

Conservation Action Planning

Biodiversity

June 2016 Summary



A Collaborative, Landscape Planning Approach to
Biodiversity Conservation in the Southern Flinders Ranges,
South Australia

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and the Department for Environment, Water and Natural Resources



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Acknowledgements

Current and previous participants of the Living Flinders Conservation Action Planning process as listed in Appendix 4.

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Abbreviations

CAP	Conservation Action Planning
DEWNR	Department for Environment, Water and Natural Resources
NPWS	National Parks and Wildlife Service
NRM	Natural Resources Management
WONS	Weeds of National Significance
GA	Greening Australia
Aus	Australia
SA	South Australia
CE	Critically Endangered
E	Endangered
V	Vulnerable
R	Rare

1. Planning Context and Regional Description

1.1. Introduction

This document summarises the current state of technical planning for biodiversity conservation under the **Living Flinders Conservation Program**. The planning process commenced in November 2007 and has used the global Open Standards for Conservation (CMP 2015) as a basis for collaborative regional action on biodiversity issues. A complementary process for soil and water assets has been developed since 2014.

The Living Flinders Conservation Program is a collaboration between Natural Resources Northern and Yorke, environmental and agricultural NGOs, community groups and individuals with a vision to protect and restore the natural and productive values of the Southern Flinders Ranges.

The Program is supported by Natural Resources Northern and Yorke and is being used as a major planning tool for the regional Natural Resources Management Plan.

1.1.1. Planning Progress in 2015 / 2016

Planning

- 1 Community CAP workshop (April 2016)
- 2 Technical CAP meetings (October 2015, June 2016)
- Focus on Climate Change impact and adaption
- Major review of Biodiversity CAP Assets and Objectives

Project Development

- October 2015 meeting focussed on the integration of soil and water issues into project development for the Living Flinders Program
- 5 projects identified at the community CAP
 1. Natural Springs Management Project
 2. Fox Bait Expansion Project
 3. Roadside vegetation plan management/education
 4. Nelshaby Ressie Management Plan Implementation Project
 5. Corella Management
- June 2016 meeting focussed on developing an integrated pest management, erosion control and biodiversity conservation project for the Semi-Arid Ranges Asset using the existing Arden Vale Ranges project as a basis.

Resources

- Paul Koch 2016 Climate Change Assessment
- A list of available resources produced for the Living Flinders Project is presented in Appendix 5.

1. Planning Context and Regional Description

1.2 Regional Planning Context

1.2.1 Northern and Yorke Natural Resources Management (NRM) Board Region

The NRM region extends from the northern Adelaide plains in the south to the Southern Flinders Ranges in the north, and includes the whole of the Yorke Peninsula. In total the Northern and Yorke NRM region covers over 3 million hectares and supports a population of approximately 95,000 people (Northern and Yorke NRM Board 2009).

For biodiversity conservation purposes, the region has been divided into four sub-regions based primarily on ecological characteristics but also including social considerations (refer Map 1).

Currently the 4 sub-regions are:

- Southern Flinders Ranges (Living Flinders)
- Mid North Agricultural Districts
- Southern Yorke Peninsula (Naturally Yorke)
- Upper Yorke Peninsula (Naturally Yorke)

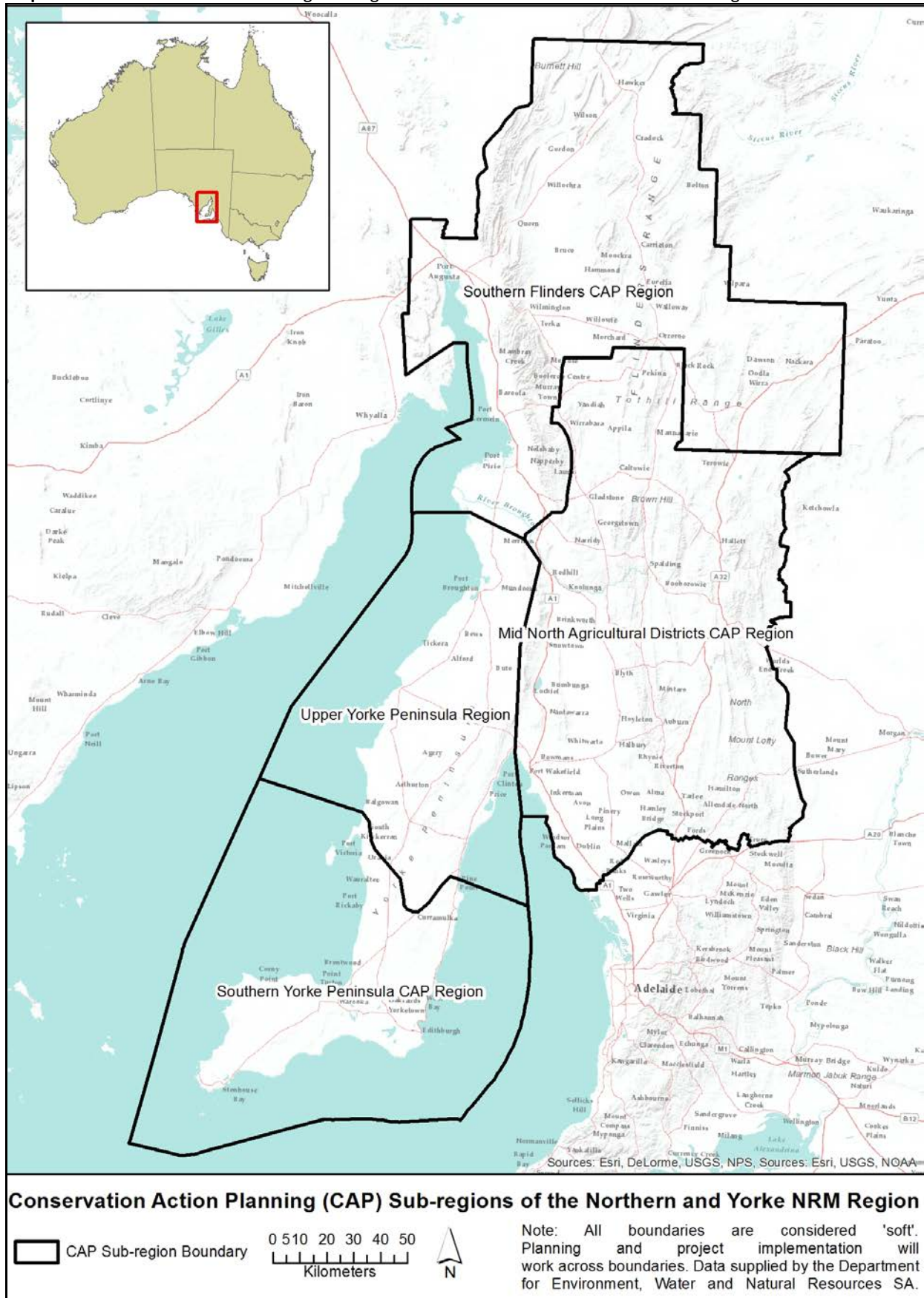
1.2.2 Soil and Water Conservation

In 2014 complementary planning processes for the soil and water assets of the Northern and Yorke region were initiated and similar summary documents have been produced in 2015 and 2016.

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1. Planning Context and Regional Description

Map 1: Conservation Action Planning Sub-Regions within the Northern and Yorke NRM Region



1. Planning Context and Regional Description

1.3 Living Flinders Region Description

The Living Flinders program region covers approximately 1.6 million hectares of the Southern Flinders Ranges from Port Pirie in the south, Hawker in the north, the Flinders-Olary Plains to the east, and upper Spencer Gulf to the west (refer Map 2).

1.3.1 Regional Landforms

Major landforms include: 1) the parallel ranges and valleys in the west of the region with steep gorges and rocky outcrops (i.e. from Beetaloo Valley to Hawker); 2) the extensive Willochra Plain in the centre of the region with the Willochra Creek flowing north and west through to Lake Torrens; 3) the coastal plains of the upper Spencer Gulf; and 4) the smaller ranges interspersed with undulating plains in the east.

1.3.2 Climate and Rainfall

The Southern Flinders Ranges are subject to a Mediterranean climate with mild wet winters and hot dry summers. This pattern is most pronounced in the south of the region and becomes less so in the north where summer rainfall events are common. The climate and rainfall are strongly influenced by the topography of the main ranges with annual average rainfall in high altitude areas in excess of 600 mm while the northern plains country receives less than 200 mm. The region is prone to periodic drought periods which have occurred with relative regularity since records began (Schwertfeger & Curran in Davies et al 1996).

1.3.3 Aboriginal Culture

Aboriginal people maintain a rich connection to the Southern Flinders Ranges and this is demonstrated by the numerous significant sites and artefacts found throughout the region, including the well known Yourambulla Caves near Hawker. A number of language groups are associated with the region including the Nukunu of the main southern ranges, the Ngadjuri people of the woodlands to the east and south of the main range, the Pankarla (Bungala) from around Port Augusta and west, and the Adnyamathanha in the northern parts of the ranges. Neighbouring groups also interacted with the people and landscape of the Southern Flinders Ranges including the Kurna to the south and Narungga people from Yorke Peninsula. Aboriginal communities are found at Port Augusta (Davenport), Yappala, Baroota and Quorn.

1.3.4 Regional Land Use

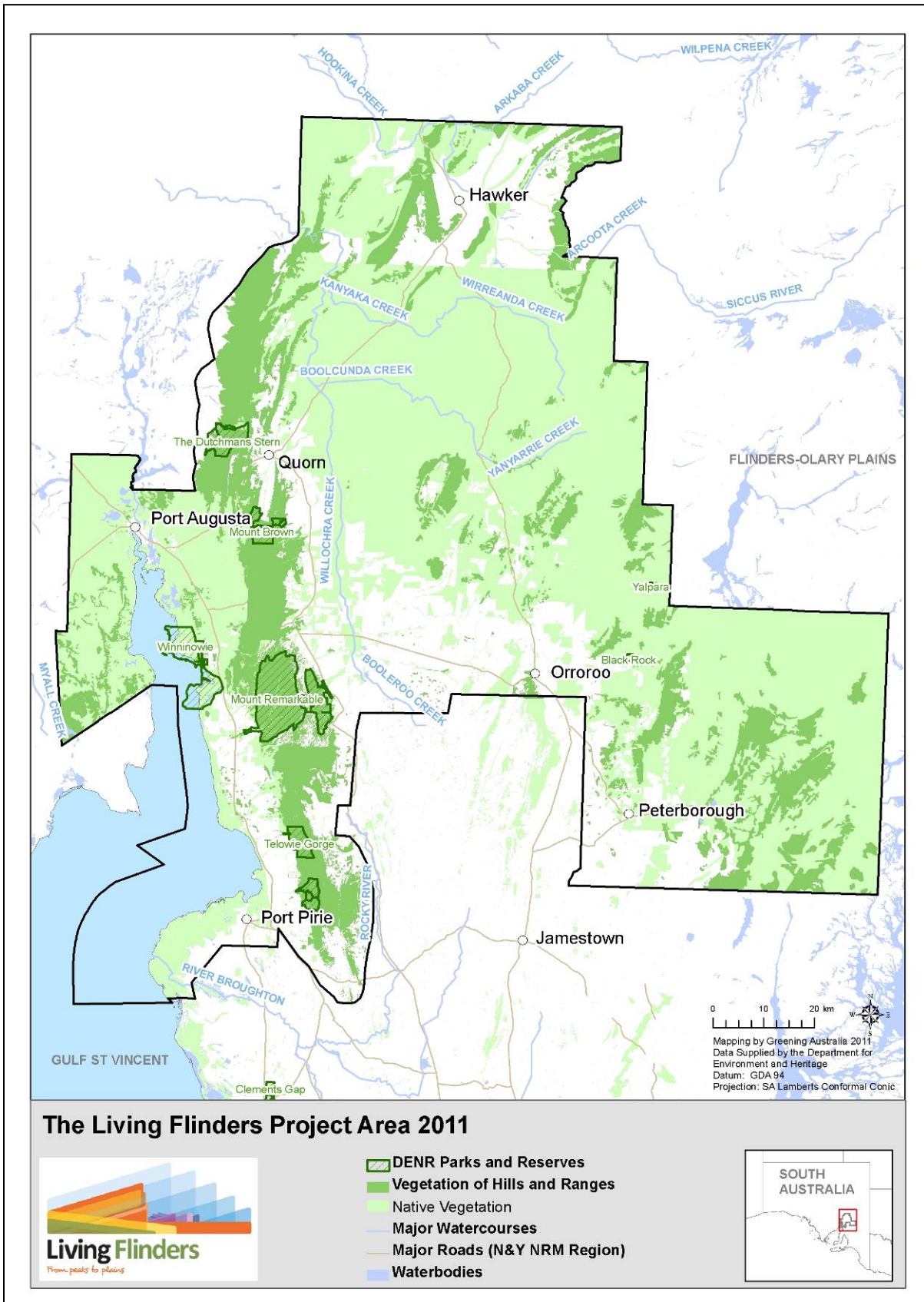
The dominant land uses in the region are stock grazing, public and private conservation reserves, eco-tourism, forestry and water catchment (restricted to the main southern ranges), and residential development and heavy industry in coastal townships. Due to the southern boundary of the project area roughly coinciding with Goyders line (identified in 1865 as the extent of viable cropping in South Australia), contemporary cropping activities are limited.

