NORMANVILLE DUNES

BIODIVERSITY ACTION PLAN

T&M Ecologists

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Certain assumptions have been made in the preparation of this report. We have assumed that all information and documents provided to us by the Client or as a result of a specific request or enquiry were complete, accurate and up-to-date. Where we have obtained information from a government register or database, we have assumed that the information is accurate. Where an assumption has been made, we have not made any independent investigations with respect to the matters the subject of that assumption. We are not aware of any reason why any of the assumptions are incorrect.

T & M Ecologists Pty Ltd
5/26 Hack St
Mount Barker, South Australia 5251
Telephone: (08) 8185 3225
admin@tmecologists.com.au

Contents

Executive Summary

The Normanville Dunes are a recognised geological and biodiversity asset of the Fleurieu Peninsula. As evidence of their value, the Dunes are listed with the Australian Heritage Commission, the South Australian Heritage Register and have been accepted as a Geological Monument by the Geological Monuments Sub-committee of the South Australian Division of the Geological Society of Australia Limited. From a biodiversity perspective, the Dunes contain sixteen plants of regional or state conservation significance, and form habitat for reptiles and birds of state or regional conservation significance.

The Dunes are one of two key coastal systems on the Fleurieu Peninsula that are recognised as being exposed to high threat whilst also having high conservation values. This makes them a priority area for protection and remediation activities. Key threats include invasive weeds, pest animals (especially foxes and cats), incursion of grazing animals from adjacent land, pedestrian and horse trails, and dieback of the woodland overstorey.

The following plan inventories the biodiversity assets of the Dunes, assesses and prioritises threats, and documents the actions required to help maintain or improve the unique Heritage and biodiversity values of the dunes. Key actions include:

- Control of priority woody weeds, especially Olive and Boxthorn
- Prevention of new weed incursions
- Consolidation of pedestrian and horse trails
- Control of rabbits and foxes
- Revegetation of degraded areas to improve overall habitat values in the dunes
- Revegetation of key woodland species (She-oak, Coast Silver Wattle) to retain important woodland habitat

Measurable five year objectives and a protocol to monitor whether these objectives are met are also provided to measure successful implementation of this Plan.

Acknowledgements

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A number of individuals provided significant amounts of time to provide assistance and comments with regard to the Plan. Corey Jackson, Coast, Estuary & Marine Officer, Natural Resources Adelaide and Mount Lofty Ranges provided extensive background knowledge and material, assisted with site access and site visits, and provided comments on the draft Plan. Damian Moroney, Seascapes Coordinator Natural Resources Adelaide and Mount Lofty Ranges, managed the project and provided many useful comments and guidance through the development of the Plan. The Integrated Weed Management Strategy written by Ron Taylor was an invaluable resource used many times during preparation of this Plan.

Government of South Australia

Natural Resources Adelaide and Mt Lofty Ranges

1 INTRODUCTION

The Normanville Dunes are are significant natural resource of the Fleurieu Peninsula. They are one of the few examples of preserved natural dunes[1], and are recognised as one of two key areas in the Southern Fleurieu Coastal Action Plan and Conservation Priority Study that are exposed to high threats and have high conservation values[2]. The Dunes are listed with the Australian Heritage Commission, the South Australian Heritage Register and have been accepted as a Geological Monument by the Geological Monuments Sub-committee of the South Australian Division of the Geological Society of Australia Limited[3]. The State heritage values are:

- it has rare, uncommon or endangered qualities that are of cultural significance
- it may yield information that will contribute to an understanding of the State's history, including its natural history

The Register also notes:

"These relatively untouched sandhills, with their cover of native vegetation, are the last major relics of similar coastal dunes that once existed along the east coast of Gulf St Vincent. The dunes provide information on the processes of shoreline development during the Holocene (5,000 years), forming a double crested system with younger foredunes to seaward and older dunes inland. These dunes are also an important source for the replenishment of beach sand in the area."[4]

The importance of the preservation of coastal features, such as the Normanville Dunes, is recognised in the Yankalilla District Council Development plan[5] through: "Objective 1: The preservation and management of coastal land and features, environmentally important natural features such as dunes, estuaries, stands of native vegetation, wildlife habitat, exposed cliffs, headlands and hilltops, and areas which form an attractive background to urban and tourist development."

