region that should, in the opinion of the board, be reviewed under that *Act* in order to promote the objects of this *Act* or to improve the relationship between the policies in the Development Plan and the policies reflected in the board's plan".

Further, section 75(3)(fa) of the *NRM Act 2004* requires a regional NRM plan to "identify the changes (if any) considered by the board to be necessary or desirable to any other statutory instrument, plan or policy (including subordinate legislation) to promote the objects of this *Act* ...".

With the exception of the towns of Coober Pedy and Roxby Downs, which are incorporated under the *Local Government Act 1999* (the District Council of Coober Pedy and the Municipal Council of Roxby Downs, respectively) the remainder of the Region is unincorporated (i.e. outside of Council areas). The Outback Areas Community Development Trust provides limited local government-type support in the unincorporated areas.

The State Government, through Planning SA, has prepared a draft *Far North Regional Land Use Framework*, which covers all of the Region and parts of far northern South Australia. The Framework presents a vision for the growth and development of the Far North by broadly identifying where housing, population and industry growth is best located – and not located – across the Far North region.

The Board supports the key elements of the Framework and in particular it notes the Framework's vision, namely:

- Population and industry growth, with a focus, as far as the SAAL NRM Region is concerned, on Roxby Downs and Coober Pedy
- » Building sustainable local service towns and communities, informed by strategic infrastructure and services planning
- » Strengthening the tourism industry in the Outback and Flinders Ranges, building on the region's rich natural and cultural assets
- » Expansion of mining and defence industries, and associated infrastructure, and
- » Sustainable and innovative approaches to securing water and energy supplies.

The Board will take an active role in regional development by fostering collaborative and consultative arrangements with planning authorities and other stakeholders involved in regional development. The Board has not identified any policies reflected in a Development Plan under the *Development Act 1993*, or in any other statutory instrument, plan or policy that should be reviewed.

The Board will monitor regional development and will consider any proposed development that is referred to it under the *Development Act 1993* within this plan's vision and goals.



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