1.3.5 Native Vegetation

Approximately 1.2 million hectares is mapped as native vegetation in the project area (76% of the region), although the mapping is coarse and largely unverified. The condition of the vegetation varies considerably from relatively intact woodlands and mallee on the main ranges to more modified vegetation on the plains and low hills. Vegetation condition is not well mapped for the region.

1. Planning Context and Regional Description

Map 2: The Living Flinders Project Area 2012



1. Planning Context and Regional Description

Plant Communities

Coastal plant communities include low mangrove forests (*Avicennia marina* ssp. *marina*) and samphire (*Tecticornia* sp. and *Sarcocornia* sp. low shrublands) shrublands in inter-tidal areas around Port Pirie and the Upper Spencer Gulf, and tall coastal shrublands (*Olearia axillaris* +/- *Leucopogon parviflorus* +/- *Acacia* spp. +/- *Myoporum insulare*) on coastal sand dunes. Major ephemeral creeks in the region support River Red Gum (*Eucalyptus camaldulensis*) woodlands with a rush and sedge dominated understorey. In drier areas, small tributaries and creeks are lined with mallee associations (eg. *Eucalyptus porosa*, *E. odorata*), Native Pine (*Callitris glaucophylla*) or Gum Barked Coolibah (*E. intertexta*).

Temperate woodlands are restricted to the peaks and slopes of the main southern ranges and occur with either a densely shrubby understorey or a more open grass / sedge understorey. Eucalypt woodlands include the tall Sugar Gum (*Eucalyptus cladocalyx*) woodlands of Mount Remarkable and other high elevations, and South Australian Blue Gum (*Eucalyptus leucoxylon* spp. *pruinosa*) and the nationally endangered Grey Box (*Eucalyptus microcarpa*) woodlands on the eastern slopes of moderate rainfall. Mallee Box (*Eucalyptus porosa*) and Peppermint Box (*Eucalyptus odorata*) woodlands occur on drier slopes and plains. Non-eucalypt woodlands in the region are dominated by Drooping Sheoak (*Allocasuarina verticillata*), Southern Cypress-pine (*Callitris gracilis*) and Northern Cypress-pine (*Callitris glaucophylla*).

Mallee vegetation occurs throughout the region but particularly in northern areas around Quorn through to Hawker and east around Orroroo and Peterborough. The project area also includes the northern extent of temperate grasslands in South Australia including the nationally endangered Iron Grass (*Lomandra* spp.) grasslands. The remainder of the region contains semi-arid shrublands and open woodlands dominated by Bluebush (*Maireana* spp.), Black Oak (*Casuarina pauper*), Sugarwood (*Myoporum platycarpum*) and Northern Cypress-pine (*Callitris glaucophylla*) with Western Myall (*Acacia papyrocarpa*) common in the west.

Threatened Plant Species

A high diversity of plant species is found in the project area including at least 118 species which are Endangered, Vulnerable or Rare at the state level under National Parks and Wildlife Act 1974, and at least 16 which are rated nationally threatened under the Environment Protection and Biodiversity Conservation Act 1996. Selected threatened flora records are displayed in Map 3 and Appendix 1 contains a complete list of state and nationally rated vascular plant species.

1.3.6 Fauna

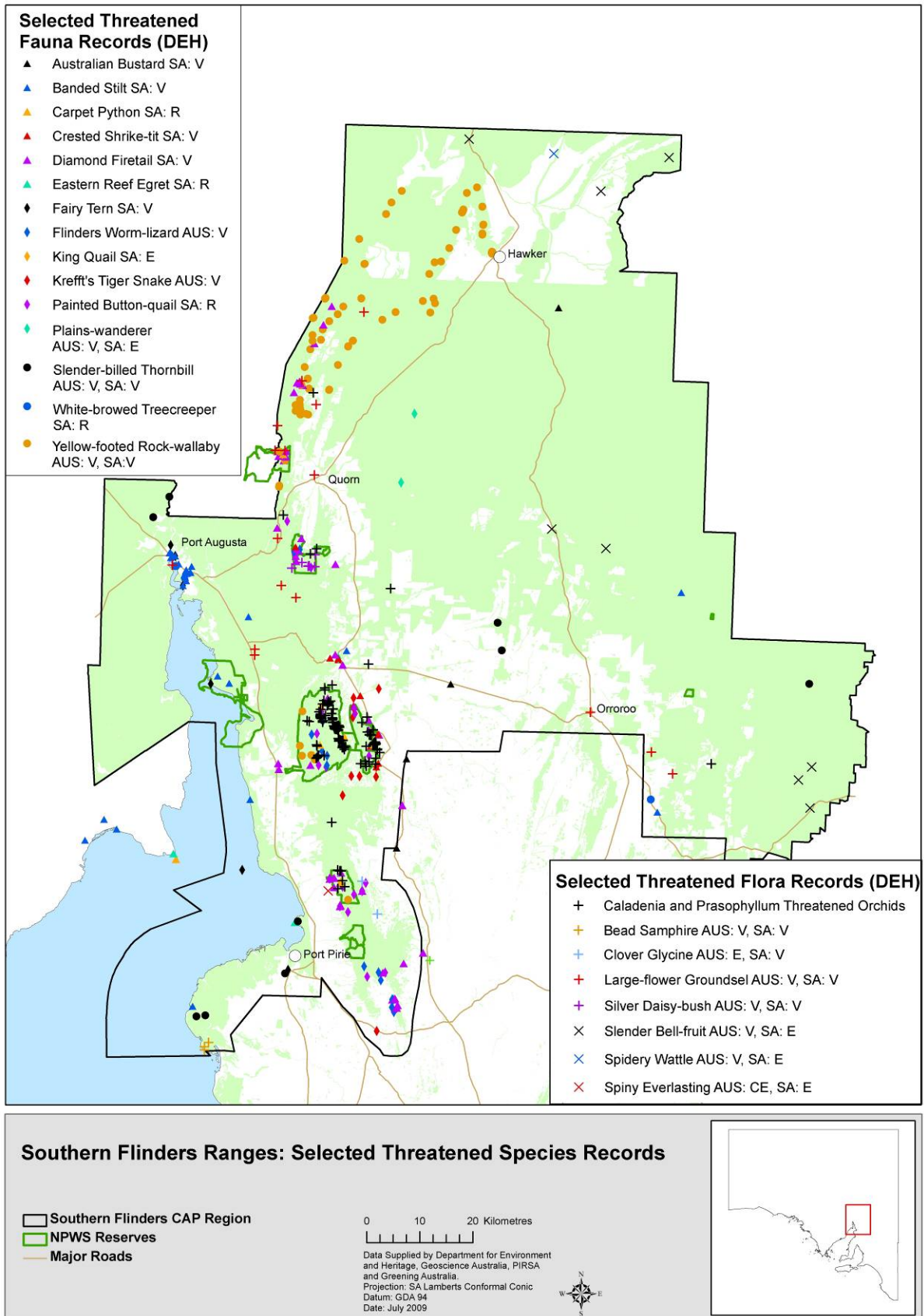
Smith (in Davies et al 1996) recount that the early explorers to the Flinders Ranges encountered a diverse mammal fauna with as many as 50 species occurring in the greater Flinders Ranges area. Unfortunately approximately half of these species have become extinct and many are still declining. The Southern Flinders Ranges however still supports a diverse range of bird species owing to the topographic and climate variation between coastal, temperate and arid zones. The reptile fauna is similarly diverse.

Threatened Fauna Species

Approximately 74 mammal, bird and reptile species of conservation significance at the state level occur within the project area. At least 4 species of national significance also occur including the vulnerable Yellow-footed Rock-wallaby (*Petrogale xanthopus*). A further 17 species were assessed as regionally Endangered or Vulnerable by Gilliam & Urban (2008). Selected threatened flora records are displayed in Map 3 and Appendix 2 contains a complete list of state and nationally rated fauna.

1. Planning Context and Regional Description

Map 3: Selected Threatened Species Records (DENR 2007)



1. Planning Context and Regional Description

1.4 Social Context

1.4.1 Population

The main population centres are Port Augusta and Port Pirie with a little over 13,000 people in each urban locality. Most other towns in the region are much smaller with 1,068 people at Quorn, 543 at Orroroo, 431 at Melrose, 229 at Hawker and 251 at Wirrabara. Total population is difficult to assess as the CAP boundary does not correspond to statistical boundaries, however an approximation using Local Government Areas gives a figure of 34,500 people (refer to Table 2 below).

Table 2: Selected Demographic Statistics from the 2006 Census

Location	Population	Labour Force	Labour Force involved in Farming Activities	% Involved in Farming Activities
Flinders Ranges LGA	1,730	695	72	11%
Orroroo Carrieton LGA	935	457	163	37.5%
Mount Remarkable LGA	2,842	1,302	329	26.2%
Port Augusta LGA	13,874	6,062	0	0%
Port Pirie Urban Locality	13,206	5,088	0	0%
Peterborough LGA	1,904	601	73	14.1%
Totals	34,491	14,205	637	~

1.4.2 Current Land Management and Ownership

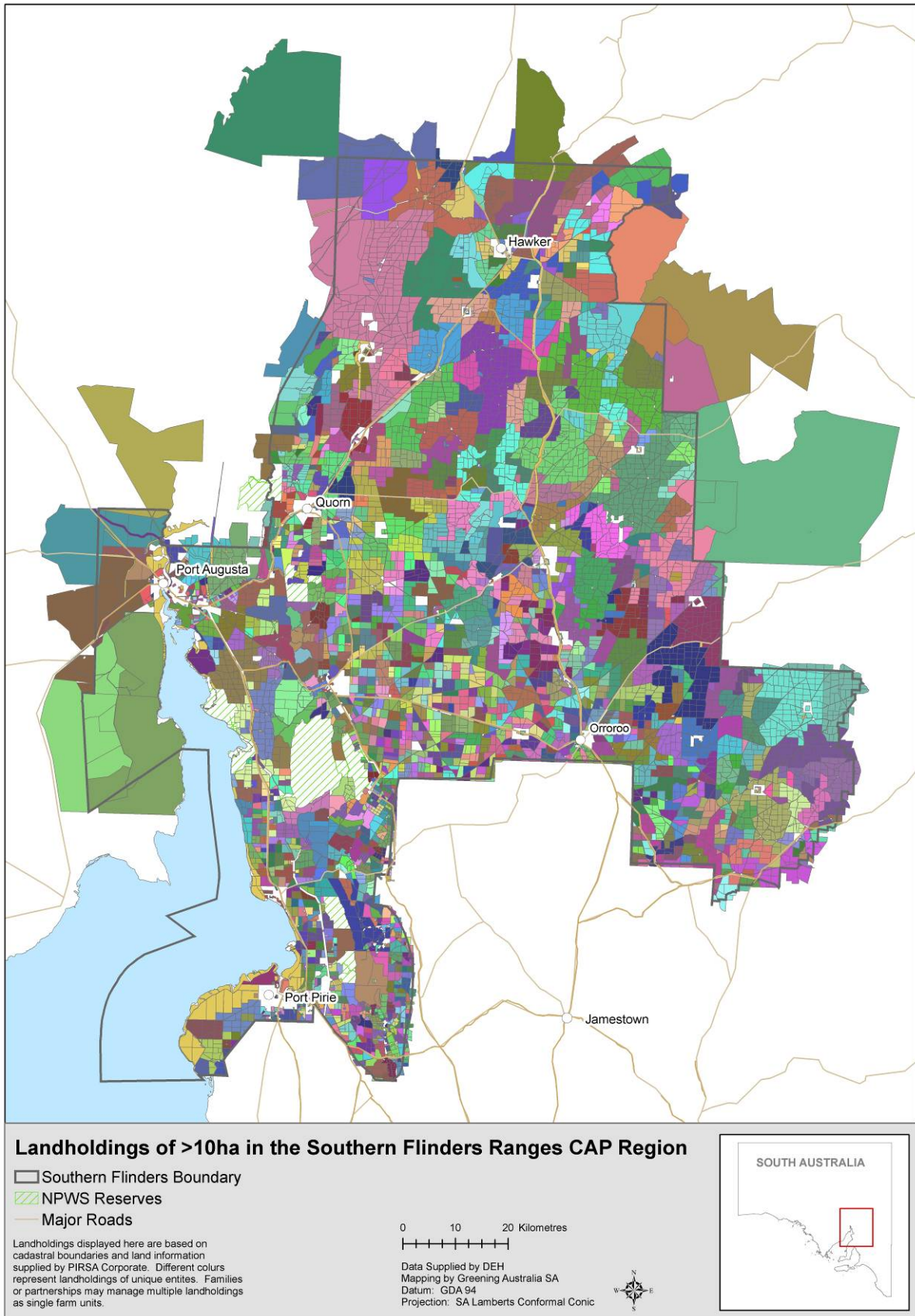
The following analysis is based on Stokes (2008) which adhered to the former NRM boundary and therefore did not include the Peterborough area. According to Stokes (2008) there are approximately 1,700 landholders in the region with potentially suitable land for conservation (refer to Table 3). The largest single landholder in terms of land area is the Minister for Environment with over 54,000 hectares of parks, reserves and other lands. It is also worth noting that only 3% (46 landholders) of the total number of landholders manage in excess of 40% of the land area. For additional information on land management and ownership in the Southern Flinders Ranges refer to **CAP Scoping Report # 1 - Land Holder Mapping**.

Table 3: Landholdings by Size Class

Size Class (ha)	No. of Landholders*	% of Total No. of Landholders*	% of Land Area (hectares)
<10	526	31%	<1%
10-100	351	21%	1%
101-500	392	23%	8%
501-1000	165	10%	10%
1001-5000	220	13%	40%
5000-10,000	31	2%	18%
>10,000	15	1%	23%
Total	1,700	100%	100%

1. Planning Context and Regional Description

Map 4: Landholdings in the Living Flinders Project Area



Biodiversity Conservation Assets

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2. Biodiversity Conservation Assets

2.1. Biodiversity Conservation Assets of the Southern Flinders Ranges

Conservation assets were reviewed by the Living Flinders planning team in June 2016 and some significant changes were agreed upon, including the redefinition and merging of a number of the original assets (eg. Semi-arid Ranges includes parts of Arid Ecosystems, Mallee Communities and Rocky Escarpments, and Coastal Ecosystems includes Sandy Coasts and Dunes merged with Mangroves and Samphire). The review also included the addition of a new asset relating to future changes expected as a result of climatic changes.

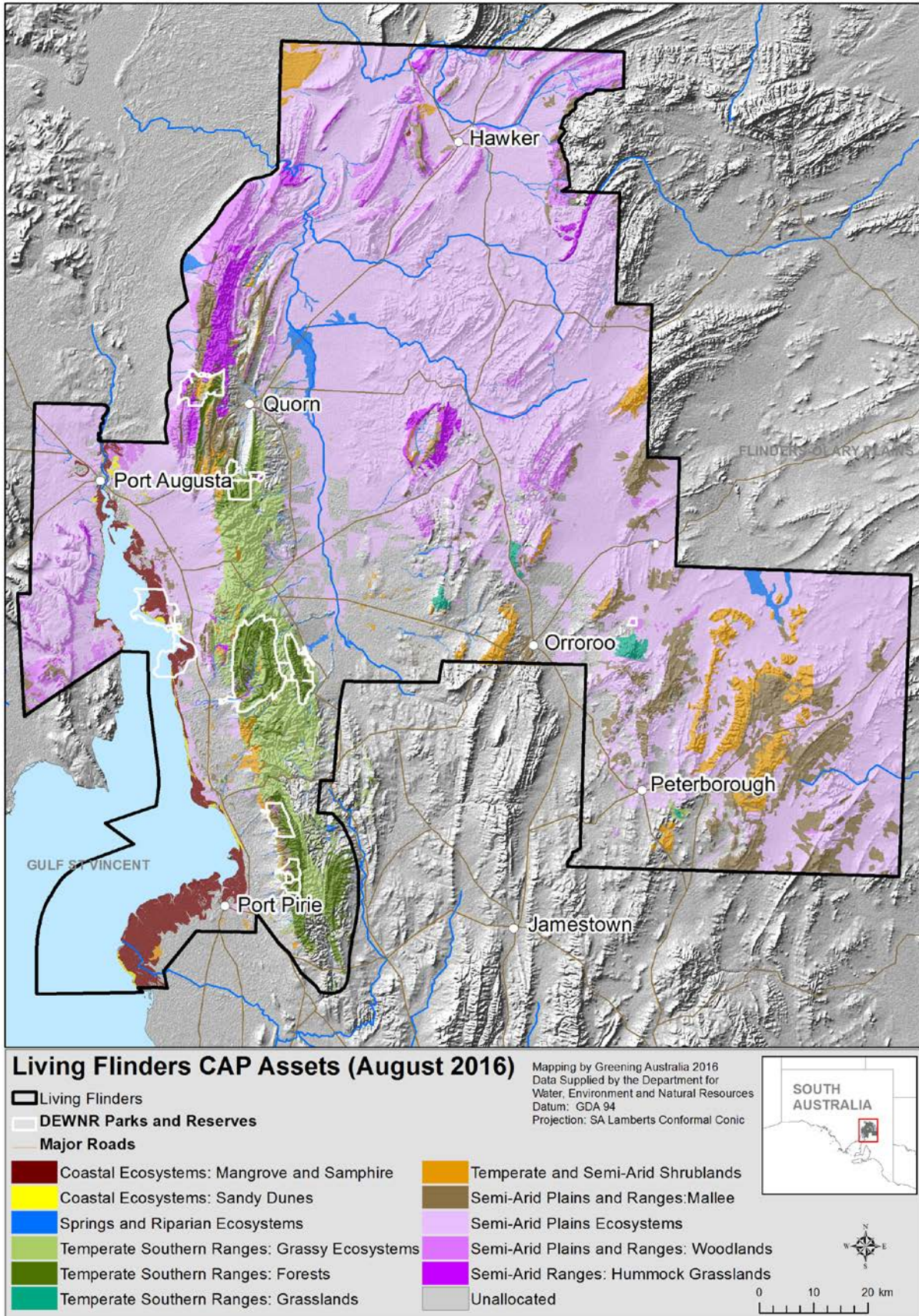
The renewal of the CAP Assets represents a shift in the general approach to conservation in the region toward a more wholistic, integrated and ecosystem function-based approach. The group agreed that planning for biodiversity in this way improved the alignment with the Soil CAP Assets and allows better incorporation of climate change impacts and implications.

The 6 Assets identified are:

- 1. Coastal Ecosystems**
- 2. Springs and Riparian Ecosystems**
- 3. Semi-arid Plains Ecosystems**
- 4. Temperate Southern Ranges**
- 5. Semi-Arid Ranges**
- 6. Novel Arid Ecosystems (eg. Mulga Woodlands)**

2. Biodiversity Conservation Assets

Map 5: Conservation Assets of the Living Flinders Project Area



2. Biodiversity Conservation Assets

2.1.1. Coastal Ecosystems

This asset includes the previously defined assets of **Mangrove and Samphire Communities** and **Sandy Coasts and Dunes**.

Coastal mangroves (*Avicennia marina ssp. marina*) and samphire communities occur within inter-tidal areas of sheltered coastlines between Port Pirie and Port Augusta. Mangrove communities are exceptionally rich and productive environments and provide important marine habitat for commercial fish species. Samphire low shrublands occur on tidal flats and provide habitat for the nationally vulnerable Bead Samphire (*Tecticornia flabelliformis*) and a number of threatened bird species. The zone around Port Pirie is designated an Important Bird Area (IBA) by Bird Life Australia due to its importance for shore birds. This nested asset is formally protected with Winninowie Conservation Park.

Sandy coasts and dunes occur in narrow, linear strips intermittently along the coast from north of Port Pirie to Port Augusta. This is a low energy coastline so the dunes tend to be low and stable and support tall shrublands dominated by Coastal Daisy-bush (*Olearia axillaris*), Coastal Beard-heath (*Leucopogon parviflorus*), Sea-berry Saltbush (*Rhagodia candolleana ssp. candolleana*) and Boobialla (*Myoporum insulare*). Rear dunes support stands of Dryland Tea-tree (*Melaleuca lanceolata*), Leafless Cherry (*Exocarpus aphyllus*), Quandong (*Santalum acuminatum*), Native Apricot (*Pittosporum angustifolium*) and Hop-bush (*Dodonaea viscosa ssp. spathulata*). Important nested fauna species include the State vulnerable Fairy Tern (*Sterna nereis*).



Nested Assets: Coastal Ecosystems		AUS	SA
SUB-ASSET	Coastal Mangroves and Samphire		
SUB-ASSET	Sandy Coasts and Dunes		
PLANT COMMUNITIES	Temperate Coastal Saltmarsh Communities	V	
PLANT COMMUNITIES	Mangrove (<i>Avicennia marina ssp. marina</i>) Forests and Samphire (<i>Tecticornia spp.</i>) Shrublands		
PLANT COMMUNITIES	Coastal Dune Shrublands (<i>Olearia axillaris</i> , <i>Leucopogon parviflorus</i>)		
FISH ASSEMBLAGES	Marine fish species		
BIRD ASSEMBLAGES	Shorebirds, seabirds and waders		
THREATENED BIRDS	Eastern Reef Egret (<i>Egretta sacra</i>)		R
THREATENED BIRDS	Fairy Tern (<i>Sterna nereis</i>)		V
THREATENED PLANTS	Bead Samphire (<i>Tecticornia flabelliformis</i>)	VU	V
KEY LOCATIONS	Winninowie Conservation Park, Port Germein, Port Pirie mangroves – Nationally Important Bird Area,		

2. Biodiversity Conservation Assets

2.1.2. Springs and Riparian Ecosystems

Two major river catchments occur in the project area: the Willochra catchment which drains from the eastern side of the main ranges through the plains north and west to Lake Torrens; and the Mambray Coast which drains the western side of the main ranges across the coastal plain to the sea. The region also includes parts of the Broughton catchment in the south west (Rocky River), Lake Torrens catchment in the north-west, Lake Frome catchment in the east and the Murray-Darling Basin catchment in the south-east corner. Major creek systems in the region are dominated by River Red Gum (*Eucalypt camaldulensis*) woodlands which provide important habitat for species such as the Brush-tail Possum (*Trichosaurus vulpecula*) and State vulnerable Carpet Python (*Morelia spilota*).

Permanent waterholes and seeps occur along many of the ephemeral creek lines, particularly in the Willochra Catchment, and fractured rock-springs occur in the ranges and rocky gorges. Permanent waterholes provide critical water for water-dependant species such as native fish, amphibians and aquatic plants.



Nested Assets: Springs and Riparian Ecosystems		AUS	SA
PLANT COMMUNITIES	River Red Gum (<i>Eucalyptus camaldulensis</i>) Woodlands		
PLANT COMMUNITIES	Aquatic Vegetation (<i>Phragmites sp.</i> , <i>Typha sp.</i> , <i>Juncus sp.</i> , <i>Cyperus spp.</i>)		
THREATENED MAMMALS	Common Brush-tail Possum (<i>Trichosaurus vulpecula</i>)		R
THREATENED REPTILES	Krefts Tiger Snake (<i>Notechis scutatus ater</i>)	VU	
THREATENED REPTILES	Carpet Python (<i>Morelia spilota</i>)		R
KEY LOCATIONS	Mambray Creek, Willochra River, Rocky River, Springs on private lands		

2. Biodiversity Conservation Assets

2.1.3. Semi-arid Plains Ecosystems

The semi-arid plains occur are widespread in the region, including the central, northern, eastern and far west. The plains correspond closely with pastoral land uses and grazing on native vegetation in lower rainfall zones on flat or undulating country. There is also some alignment with the major catchments of region, including the Willochra and the sub-catchments of the Wirreanda and Boolcunda creeks.

Semi-arid woodlands occur with overstorey species including *Myoporum platycarpum*, *Casuarina pauper*, *Acacia papyrocarpa*, *Callitris glaucophylla*, *Alectryon oleifolius*, and pockets of chenopod mallee are dominated by *Eucalyptus socialis*, *Eucalyptus oleosa*, *E. gracilis*, *E. porosa* and *E. dumosa*).

Extensive shrublands of Bluebush (*Maireana sedifolia*) and open derived grasslands of *Austrostipa* spp., *Aristida* spp. and *Enneapogon* spp. are an important resource base for grazing in this asset. Mallee and woodland associations are critical to a range of declining bird species and support nationally vulnerable plants such Sandalwood (*Santalum spicatum*).



Nested Assets: Semi-Arid Plains		AUS	SA
SUB-ASSET	Mallee Communities		
SUB-ASSET	Arid Woodlands and Shrublands		
PLANT COMMUNITIES	Yorrell (<i>Eucalyptus gracilis</i>) &/or Red Mallee (<i>E. oleosa</i>)		
PLANT COMMUNITIES	Beaked Red Mallee (<i>E. socialis</i>) +/- White Mallee (<i>E. dumosa</i>) +/- Mallee Box (<i>E. porosa</i>)		
PLANT COMMUNITIES	Sugarwood (<i>Myoporum platycarpum</i>) , Black Oak (<i>Casuarina pauper</i>), Western Myall (<i>Acacia papyrocarpa</i>), Native Pine (<i>Callitris glaucophylla</i>), Bullock Bush (<i>Alectryon oleifolius</i>) Woodlands		
PLANT COMMUNITIES	Bluebush (<i>Maireana sedifolia</i>), Blackbush (<i>M. pyramidata</i>), Bladder Saltbush (<i>Atriplex vesicaria</i>) shrublands		
PLANT COMMUNITIES	Derived grasslands of <i>Austrostipa</i> spp., <i>Aristida</i> spp., <i>Enneapogon</i> spp.		
BIRD ASSEMBLAGES	Declining mallee birds		
THREATENED PLANTS	Slender Bell fruit (<i>Codonocarpus pyramidalis</i>)	VU	E
THREATENED BIRDS	White browed Treecreeper (<i>Climacteris affinis</i>), Redthroat (<i>Pyrrholaemus brunneus</i>), Slender-billed Thornbill (<i>Acanthixia iredalei</i>)		R
KEY LOCATIONS	Mallee: Orroroo to Peterborough, Booleroo / Willowie. Semi-arid Woodlands and Shrublands: Craddock to Carrieton, Willochra Plain, Cultana Defence lands		V

2. Biodiversity Conservation Assets

2.1.4. Temperate Southern Ranges

The Temperate Southern Ranges Asset refers to the main spine of ranges from Crystal Brook/Betaloo Valley in the south to around Mt Brown in the north and also includes some temperate ranges and hills in the south-east of the region. Some components of this asset can also be found as far north as Dutchman's Stern CP. Conservation is a major land-use along with grazing on grassy vegetation types.

Grassy ecosystems are generally privately owned, grazed by livestock and dominated by annual weeds. Nationally threatened grassy ecosystems include Peppermint Box and Grey Box grassy woodlands, and Iron Grass grasslands. Threatened fauna and flora species include the Plains Wanderer, Flinders Worm Lizard, Small Scurf-Pea, Clover Glycine and Bayonet Spider-orchid.

Temperate forests and woodlands with a shrub dominated understorey are a major component of this asset and are restricted to the main range. Common overstorey tree species include Sugar Gum and Long-leaf Box at high elevations, and Blue Gum, Mallee Box and Peppermint Box on the lower slopes. Non-eucalypt tree species include Drooping Sheoak and Southern Cypress-pine. These areas support important habitat for declining woodland birds, important Yellow-footed Rock Wallaby populations and a number of nationally threatened orchids.

Temperate shrublands can be botanically diverse and provide important habitat for a range of bird species. Dominant shrub species include Yacca (*Xanthorrhoea quadrangulata*) and Sweet Bursaria (*Bursaria spinosa*) which occur on rocky ranges and low hills.



2. Biodiversity Conservation Assets

Nested Assets: Temperate Southern Ranges		AUS	SA
SUB-ASSET	Grassy Ecosystems		
PLANT COMMUNITIES	Peppermint Box (<i>Eucalyptus odorata</i>) Grassy Woodlands	CE	E
PLANT COMMUNITIES	Grey Box (<i>Eucalyptus microcarpa</i>) / White Box (<i>Eucalyptus albens</i>)Grassy Woodland	EN	E
PLANT COMMUNITIES	Blue Gum (<i>Eucalyptus leucoxylo</i> n) Grassy Woodland		V
PLANT COMMUNITIES	Iron Grass (<i>Lomandra spp</i>) Grasslands	CE	E
PLANT COMMUNITIES	Spear Grass (<i>Stipa spp.</i>), Wallaby Grass (<i>Danthonia spp.</i>) Grassland		
PLANT COMMUNITIES	Spinifex (<i>Triodia spp</i>) Temperate Grasslands		
THREATENED BIRDS	Crested Shrike-tit (<i>Falcunculus frontatus</i>)		V
THREATENED BIRDS	Diamond Firetail (<i>Stagonopleura guttata</i>)		V
THREATENED BIRDS	Painted Button-quail (<i>Turnix varia</i>)		R
THREATENED BIRDS	Plains-wanderer (<i>Pedionomus torquatus</i>)	VU	E
THREATENED BIRDS	King Quail (<i>Coturnix chinensis</i>)		E
THREATENED REPTILES	Flinders Worm Lizard (<i>Aprasia pseudopulchella</i>)	VU	
THREATENED PLANTS	Bayonet Spider-orchid (<i>Caladenia gladiolata</i>)	EN	E
THREATENED PLANTS	Small Scurf-Pea (<i>Cullen parvum</i>)	EN	V
THREATENED PLANTS	Clover Glycine (<i>Glycine latrobeana</i>)	VU	V
KEY LOCATIONS	Grasslands - Narien Range, Oladdie Range, Bellalie Range. Grassy woodlands - Peekina to Tarcowie, Beetaloo Reservoir to Mt Brown.		
SUB-ASSET	Temperate Forests and Woodlands		
PLANT COMMUNITIES	Shrubby or Spinifex Understorey Woodlands: Sugar Gum (<i>Eucalyptus cladocalyx</i>) Forest, Long-leaf Box (<i>Eucalyptus gonicalyx</i>) Woodland, Blue Gum (<i>Eucalyptus leucoxylo</i> n), Woodland Grey Box (<i>Eucalyptus microcarpa</i>) / Woodlands		
THREATENED REPTILES	Tree Goanna (<i>Varanus varius</i>)		R
THREATENED PLANTS	Flinders Ranges White Caladenia (<i>Caladenia xantholeuca</i>)	EN	E
THREATENED PLANTS	Woolcock's Spider-orchid (<i>Caladenia woolcockiorum</i>), Pale Leek Orchid (<i>Prasopphyllum pallidum</i>), Mt Remarkable Leek-orchid (<i>P. validum</i>)	VU	V
KEY LOCATIONS	Mount Remarkable NP, Telowie Gorge CP, ForestrySA		
SUB-ASSET	Temperate Shrublands		
PLANT COMMUNITIES	Grass-tree (<i>Xanthorrhoea quadrangulata</i>) Shrublands, Sweet Bursaria (<i>Bursaria spinosa</i>) Shrublands, Velvet-bush (<i>Lasiopetalum sp.</i>) Shrublands, Cryptandra (<i>Cryptandra sp.</i>) Shrublands		
PLANT COMMUNITIES	Wattle (<i>Acacia sp</i>) Hop-bush (<i>Dodonaea sp</i>), Senna (<i>Senna sp</i>) Mallee Shrubland		
THREATENED PLANTS	Spiny Daisy (<i>Acanthocladium dockeri</i>)	CR	E
KEY LOCATIONS	Western side of the main southern ranges, Peterborough to Dawson		

2. Biodiversity Conservation Assets

2.1.5. Semi-arid Ranges

The semi-arid ranges of the region are a complex of many landscape elements including rocky peaks and outcrops, deep valleys and gorges, low hills and extensive creek networks. They generally occur in perpetual lease or pastoral country receiving less than 250 mm annual rainfall.

The vegetation in these ranges is a diverse mosaic of shrublands, woodlands, mallee and spinifex (*Triodia* spp.). Dominant woodland overstorey species include Black Oak (*Casuarina pauper*), Bullock Bush (*Alectryon oleifolius*), Northern Cypress Pine (*Callitris glaucopyhlla*), Gum-barked Coolibah (*Eucalyptus intertexta*) and mallee species such as Beaked Red Mallee (*Eucalyptus socialis*), White Mallee (*Eucalyptus dumosa*), Flinders Ranges Mallee (*Eucalyptus flindersii*). Two mallee species are endemic to the region: *Eucalyptus percostata* and *Eucalyptus flindersii* and a number of plant species occur on rocky outcrops and hill-slopes where they are vulnerable to goat browsing, including the SA-Vulnerable Wild Lime (*Citrus glauca*) and Sandalwood (*Santalum spicatum*).

A key fauna species is the nationally vulnerable Yellow-footed Rock-wallaby (*Petrogale xanthopus* ssp. *xanthopus*) with a significant population between Dutchmans Stern Conservation Park, through the Arden Vale Ranges to Hawker. A number of raptor species also use these areas for hunting and nesting. Rocky outcrops are also thought to be important for a range of reptile species. Short-tailed Grasswren is a rare species with specific habitat affiliations to the *Triodia* hummock grasslands.

The semi-arid ranges are integral to local Aboriginal culture and there are many significant sites.



2. Biodiversity Conservation Assets

Nested Assets: Semi-Arid Ranges		AUS	SA
SUB-ASSET	Mallee Communities		
SUB-ASSET	Arid Woodland Shrublands		
SUB-ASSET	Springs and Riparian Ecosystems		
PLANT COMMUNITIES	Black Oak (<i>Casuarina pauper</i>) Woodlands		
PLANT COMMUNITIES	Mulga (<i>Acacia aneura</i>) Low Woodland		V
PLANT COMMUNITIES	Northern Native Pine (<i>Callitris glaucophylla</i>) Woodlands		
PLANT COMMUNITIES	Bullock Bush (<i>Alectryon oleifolius</i>) Woodlands		V
PLANT COMMUNITIES	Bluebush (<i>Maireana sedifolia</i>), Blackbush (<i>M. pyramidata</i>) shrublands		
PLANT COMMUNITIES	Spinifex (<i>Triodia irritans</i>) Hummock Grassland		
BIRD ASSEMBLAGES	Raptor species (e.g. Peregrine Falcon)		
REPTILE ASSEMBLAGES	Rock habitat specialists (eg. Gidgee Skink, Tawny Dragon)		
THREATENED MAMMALS	Yellow-footed Rock-wallaby (<i>Petrogale xanthopus</i>)	VU	V
OTHER BIRDS	Short-tailed Grasswren (<i>Amytornis merrotsyi</i>)		
THREATENED PLANTS	Slender Bell fruit (<i>Codonocarpus pyramidalis</i>)	VU	E
THREATENED PLANTS	Superb Groundsel (<i>Senecio megaglossus</i>)	VU	V
THREATENED PLANTS	Spidery Wattle (<i>Acacia araneosa</i>)	VU	E
THREATENED PLANTS	Desert Lime (<i>Citrus glauca</i>)		V
THREATENED PLANTS	Sandalwood (<i>Santalum spicatum</i>)		V
PALATABLE PLANTS	Eg. Inland Spyridium (<i>Spyridium phlebophyllum</i>), Jockey's Cap (<i>Prostanthera striatiflora</i>), Narrow-leaf Emubush (<i>Eremophila alternifolia</i>), Flinders Ranges Corkwood (<i>Hakea edniiana</i>), Sandalwood (<i>Santalum spicatum</i>) and Wild Lime (<i>Citrus glauca</i> – SA:V, FR:V)		
KEY LOCATIONS	Arden Vale Ranges, Ranges west of Hawker (Yappala / Yourambulla Range, Wild Dog Range), Horseshoe Range, Ranges of the eastern Plain (Olladie Hills, Hungry Range)		

2. Biodiversity Conservation Assets

2.1.6. Novel Arid Ecosystems

Based on recent Climate Change impact assessment work (P. Koch 2016), an asset has been included which covers a predicted expansion of arid-affiliated ecosystems into the north of the region.

One of the main arid vegetation types that may move southward into the region is a low open woodland of Mulga (*Acacia aneura*) over chenopod shrubs. This vegetation already occurs in small pockets around Hawker and west on low hills, but is much more common to the north at present. Other possibilities include the Flinders Ranges Mallee (*Eucalyptus flindersii*) mallee woodland which currently occurs on the ranges near Hawker, and a range of arid shrubs which generally occur to the north of the region at present (eg. *Hakea edniana*, *Acacia havilandiorum*, *Acacia burkitii*).

It may be that conservation strategies will be developed in the future to facilitate the movement of arid ecosystems.



Photo: Mulga (*Acacia aneura*) low open woodland at Kanyaka.

Nested Assets: Novel Arid Ecosystems		AUS	SA
PLANT COMMUNITIES	Mulga (<i>Acacia aneura</i>) Low Woodland		V
PLANT COMMUNITIES	Flinders Ranges Mallee (<i>Eucalyptus flindersica</i>)		
PLANT COMMUNITIES	Various Arid Shrublands		

Asset Health and Viability Assessment

DRAFT

3. Asset Health and Viability

3.1. Asset Health and Viability

The overall viability of the conservation assets, as assessed by the planning team, is displayed in Table 5. Viability was determined by identifying and rating the current status of the key ecological attributes of each conservation asset based on considerations of size, condition and landscape context (refer Table 4). These assessments were supported by existing monitoring data for some key ecological attributes and in other cases were based on local expert opinion. The absence of quantitative data for assessing the viability of many key ecological attributes highlights a gap in the existing biodiversity monitoring program and an area for future development (refer section 7).

***NOTE:** Table 5 is a draft assessment of viability based on the older asset definitions. The viability assessment will need to be updated in a technical CAP workshop setting to reflect the new assets.

Table 4: Key Ecological Attributes of Conservation Assets

Conservation Asset	Landscape Context	Condition	Size
Coastal Ecosystems	<ul style="list-style-type: none"> natural tidal flows (mangroves) connectivity to terrestrial vegetation communities dune formation processes 	<ul style="list-style-type: none"> fauna species diversity flora species diversity water quality fauna species diversity (sandy) flora species diversity (sandy) 	<ul style="list-style-type: none"> total area remaining and patch size (mangrove) total area remaining and patch size (sandy)
Springs and Riparian Ecosystems	<ul style="list-style-type: none"> hydrological regime connectivity to adjacent vegetation communities 	<ul style="list-style-type: none"> fauna species diversity flora species diversity bank stability tree crown health 	not applicable
Semi-Arid Plains Ecosystems	<ul style="list-style-type: none"> connectivity to adjacent vegetation communities 	<ul style="list-style-type: none"> fauna species diversity flora species diversity 	<ul style="list-style-type: none"> total area remaining and patch size
Temperate Southern Ranges	<ul style="list-style-type: none"> fire regime connectivity to adjacent vegetation communities (grassy and shrublands) fire regime (forests) connectivity to adjacent vegetation communities (forests) 	<ul style="list-style-type: none"> fauna species diversity (grassy) flora species diversity (grassy) soil condition (grassy) fauna species diversity (forests and shrublands) flora species diversity (forests) flora species diversity (shrublands) 	<ul style="list-style-type: none"> total area remaining and patch size (grassy and shrublands) total area remaining and patch size (forests)
Semi-Arid Ranges	<ul style="list-style-type: none"> fire regime connectivity to adjacent vegetation communities 	<ul style="list-style-type: none"> fauna species diversity flora species diversity flora species diversity (rocky) soil condition (arid) 	<ul style="list-style-type: none"> total area remaining and patch size
Novel Arid Ecosystems	not assessed	not assessed	not assessed

Note: Status of Key Ecological Attribute - Poor, Fair, Good

3. Asset Health and Viability

Table 5: Original: Viability Ratings for the Conservation Assets

	Conservation Asset	Landscape Context	Condition	Size	Overall Viability
1	Coastal Mangrove & Samphire Communities	Fair	Good	Good	Good
2	Sandy Coasts and Dunes	Poor	Fair	Fair	Fair
3	Ephemeral Creeks and Permanent Waterholes	Poor	Poor	-	Poor
4	Temperate Shrublands	Fair	Fair	Fair	Fair
5	Mallee Communities	Good	Fair	Good	Good
6	Temperate Grassy Ecosystems	Fair	Poor	Fair	Fair
7	Temperate Forests & Woodlands	Fair	Fair	Good	Fair
8	Arid Ecosystems	Good	Fair	Good	Good
9	Escarments (Gorges, Outcrops, Scree Slopes)	Good	Fair	-	Good
Overall Landscape Viability					Fair

Table 6: Updated Draft: Viability Ratings for the Conservation Assets

	Conservation Asset	Landscape Context	Condition	Size	Overall Viability
1	Coastal Ecosystems	Poor	Fair	Good	Fair
2	Springs and Riparian Ecosystems	Poor	Poor	-	Poor
3	Semi-Arid Plains Ecosystems	Good	Poor	Fair	Poor ?
4	Temperate Southern Ranges	Fair	Fair	Fair	Fair
5	Semi-Arid Ranges	Good	Fair	Good	Good
6	Novel Arid Ecosystems	Not assessed	Not assessed	Not assessed	Not assessed
Overall Landscape Viability					Fair

Biodiversity Threats and Issues

DRAFT

4. Biodiversity Threats and Issues

4.1. Biodiversity Threat and Issue Assessment

Table 7 shows a draft threat assessment summary for the newly defined biodiversity assets. Inappropriate stock grazing and climate change / variability are shown as 2 of the major threats.

***NOTE:** Table 7 is a draft for comment - the threat assessment will need to be updated in a collaborative technical CAP workshop setting to reflect the new assets and the inclusion of climate change and other new threats.

4.1.1 New and Emerging Threats

The group participated in a brainstorming session at the June 2016 Technical CAP meeting to identify new, emerging or increasing threats in the region. A session was also run on the predicted impacts of climate change to the biodiversity assets of the region (Dr P. Koch).

Climate Change / Variability

The impacts of climate change on the biodiversity assets (original) of the region were assessed in 2016 by Dr Paul Koch and a report was produced. The assessment was also presented to the Living Flinders group at the meeting in June 2016. The draft assessment in Table 7 is adapted from the presentation and applied to the new biodiversity asset definitions.

Buffel Grass (and potentially African Lovegrass)

The current and potential threat of Buffel Grass (*Cenchrus ciliaris*) in the region was highlighted in 2016. This grass poses a high to very-high risk to the semi-arid chenopod shrublands and woodlands of the Mambray coast where it is beginning to spread outward from the main road and rail corridors. There is a real risk that Buffel Grass could 'escape' through the main range and enter the Willochra catchment

Major Infrastructure Developments

Major infrastructure developments such as solar-thermal power and wind-farms are likely to proceed in the Upper Spencer Gulf with potential impacts on Coastal Assets (incl. EPBC-listed Temperate Saltmarshes) and Semi-Arid Plains Ecosystems (eg. Western Myall and Sugarwood woodlands). Also the decommissioning of the Pt Augusta powerstation may have impacts, particularly if the man-made lake is filled in (impacts on Banded-Stilts).

The possibility of nuclear waste developments was also highlighted as having potential impacts in the region (eg. Transport corridors).

Feral Pigs

The number of feral pig sightings has been increasing in the Boolcunda and Arden Vale Ranges districts. Since the June meeting there have also been reports of livestock deaths attributed to pigs. The threat of increasing pig numbers is relevant to Springs and Riparian Ecosystems in particular but also to soil and production values. The fact that this is a newly emerging threat would suggest it should be treated as a separate threat to Feral Herbivores and Feral Carnivores.

Abundant Native Species

While this threat has been recognised from early in the process, landholders and NRM staff are reporting increases in the numbers and grazing impacts of kangaroo species and corellas. Strategies need to be developed to address this threat.

4. Biodiversity Threats and Issues

Table 7: Draft Threat Assessment

Threats Across Targets	Coastal Ecosystems	Springs and Riparian Ecosystems	Semi-Arid Plains Ecosystems	Temperate Southern Ranges	Semi-Arid Ranges	Novel Arid Ecosystems	Overall Threat Rank
Project-specific threats	1	2	3	4	5	6	
Inappropriate Livestock Grazing & Access	-	High	High?	Medium?	High	Not assessed	High
Climate Change / Variability	High?	High?	High?	Medium?	Medium?	Not assessed	High?
Encroachment of Agriculture	Medium	High	-	Medium	-	Not assessed	Medium
Environmental Weeds	Medium?	Medium?	Low	Medium	Medium?	Not assessed	Medium
Feral Herbivores (goats, deer, rabbits)	-	Medium	Medium ?	Medium	High?	Not assessed	Medium
Feral Carnivores (foxes, cats)	Medium?	Medium	Low	Medium	Medium	Not assessed	Medium
Water Extraction & Harvesting	-	High	-	-	-	Not assessed	Medium
Inappropriate Fire Regimes	-	-	Low	High?	Low?	Not assessed	Medium
Abundant Native Species (kangaroos)	-	Low	Low?	Medium?	Medium	Not assessed	Medium
Historic Land Clearance (fragmentation)	-	-	Medium	Medium?	-	Not assessed	Medium
Major Energy Infrastructure Development	Medium?	-	Medium?	Low	-	Not assessed	Medium
Feral Pigs	-	Medium ?	Low	-	Low	Not assessed	Medium?
Feral Aquatic Fauna	-	Medium	-	-	-	Not assessed	Low
Infrastructure Restricting Tidal Flows	Medium?	-	-	-	-	Not assessed	Low
Threat Status	Medium?	Very High?	High?	Medium?	High?	Medium	High

Goals, Objectives and Strategies

DRAFT

5. Goals, Objectives and Strategies

5.1. Asset Goals, Objectives and Strategies

The Objectives of the Living Flinders Program were examined and re-assessed at the June 2016 workshop. Significant changes were proposed to ensure that landscape goals are properly articulated. It was noted that many of the older Objectives for biodiversity conservation were really an amalgam of goals, objectives and strategies and that broader, more holistic goals needed to be developed.

The Goals and Objectives presented below are preliminary drafts for comment and were developed based on the group exercise at the June 2016 meeting.

FOUNDATIONS

Funding Objective: By 2020, significant traditional (eg. Aus. & State Gov.) and non-traditional (eg. NGO, corporate) funding is being used for the implementation of the Living Flinders Program.

Community Support Objective: By 2018 community support for the Living Flinders Program is measurable and the group is actively seeking to increase support through demonstrated activities.

Partnerships Objective: By 2018, organisational partnerships are demonstrated by high-level organisational support and in-kind contributions to the Living Flinders Program.

Knowledge and Research Objective: By 2018, priority ecological knowledge gaps have been identified and the group is actively seeking partnerships with Research Organisations to address them.

COASTAL ECOSYSTEMS GOAL: Ensure that coastal ecosystems can migrate landward in response to sea level change, and that they continue to function as suitable habitat for associated flora and fauna.

Objective: By 2025 secure sufficient (tbd) land to allow the landward migration of samphire and saltmarsh habitats while protecting all identified priority agricultural land.

Milestone Objective: By 2020, land areas likely to experience tidal inundation first are mapped, prioritised and at least one major site is managed for future tidal incursion.

Strategy: Secure Land to facilitate the Landward Migration of Tidal Inundation

Objective: By 2018, the Living Flinders Program is engaging with all major infrastructure developments and projects are in development to ensure biodiversity impacts are minimised.

Strategy: Corporate Engagement Program

Objective: By 2020, eradication of outlying occurrences of priority coastal weeds (e.g. African Boxthorn, Carrion Flower, Gazania, Buffel Grass).

Strategy: Coastal Weed Control Program

5. Goals, Objectives and Strategies

SPRINGS AND RIPARIAN ECOSYSTEMS GOAL: Maintain and enhance the biodiversity values of the majority of springs and permanent waterholes in the region, and improve the condition and connectivity of riparian vegetation in priority creek segments to support associated flora and fauna.

Objective: By 2020, locate, map and prioritise over 90% of the springs and permanent waterholes in the region, including on private land, and be actively undertaking actions to protect and enhance the high priority sites.

Strategy: Identification and Mapping Program

Objective: By 2020, 1,000 hectares of high priority river reaches are assessed as in 'good' condition based on agreed measures of vegetation condition, hydrology, ecological function and connectivity.

Strategy: Enhance Priority Riparian Vegetation

SEMI-ARID PLAINS ECOSYSTEMS: Manage vegetation, soil and water to: 1) facilitate transition/change, maintain structural and functional traits and protect climate refugia; and 2) improve the condition, diversity and ecosystem function within the grazing resource base (eg. *Maireana sedifolia* shrublands, derived semi-arid grasslands) to maximise biodiversity, production and tourism values.

Objective: By 2020 identify and secure appropriate conservation management (to be identified) of key potential climate refugia and transition zones (to be identified).

Strategy: Protect Climate Refugia

Objective: By 2025, implemented livestock grazing regimes (including exclusion) result in regeneration of tall shrub and tree species (eg. *Myoporum platycarpum*, *Callitris glaucophylla*, *Eremophila* spp., *Acacia* spp.) over at least 5,000 hectares with a trajectory toward an open woodland and tall shrubland structure.

Strategy: Improve Low-rainfall Livestock Grazing Regimes to Encourage Regeneration

TEMPERATE SOUTHERN RANGES GOAL: Protect climate refugia for threatened flora and fauna, improve the diversity and abundance of declining woodland birds, maintain appropriate mix of vegetation structure (forests, grassy woodlands and shrublands) and improve biodiversity value in the agriculturally productive areas of the Southern Ranges landscape.

Objective: By 2025, active manipulation of fire regimes (spatial, temporal and intensity) in temperate forests and woodlands is resulting in demonstrated improvements in the vegetation structural mosaic, heterogeneity in age-since-fire, and protection of threatened species and significant habitat values (eg. tree hollows).

Strategy: Actively Manipulate Fire Regimes

Objective: By 2025 the combined grazing pressure impacts from feral herbivores (goats, deers), abundant native species and livestock are measurably reduced in grassy ecosystems (measured at the landscape scale), resulting in measurable improvements in vegetation condition across 10,000 hectares.

Strategy: Total Grazing Pressure in Grassy Ecosystems

5. Goals, Objectives and Strategies

Objective: By 2025, eradication of prioritised outlying occurrences of Bridal Creeper and Blackberry infestations, and on-going 10 % annual reduction of core infestations to protect high value habitat.

Strategy 3: Priority Environmental Weed Program

SEMI-ARID RANGES: Maintain and enhance ecosystem structure, condition and key ecological functions to maximise biodiversity, tourism and agricultural production values and to maintain and improve associated native fauna (eg. Yellow-footed Rock-Wallaby populations, reptile assemblage).

Objective: By 2020, a measurable increase in the recruitment of palatable shrub species (eg. *Eremophila alternifolia*, *Bursaria spinosa*, *Spyridium phlebophyllum*) can be detected at a landscape/district scale in the Arden Vale and Eastern Ranges.

Strategy: Coordinated Landholder Pest Management Program in the Arden Vale Ranges

Objective: By 2026 impacts of feral carnivores (foxes, cats, pigs) on key native animal spp. (eg. Yellow-footed Rock-Wallaby, rock-specialist reptiles) are able to be detected and are measurably reduced over more than 1 year.

Strategy: Coordinated landholder pest management program in the Arden Vale Ranges

Strategy: Native Fauna Monitoring Program

Objective: By 2021, landholders and NRM professionals are implementing an ecological burning program at the district scale (tbd) within Spinifex (*Triodia*) hummock grasslands of the Arden Vale Ranges, to maintain habitat values for key fauna species such as the Short-tailed Grasswren.

Strategy: Ecological Burning Program in Triodia

Objective: By 2020 measurably reduce the density, distribution and abundance of opuntiod cacti (particularly *Opuntia engelmannii*, *O. stricta*, *O. robusta* *Austrocyllindrica* spp.) in the Arden Vale Ranges and Dawson / Peterborough districts.

Strategy: Opuntiod Cactus Control Program, Arden Vale and Dawson Wheel Cactus

Objective: By 2021 vegetation cover is increasing and water infiltration is measurably improved at 5 identified soil erosion hotspots within the Semi-Arid Plains Asset.

Strategy: Soil Erosion Technical Advice and Earth-works Program.

NOVEL ARID ECOSYSTEMS (EG. MULGA WOODLANDS)

To be developed.

6 Monitoring, Evaluation and Adaptive Management

6.1 Monitoring Indicators for the Southern Flinders Ranges

An effective monitoring program for the Living Flinders Program at least 3 streams of data:

1) RESOURCE CONDITION MONITORING

- provide quantitative data to confirm or revise the **current status** of the key ecological attributes and overall viability of the conservation assets & / or the current status of the key threats;
- establish baseline data to monitor **future changes** in the status of the key ecological attributes and overall viability of the conservation assets &/ or status of the key threats;
- Develop robust indicators which are easy to measure and which target the required information.

2) STRATEGY EFFECTIVENESS MONITORING

- provide quantitative data to assess the effectiveness of the conservation strategies and action steps and identify areas for refinement (adaptive management).
- ensure the Program is flexible enough to incorporate learnings from the data.

3) TRACKING PROGRESS

- Develop a report card type reporting system to track accumulated project outcomes toward the stated objectives (eg. Multiple revegetation projects all achieving the same stated objective).

Monitoring indicators should be closely associated to the status of the key ecological attributes and address landscape context, condition and size attributes of the conservation assets (refer Table 8). A monitoring program should also make use of any existing monitoring data to ensure resources are used efficiently. This may involve creating links with other organisations that have complimentary aims or legislative requirements to undertake environmental monitoring. For additional detail regarding historical monitoring programs in the region refer to ***Overview of Biodiversity Monitoring in the Northern & Yorke NRM Region (Milne & McGregor 2011)***.

The Living Flinders Program recognises that considerably more work is required with regards to monitoring in the region.

6 Monitoring, Evaluation and Adaptive Management

Table 8: Recommended Monitoring Indicators for Key Ecological Attributes (KEA) of Conservation Assets

Conservation Asset	LANDSCAPE CONTEXT KEA				CONDITION KEA				SIZE KEA
	Fire Regime	Connectivity to adjacent communities	Dune formation processes	Hydrological Regime	Water Quality	Flora Species Diversity	Fauna Species Diversity	Soil Condition	Total area and patch size
Coastal Ecosystems	-	Percentage of coastal zone buffered by terrestrial vegetation communities	Presence of primary and secondary dunes, Presence of barriers to natural processes	Extent of tidal inundation, Number of barriers to tidal flows	Level of turbidity, pollutants and water temperature in mangrove estuaries	Flora Species composition (BCM sites), Presence of weeds	Habitat-sensitive fauna species numbers (shorebirds)	-	Percentage of pre-European cover and total size & number of separate patches
Springs and Riparian Ecosystems	-	Percentage of riparian zone and waterholes buffered by terrestrial vegetation communities	-	Timing, frequency, duration and extent of river flows Groundwater depth	Level of turbidity, pollutants & quality of rivers, waterholes and groundwater	Riparian Tree crown health, Flora Species composition (BCM sites), Presence of weeds	Habitat-sensitive fauna species numbers (Tiger Snake, Carpet Python, native fish)	River bank stability and structure	-
Semi-Arid Plains Ecosystems	Timing, frequency intensity & extent of fire events (fire age mapping)	Degree of habitat fragmentation and connectivity with other large patches	-	-	-	Flora Species composition (BCM sites), Presence of weeds	Habitat-sensitive fauna species numbers, Presence of feral carnivores	-	Percentage of pre-European cover and total size & number of separate patches
Temperate Southern Ranges	Timing, frequency intensity & extent of fire events (fire age mapping)	Degree of habitat fragmentation and connectivity with other large patches	-	-	-	Flora Species composition (BCM sites), Presence of weeds and feral herbivores	Habitat-sensitive fauna species numbers (declining woodland birds)	Presence or absence of cryptogams, lichens and inter-tussock spaces	Percentage of pre-European cover and total size & number of separate patches
Semi-Arid Ranges	-	Degree of habitat fragmentation and connectivity with other large patches	-	-	-	Flora Species composition (BCM sites), Presence of weeds	Habitat-sensitive fauna species numbers, Presence of feral carnivores, population of Yellow-footed Rock-Wallaby	Presence / absence of lichens, cryptogams, leaf litter and timber	Percentage of pre-European cover and total size & number of separate patches
Novel Arid Ecosystems	tbd	tbd	tbd	tbd	tbd	tbd	tbd	tbd	tbd

7.1 Key Knowledge Gaps

Key knowledge gaps have been discussed at many of the Living Flinders planning meetings but it has been recognised that the Program needs to be more proactive in this regard.

The following is the beginning of a more formal list of research topics and questions that will need to be addressed in order to successfully implement the Strategies and Actions of the Program

List of Key Knowledge Gaps/Requirements

1. Interactions and monitoring indicators in relation to native fauna and feral carnivores at a range of scales.
2. Goat population sizes in the Southern Ranges and Arden Vale Ranges
3. Coastal elevation modelling/mapping to inform and prioritise land for retreat

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8. Appendices

Appendix 1: Plant Species of Conservation Significance in the Living Flinders Region (DENR spatial database 07)

Species Name	Common Name	Conservation Ratings*		
		AUS	SA	No. Records
<i>Acacia araneosa</i>	Spidery Wattle	VU	E	4
<i>Acacia confluens</i>	Arkaroola Wattle		V	1
<i>Acacia gracilifolia</i>	Graceful Wattle		R	77
<i>Acacia iteaphylla</i>	Flinders Ranges Wattle		R	36
<i>Acacia menzeli</i>	Menzel's Wattle	VU	V	1
<i>Acacia montana</i>	Mallee Wattle		R	7
<i>Acacia quornensis</i>	Quorn Wattle		R	30
<i>Acanthocladium dockeri</i>	Spiny Everlasting	CR	E	3
<i>Amphibromus archeri</i>	Pointed Swamp Wallaby-grass		R	1
<i>Anogramma leptophylla</i>	Annual Fern		R	10
<i>Anthocercis angustifolia</i>	Narrow-leaf Ray-flower		R	10
<i>Aristida australis</i>			R	1
<i>Asperula syrticola</i>	Southern Flinders Woodruff		R	17
<i>Atriplex eichleri</i>	Eichler's Saltbush		R	3
<i>Austrodanthonia laevis</i>	Smooth Wallaby-grass		R	3
<i>Austrodanthonia tenuior</i>	Short-awn Wallaby-grass		R	3
<i>Austrostipa breviglumis</i>	Cane Spear-grass		R	17
<i>Austrostipa gibbosa</i>	Swollen Spear-grass		R	9
<i>Austrostipa petraea</i>	Flinders Range Spear-grass		R	5
<i>Austrostipa pilata</i>	Prickly Spear-grass		V	8
<i>Austrostipa tenuifolia</i>			R	3
<i>Bothriochloa macra</i>	Red-leg Grass		R	4
<i>Brachycome parvula</i> var. <i>lissocarpa</i> (NC)	Coast Daisy		R	1
<i>Brachyscome ciliaris</i> var. <i>subintegrifolia</i>			R	8
<i>Caladenia flaccida</i>	Drooping Spider-orchid		V	2
<i>Caladenia gladiolata</i>	Bayonet Spider-orchid	EN	E	91
<i>Caladenia macroclavia</i>	Large-club Spider-orchid	EN	E	2
<i>Caladenia saxatilis</i>	Star Spider-orchid		R	5
<i>Caladenia stellata</i> (NC)	Star Spider-orchid		R	2
<i>Caladenia tensa</i>	Inland Green-comb Spider-orchid	EN		1
<i>Caladenia woolcockiorum</i>	Woolcock's Spider-orchid	VU	E	157
<i>Caladenia xantholeuca</i>	Flinders Ranges White Caladenia	EN	E	13
<i>Callitriche umbonata</i>	Water Starwort		V	1
<i>Calotis lappulacea</i>	Yellow Burr-daisy		R	6
<i>Choretrum glomeratum</i> var. <i>chrysanthum</i>	Yellow-flower Sour-bush		R	13
<i>Christella dentata</i>	Soft Shield-fern		R	2
<i>Citrus glauca</i>	Desert Lime		V	4
<i>Cladium procerum</i>	Leafy Twig-rush		R	4
<i>Codonocarpus pyramidalis</i>	Slender Bell-fruit	VU	E	9
<i>Crassula peduncularis</i>	Purple Crassula		R	2
<i>Crassula sieberiana</i>	Sieber's Crassula		E	3
<i>Cryptandra</i> sp. <i>Long hypanthium</i> (C.R. Alcock 10626)	Long-flower Cryptandra		R	6
<i>Cullen parvum</i>	Small Scurf-pea		V	11

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<i>Cyperus sanguinolentus</i>	Dark Flat-sedge		R	1
<i>Daviesia pectinata</i>	Zig-zag Bitter-pea		R	1
<i>Daviesia stricta</i>	Flinders Ranges Bitter-pea		R	1
<i>Derwentia decorosa</i>	Showy Speedwell		R	41
<i>Deyeuxia densa</i>	Heath Bent-grass		R	2
<i>Dianella longifolia</i> var. <i>grandis</i>	Pale Flax-lily		R	6
<i>Diuris behrii</i>	Behr's Cowslip Orchid		V	1
<i>Echinopogon ovatus</i>	Rough-beard Grass		R	8
<i>Elachanthus glaber</i>	Shiny Elachanth		R	2
<i>Elatine gratioloides</i>	Waterwort		R	5
<i>Eragrostis infecunda</i>	Barren Cane-grass		R	1
<i>Eragrostis lacunaria</i>	Purple Love-grass		R	1
<i>Eremophila subfloccosa</i> ssp. <i>Glandulosa</i> (R.Bates 32961)	Green-flower Emubush		R	1
<i>Eryngium ovinum</i>	Blue Devil		V	1
<i>Eucalyptus albens</i>	White Box		R	33
<i>Eucalyptus behriana</i>	Broad-leaf Box		R	1
<i>Eucalyptus percostata</i>	Ribbed White Mallee		R	40
<i>Eucalyptus viridis</i> ssp. <i>viridis</i>	Green Mallee		R	8
<i>Festuca benthamiana</i>	Bentham's Fescue		R	6
<i>Frankenia cupularis</i>			R	2
<i>Glycine latrobeana</i>	Clover Glycine	VU	V	2
<i>Glycine tabacina</i>	Variable Glycine		V	3
<i>Gratwickia monochaeta</i>			R	2
<i>Haeckeria cassiniiformis</i>	Dogwood Haeckeria		R	1
<i>Hovea purpurea</i>	Tall Hovea		R	59
<i>Juncus australis</i>	Austral Rush		R	3
<i>Juncus homalocalis</i>	Wiry Rush		V	2
<i>Juncus radula</i>	Hoary Rush		V	3
<i>Lepidium pseudotasmanicum</i>	Shade Peppercross		V	1
<i>Leptorhynchus elongatus</i>	Lanky Buttons		R	2
<i>Leptorhynchus scabrus</i> (NC)	Annual Buttons		R	1
<i>Logania saxatilis</i>	Rock Logania		R	42
<i>Maireana excavata</i>	Bottle Fissure-plant		V	24
<i>Maireana rohrlachii</i>	Rohrlach's Bluebush		R	14
<i>Malacocera gracilis</i>	Slender Soft-horns		V	10
<i>Mentha satureioides</i>	Native Pennyroyal		R	4
<i>Olearia pannosa</i> ssp. <i>cardiophylla</i>	Velvet Daisy-bush		R	26
<i>Olearia pannosa</i> ssp. <i>pannosa</i>	Silver Daisy-bush	VU	V	8
<i>Olearia picridifolia</i>	Rasp Daisy-bush		R	6
<i>Orobanche cernua</i> var. <i>australiana</i>	Australian Broomrape		R	2
<i>Osteocarpum acropterum</i> var. <i>deminutum</i>	Wingless Bonefruit		R	2
<i>Osteocarpum pentapterum</i>	Five-wing Bonefruit		E	1
<i>Ottelia ovalifolia</i> ssp. <i>ovalifolia</i>	Swamp Lily		R	1
<i>Ozothamnus scaber</i>	Rough Bush-everlasting		V	20
<i>Phyllangium sulcatum</i>			V	2
<i>Poa fax</i>	Scaly Poa		R	1
<i>Podolepis jaceoides</i>	Showy Copper-wire Daisy		R	2
<i>Podolepis muelleri</i>	Button Podolepis		V	20

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<i>Prasophyllum pallidum</i>	Pale Leek-orchid	VU	R	21
<i>Prasophyllum validum</i>	Mount Remarkable Leek-orchid	VU	V	93
<i>Pterostylis curta</i>	Blunt Greenhood		R	1
<i>Ptilotus exaltatus</i> var. <i>semilanatus</i>	Lamb's Tails		E	1
<i>Pycnosorus globosus</i>	Drumsticks		V	7
<i>Ranunculus pumilio</i> var. <i>politus</i>	Smooth-fruit Ferny Buttercup		V	2
<i>Rumex dumosus</i> var. (NC)	Wiry Dock		R	3
<i>Santalum spicatum</i>	Sandalwood		V	18
<i>Sarcozona bicarinata</i>	Ridged Noon-flower		V	1
<i>Sclerolaena muricata</i> var. <i>villosa</i>	Five-spine Bindyi		R	1
<i>Scutellaria humilis</i>	Dwarf Skullcap		R	3
<i>Senecio megaglossus</i>	Large-flower Groundsel	VU	E	20
<i>Solanum eremophilum</i>	Rare Nightshade		R	4
<i>Spyridium bifidum</i> var. <i>integrifolium</i>			R	1
<i>Swainsona behriana</i>	Behr's Swainson-pea		V	1
<i>Swainsona murrayana</i>	Murray Swainson-pea	VU	V	1
<i>Swainsona procumbens</i>	Broughton Pea		V	3
<i>Tecticornia flabelliformis</i>	Bead Samphire	VU	V	3
<i>Tecticornia lepidosperma</i>			R	1
<i>Thelymitra grandiflora</i>	Great Sun-orchid		R	11
<i>Thysanotus tenellus</i>	Grassy Fringe-lily		R	20
<i>Trachymene thysanocarpa</i>	Native Parsnip		R	1
<i>Triglochin minutissima</i>	Tiny Arrowgrass		R	1
<i>Utricularia australis</i>	Yellow Bladderwort		R	1
<i>Veronica parrkalliana</i>	Port Lincoln Speedwell		E	6
<i>Viminaria juncea</i>	Native Broom		R	1
<i>Wurmbea latifolia</i> ssp. <i>latifolia</i>	Broad-leaf Nancy		V	4
		16	118	1252

Conservation Ratings

*AUS = National Rating under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999; SA = State Conservation Rating under the National Parks and Wildlife Act 1972 (South Australia); FR = Regional Conservation Rating for the Flinders Ranges Botanical Region.

E = Endangered; T = Threatened; V = Vulnerable; R = Rare; U = Uncommon (Taplin 2008)

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Appendix 2: Fauna Species of Conservation Significance in the Living Flinders Region (DENR spatial database 2007)

Species Name	Common Name	Conservation Ratings*		
		AUS	SA	Gilliam & Urban 11
<i>Acanthiza iredalei iredalei</i>	Slender-billed Thornbill		R	
<i>Actitis hypoleucos</i>	Common Sandpiper		R	
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill			VU
<i>Amytornis merrotsyi</i>	Short-tailed Grasswren			VU
<i>Anas rhynchotis</i>	Australasian Shoveler		R	
<i>Aprasia pseudopulchella</i>	Flinders Worm-lizard	VU		
<i>Ardea ibis</i>	Cattle Egret		R	
<i>Ardea intermedia</i>	Intermediate Egret		R	
<i>Ardeotis australis</i>	Australian Bustard		V	EN
<i>Arenaria interpres</i>	Ruddy Turnstone		R	
<i>Biziura lobata</i>	Musk Duck		R	
<i>Burhinus grallarius</i>	Bush Stone-curlew		R	CR
<i>Cacatua leadbeateri</i>	Major Mitchell's Cockatoo		R	
<i>Calamanthus pyrrhopygius</i>	Chestnut-rumped Heathwren		ssp	VU
<i>Calamanthus campestris</i>	Rufous Fieldwren			VU
<i>Calidris tenuirostris</i>	Great Knot		R	
<i>Cercartetus concinnus</i>	Western Pygmy Possum			EN
<i>Charadrius leschenaultii</i>	Greater Sand Plover		R	
<i>Charadrius mongolus</i>	Lesser Sand Plover		R	
<i>Chrysococcyx luscus</i>	Shining Bronze-cuckoo			VU
<i>Cinlosoma castanotus</i>	Chestnut Quail-thrush		ssp	
<i>Cladorhynchus leucocephalus</i>	Banded Stilt		V	
<i>Climacteris affinis</i>	White-browed Treecreeper		R	
<i>Corcorax melanorhamphos</i>	White-winged Chough		R	
<i>Coturnix chinensis</i>	King Quail		E	
<i>Coturnix ypsilophora</i>	Brown Quail		V	RA
<i>Craterocephalus eyresii</i>	Lake Eyre Hardyhead			EN
<i>Dasyurus viverrinus</i>	Eastern Quoll		E	
<i>Drymodes brunneopygia</i>	Southern Scrub Robin			VU
<i>Egretta garzetta</i>	Little Egret		R	
<i>Egretta sacra</i>	Eastern Reef Egret		R	
<i>Elanus scriptus</i>	Letter-winged Kite		R	
<i>Emblema pictum</i>	Painted Finch		R	
<i>Eurostopodus argus</i>	Spotted Nightjar			VU
<i>Falco hypoleucos</i>	Grey Falcon		R	CR
<i>Falco peregrinus</i>	Peregrine Falcon		R	
<i>Falcunculus frontatus</i>	Crested Shrike-tit		R	VU
<i>Gerygone olivacea</i>	White-throated Gerygone		R	
<i>Glossopsitta pusilla</i>	Little Lorikeet		E	CR
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher		R	
<i>Haematopus longirostris</i>	Pied Oystercatcher		R	
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		E	
<i>Haliastur sphenurus</i>	Whistling Kite			VU
<i>Hieraaetus morphnoides</i>	Little Eagle			VU
<i>Heteroscelus brevipes</i>	Grey-tailed Tattler		R	
<i>Hydromys chrysogaster</i>	Water-rat			EN
<i>Ixobrychus minutus</i>	Little Bittern		E	
<i>Larus dominicanus</i>	Kelp Gull		R	
<i>Lichenostomus cratitius</i>	Purple-gaped Honeyeater			VU

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<i>Lichenostomus leucotus</i>	White-eared Honeyeater			VU
<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater			VU
<i>Limosa lapponica</i>	Bar-tailed Godwit		R	
<i>Limosa limosa</i>	Black-tailed Godwit		R	
<i>Macronectes giganteus</i>	Southern Giant-Petrel		V	
<i>Melanodryas cucullata</i>	Hooded Robin		ssp	VU
<i>Malurus splendens</i>	Splendid Fairy-wren			VU
<i>Melithreptus gularis</i>	Black-chinned Honeyeater		ssp	CR
<i>Microeca fascians</i>	Jacky Winter		ssp	
<i>Morelia spilota</i>	Carpet Python		R	RA
<i>Myiagra inquieta</i>	Restless Flycatcher		R	EN
<i>Neophema chrysostoma</i>	Blue-winged Parrot		V	
<i>Neophema elegans</i>	Elegant Parrot		R	
<i>Neophema petrophila</i>	Rock Parrot		R	
<i>Neophema splendida</i>	Scarlet-chested Parrot		R	
<i>Ninox connivens</i>	Barking Owl		R	
<i>Northiella haematogaster</i>	Blue Bonnet		ssp	
<i>Notechis ater ater (NC)</i>	Kreff's Tiger Snake	VU		VU
<i>Numenius madagascariensis</i>	Eastern Curlew		V	
<i>Numenius phaeopus</i>	Whimbrel		R	
<i>Oreoica gutturalis</i>	Crested Bellbird			VU
<i>Oxyura australis</i>	Blue-billed Duck		R	
<i>Pachycephala inornata</i>	Gilbert's Whistler		R	VU
<i>Pandion haliaetus</i>	Osprey		1	
<i>Pedionomus torquatus</i>	Plains-wanderer	VU	E	CR
<i>Petrogale xanthopus</i>	Yellow-footed Rock-wallaby	ssp	V	VU
<i>Petroica multicolour</i>	Scarlet Robin		ssp	VU
<i>Phaps elegans</i>	Brush Bronzewing			EN
<i>Philomachus pugnax</i>	Ruff		R	
<i>Pluvialis fulva</i>	Pacific Golden Plover		R	
<i>Podiceps cristatus</i>	Great Crested Grebe		R	
<i>Porzana tabuensis</i>	Spotless Crake		R	VU
<i>Pseudophryne bibronii</i>	Brown Toadlet		R	RA
<i>Stagonopleura guttata</i>	Diamond Firetail		V	VU
<i>Sterna hirundo</i>	Common Tern		R	
<i>Sterna nereis</i>	Fairy Tern		E	
<i>Stictonetta naevosa</i>	Freckled Duck		V	
<i>Strepera versicolor</i>	Grey Currawong		ssp	VU
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet			VU
<i>Trichosurus vulpecular</i>	Common Brushtail Possum		R	VU
<i>Tringa glareola</i>	Wood Sandpiper		R	
<i>Turnix varia</i>	Painted Button-quail		R	VU
<i>Varanus varius</i>	Lace Monitor		R	VU
<i>Vermicella annulata</i>	Common Bandy Bandy		R	
<i>Zoothera lunulate</i>	Bassian Thrush		R	EN
		4	75	17**

Conservation Ratings

*AUS = National Rating under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999; SA = State Conservation Rating under the National Parks and Wildlife Act 1972 (South Australia); E = Endangered; T = Threatened; VU and V = Vulnerable; R = Rare

* Gilliam Urban 2008 refers to the Species Risk Assessment for the Northern & Yorke undertaken in 2008. Ratings refer to expert opinion of the status within the Southern Flinders only – CR = Critically Endangered, EN = Endangered, VU = Vulnerable ** tally for species in addition to formally rated species only.

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Appendix 3: Northern and Yorke Natural Resources Management Board Goals to 2015

COASTAL, ESTUARINE AND MARINE ECOSYSTEMS
By 2030, there is no reduction in the extent, and a steady improvement in the condition, of coastal, estuarine and marine ecosystems, compared to 2008.
By 2015, there is no decline in the extent or condition of mangrove forests
By 2030, water quality is maintained to meet levels set for aquatic ecosystems in the Environment Protection (Water Quality) Policy.
By 2030, a 10% reduction in the pollutant load of discharges from licensed point source pollution sites.
By 2015, a 50% reduction in the pollutant load of sewage and stormwater discharged into the marine environment
By 2015, Stormwater and Flood Mitigation Plans are implemented for regional cities and major towns.
By 2015, local Development Plans incorporate principles to protect water quality, as presented in the Regulations and Policies of the NRM Plan.
By 2030, the extent and diversity of coastal landscapes is maintained and their condition improved compared to 2008.
By 2030, there is no decline in the conservation value of the 35 coastal areas of highest conservation priority.
By 2030, an improvement in the conservation value of an additional 14 areas, currently classed as "priority coastal cells".
By 2015, the condition of at least 4, out of 14, "priority coastal cells" is improved to high conservation totals.
By 2015, there is no further decline in the conservation value of the remaining coastal areas.
By 2015, there is an overall reduction in the threats to coastal ecosystems and landscapes from vegetation clearance, weeds and uncontrolled access by stock, vehicles and pedestrians
By 2015, coastal management guidelines are adopted for vegetation management and public access
By 2015, local Development Plans incorporate principles to protect coast, as presented in the Regs & Policies of the NRM Plan.
WATER AND FRESHWATER ECOSYSTEMS
By 2030, the amount of surface and groundwater available is maintained within the bounds of historical variations and does not deviate significantly from seasonal climatic drivers.
By 2030, fluctuations in groundwater levels, pressures and seasonal spring and baseflows will be maintained within the limits previously observed in the region, for comparable climatic conditions.
By 2030, flow regimes in priority river catchments do not deviate significantly from previously observed seasonal and inter-annual variations for comparable climatic conditions.
By 2015, a revised Water Allocation Plan, compliant with National Water Initiative guidelines, is in place for the Clare region.
By 2015, the Baroota area has an approved Water Allocation Plan in place.
By 2015, the management of water resources is regulated by a series of defined Water Affecting Activities.
By 2030, water quality is maintained, within climatic limitations and natural conditions, within levels set for aquatic ecosystems in the Environment Protection (Water Quality) Policy.
By 2030, mean nutrient levels in watercourses are maintained below Environment Protection Policy (Water Quality) guidelines for aquatic ecosystems.
By 2030, fluctuations in salinity levels in surface water and groundwaters exhibit trends that reflect climatic and seasonal influence and do not exceed levels recorded prior to 2008.
By 2015, Stormwater and Flood Mitigation Plans are implemented for regional cities and major towns.
By 2015, local Development Plans incorporate principles to protect water quality, as presented in the Regulations and Policies of the NRM Plan.
By 2015, salinity management plans are implemented in high priority catchments.
By 2030, core refuge areas are protected by a 20% reduction in the extent of priority degrading watercourse management issues.
By 2015, the length of watercourses unaffected by priority degrading management issues is increased by 5%, with a focus on protecting core refuge areas.
By 2015, River Management Plans are reviewed for the Light, Wakefield and Broughton Rivers

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TERRESTRIAL ECOSYSTEMS
By 2030, maintain the condition of the region's 1,200,000 ha of remnant native vegetation, and improve the condition of 15% from 2008 levels.
By 2015, increase in the area of remnant vegetation protected under legal and voluntary conservation agreements from 75,000 ha to 85,000 ha, with priority given to high conservation value remnants
By 2015, undertake active management on 100,000 ha of the region's remnant vegetation to improve condition compared with 2008.
By 2015, sustainable grazing guidelines have been developed with industry for native pastures to ensure grassy ecosystems are not degraded and to facilitate their recovery
By 2030, there has been no loss of ecologically significant species or communities, and the viability and conservation status of these species has been improved from 2008 levels.
By 2015, the status of Nationally, State and regionally listed species and ecological communities is maintained or improved from 2008 levels.
By 2015, threatened species protection plans will be developed and implemented for threatened species of local priority.
By 2030, there is an increase in ecological connectivity within and between landscapes from 2008.
By 2015, the ecological connectivity of at least three priority landscapes (Flinders-Olary, Tothill Ranges, Southern Yorke Peninsula) is increased, compared to 2008.
By 2015, increase the area of native vegetation by 5,000 ha, with a focus on increasing the functionality of remnant vegetation and the protection of erosion prone areas such as coastal dunes.
By 2015, management plans are implemented for areas of Category A and B roadside vegetation significance
By 2030, inland and estuarine water-dependent ecosystems are maintained or improved in condition from 2008 levels.
By 2015, the condition of at least 600 ha of water dependent ecosystems is improved compared to 2008.
By 2015, the extent of watercourse, wetland and other water dependent ecosystems does not decline from 2008 levels.
By 2015, at least 25% of areas classified as "important riverine habitat" are protected and actively managed.
By 2015, at least 25% of areas classified as "good native watercourse vegetation" are protected and actively managed.
By 2015, Water Allocation Plans provide water to meet the needs of the environment.
PEST PLANTS AND ANIMALS
By 2030, there is a net reduction in the impact caused by pest plants and animals on the environment, primary production and the community.
By 2030, the distribution and abundance of introduced pest plants has not increased compared with 2008.
By 2030, the distribution and abundance of pest animals has not increased compared with 2008.
By 2015, pest risk assessment and management plans are operational for priority pest plants and animals
By 2015, 50% of priority areas are managed to control feral animals.
By 2015, 90% of roadsides are managed with effective weed control programs
By 2030, no new significant introduced pest species have become established.
By 2015, biosecurity and incursion response plans are operational for priority pest plants and animals.

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Appendix 4: Contributors to the Living Flinders Biodiversity CAP to 2016

Member	Organisation
Andy Sharp	Dept. for Environment, Water and Natural Resources
Ian Falkenberg	Dept. for Environment, Water and Natural Resources
Stuart Bienke	Dept. for Environment, Water and Natural Resources
Danny Doyle	Dept. for Environment, Water and Natural Resources
Jean Turner	Dept. for Environment, Water and Natural Resources
Dan Rogers	Dept. for Environment, Water and Natural Resources
Lucy Dodd	Dept. for Environment, Water and Natural Resources
Louise Gavin	Dept. for Environment, Water and Natural Resources
Ben Dennison	Dept. for Environment, Water and Natural Resources
Dene Cuthbertson	Dept. for Environment, Water and Natural Resources
Rebecca Redden	Dept. for Environment, Water and Natural Resources
Ruth Coates	Dept. for Environment, Water and Natural Resources
Brooke Kerin	Dept. for Environment, Water and Natural Resources
Kevin Teague	Dept. for Environment, Water and Natural Resources
Jennifer Munro	Dept. for Environment, Water and Natural Resources
Wendy Fowler	Dept. for Environment, Water and Natural Resources
Lynne Waldon	Dept. for Environment, Water and Natural Resources
Daniel Hanisch	Dept. for Environment, Water and Natural Resources
Craig Nixon	Dept. for Environment, Water and Natural Resources
Paul O'Leary	Formerly Dept. for Environment, Water and Natural Resources
Trevor Naesmith	Dept. for Environment, Water and Natural Resources
Terry Boyce	Dept. for Environment, Water and Natural Resources
Sarah Voumard	Dept. for Environment, Water and Natural Resources
Chris Havelberg	Dept. for Environment, Water and Natural Resources
Lee Heard	Dept. for Environment, Water and Natural Resources
Daniel Hanisch	Dept. for Environment, Water and Natural Resources
Mopsy Daniels	Northern & Yorke Natural Resources Management Sub Group
Grant Chapman	Northern & Yorke Natural Resources Management Sub Group
Geraldine Davis	Northern & Yorke Natural Resources Management Sub Group
Monique Blasson	SA Water
Anita Crisp	Local Government Association
Matt Turner	The Wilderness Society
Anne Brown	Greening Australia
Mick Durant	Greening Australia
Paul Koch	Greening Australia
Todd Berkinshaw	Greening Australia
Andrew Moyland	ForestrySA
Sam Everingham	ForestrySA
Saideh Kent	Rural Solutions of South Australia
Zita Stokes	Rural Solutions of South Australia
Mary-Anne Young	Rural Solutions of South Australia
Trudie Stanley	Rural Solutions of South Australia
John Pitt	Rural Solutions of South Australia
Tim Milne	Nature Conservation Society of SA
Keith Bellchambers	Australian Wildlife Conservancy
Chris Rains	Aboriginal Lands Trust
Jane Luckcraft	Local landholder
Millie Nicholls	Local landholder
Michael Richards	Ag. Excellence Alliance
Andrea Tschirner	Local Resident and Fox Control Contractor
Kate Pearce	Dept. for Environment, Water and Natural Resources

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Appendix 5: Available CAP Resources

Product	Format
Living Flinders Conservation Action Plan	Excel File (Nature Conservancy Software)
Living Flinders CAP Summary 2009 - 2015	Adobe pdf document (Word versions also available)
Spatial Cap Tool	.pmf File for viewing in ESRI ArcReader software (free software)
Scoping Reports CAP Scoping Report #1 - Landholder Mapping CAP Scoping Report #2 - Interactive Mapping Pilot (Spatial CAP) CAP Scoping Report #3 - Asset Mapping CAP Scoping Report #4 - Monitoring Framework CAP Scoping Report #5 - Control of Opuntiod Cacti and African Boxthorn in Southern Flinders Ranges CAP Scoping Report #6 - Control of Feral Herbivores and Over-abundant Natives in Southern Flinders CAP Scoping Report #7 - Control of Feral Carnivores to Protect the Yellow-footed Rock-wallaby CAP Scoping Reports #8 - Control of WONS and Temperate Weeds in the Southern Flinders Ranges CAP Scoping Reports #9 - Control of Emerging Temperate Weeds in the Southern Flinders Ranges CAP Scoping Report #10 - Control of Coastal Weeds in the Southern Flinders Ranges CAP Scoping Report #11 - Management of Coastal Recreational Impacts in Southern Flinders Ranges CAP Scoping Report #12 - Conservation of Permanent Waterholes and Springs in the Southern Flinders CAP Scoping Report #13 - Strategic Buffers and Linkages in the Southern Flinders Ranges CAP Scoping Report #14 - Managing Fire Regimes in Temperate Woodlands of the Southern Flinders CAP Scoping Report #15 - Sustainable Grazing and Conservation in the Southern Flinders Ranges CAP Scoping Report #16, A Scoping Plan Review for the Living Flinders CAP	Adobe pdf documents (Word versions also available)
Priority Mapping Mount Remarkable to the Sea: Mapping Priorities for Habitat Management and Restoration. Summary report. Unpublished Report, Greening Australia. Koch, P.J. (2013) Mapping climate change impacts on vegetation and opportunities for grazing management and carbon sequestration in the Living Flinders CAP region of South Australia. Summary report. Unpublished Report, Greening Australia. Koch, P.J. (2013)	Adobe pdf document (Word versions and separate maps also available)
Soil and Water CAP Living Flinders Sustainable Soils Conservation Action Planning Summary 2014. Report to the Northern and Yorke Natural Resources Management Board and Department of Environment Water and Natural Resources. Greening Australia. McGregor, J. (2014) Sustainable Water Conservation Action Planning Summary 2014. Report to the Northern and Yorke Natural Resources Management Board and Department of Environment Water and Natural Resources. Greening Australia. McGregor, J. (2014)	Adobe pdf document (Word versions also available)
On-ground Works Reports Arden Vale Goat Control Efficacy Report. Report to the Northern and Yorke Natural Resources Management Board and Department of Environment Water and Natural Resources. Greening Australia. Durant, M. (2012, 2013, 2014)	Adobe pdf document (Word versions also available)

<p>Arden Vale Pest Management Program, Weed Control Activities Report. Report to the Northern and Yorke Natural Resources Management Board and Department of Environment Water and Natural Resources. Greening Australia. Durant, M. (2012, 2013, 2014)</p>	
<p>Monitoring Overview of Biodiversity Monitoring in the Northern and Yorke Natural Resources Management Region. Report by Greening Australia for Northern and Yorke NRM Board. Milne T. and McGregor J. (2011).</p>	<p>Adobe pdf document – limited hard copies available</p>

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