The purpose of this Biodiversity Action Plan is to assist managers in their efforts to protect and conserve the terrestrial and coastal ecological values of the Normanville Dunes. The Normanville Sand Dunes already have a comprehensive Weed Management Strategy in place. This Plan will review and update this Strategy, as well as document the key biodiversity values and other threats within Normanville Dunes and to prioritise the management of the threats for effective biodiversity conservation. The Plan is intended as a guide for management over the next 5 years with actions prioritised to ensure that time, effort and funding is spent appropriately to maximise biodiversity benefits.

[1] Behevaise and Associates (2004). Yankalilla District Foreshore Open Space Plan. A report prepared for PlanningSA and the Yankalilla District Council.
[2] Caton, B., Fotheringham, D., Lock, C., Royal, M., Sandercock, R. and Taylor, R. (2007). Southern Fleurieu Coastal Action Plan and Conservation Priority Study. Prepared for Adelaide and Mount Lofty NRM Board, Alexandrina Council, City of Victor Harbor, District Council of Yankalilla, Goolwa to Wellington Local Action Plan and Department for Environment and Heritage.
[3] Taylor, R. (1997). An Integrated Weed Strategy for the Normanville Sand Dunes. A report prepared for the District Council of Yankalilla.
[4] http://apps.planning.sa.gov.au/HeritageSearch/HeritageItem.aspx?p_heritageno=13219, accessed 21 November 2015.
[5] Department of Planning, Transport and Infrastructure (2015). Development Plan Yankalilla (DC). Consolidated 26 November 2015. Department of Planning, Transport and Infrastructure, Adelaide.

The Normanville Dunes Biodiversity Action Plan is intended to align with, and contribute to, the objectives of the *Southern Fleurieu Coastal Action Plan and Conservation Priority Study* (SFCAP)[2] which covers the coast from Myponga Beach to Goolwa. The goal of this Plan is to understand and facilitate the conservation, protection and maintenance of the region's natural coastal resources and to establish conservation priorities for places and areas within the region. This includes the following key actions for the Normanville Dunes area:

F23.2 Implement existing weed strategy for the Normanville Dunes
F 23.3 Continued effort in dune rehabilitation. Resist further development incursions into dunes.
F24.2 Community monitoring of Hooded Plover nests on beach and foredunes in spring and summer. Temporary fencing of nests. Interpretation of dangers to birds and request for restraint to dogs by owners.
F24.3 Continued effort in dune revegetation. Resist further development incursions into dunes.
F24.4 Improve access control through fencing, notices and upgrading existing paths.
F24.5 Implement existing weed plan for the dunes.
F24.6 Maintain Council effort to inform public of the ban on sandboarding.
F24.7 Vegetation rehabilitation to enhance butterfly larvae habitat within the dunes.

2 STUDY AREA

Normanville Dunes covers approximately 4.5 km of the Fleurieu Peninsula coastline, and is situated approximately 80km south of Adelaide. The mouth of Carrickalinga Creek forms the northern-most extent, and Yankalilla River is at the southern-most extent, with Bungala River in the centre. Figure 1 shows the area incorporated into this Plan, which incorporates a vegetated area of approximately 72 hectares. Henceforth this area shall be called Normanville Dunes. The area is largely a Crown Land reserve under the care and control of the District Council of Yankalilla, although there are some undeveloped smaller blocks around the township of Normanville, and private land at the northern and southern ends. Table 1 and Figure 1 show land parcels that form the State Heritage Listed Normanville Dunes[6].

[6] http://apps.planning.sa.gov.au/HeritageSearch/HeritageItem.aspx?p_heritageno=13219, accessed 21 November 2015.

Table 1. Parcels that form the State Heritage Listed Dunes

Parcel(s)	Title details
D3670 A168	CT 5670/314
D50644 A500	CR 5775/535
D50644 A501	CR 5775/536
D3670 A163	CR 5772/142
D3671 A132,133	CR 5772/143
D3671 A138	CT 5726/552
F171412 A128, 140	CT 5735/600
D50644 A500	CR 5775/535
D50655 A501	CR 5775/536
F171412 A98-117	CT 5775/537
D3671 A136-139	CT 5871/351
D3670 A163	CR 5772/142
D92889 A20	CT 6130/559
D92889 A21	CT 6130/560
H151100 S1018	CT 5715/813

Although not included in the Parcels that form the Heritage area, parts of CT 5775/538 D3670 A367 and CT5474/931 F19121 A4 are included in this plan. The former parcel is to the immediate south of the Bungala River, and the latter parcel adjoins the Yankallilla River to the north. This Plan has addressed the dune vegetation in these areas. Figure 2 shows the area covered by this Plan.

Figure 1: Land parcels that make up the State Heritage Listed Normanville Dunes

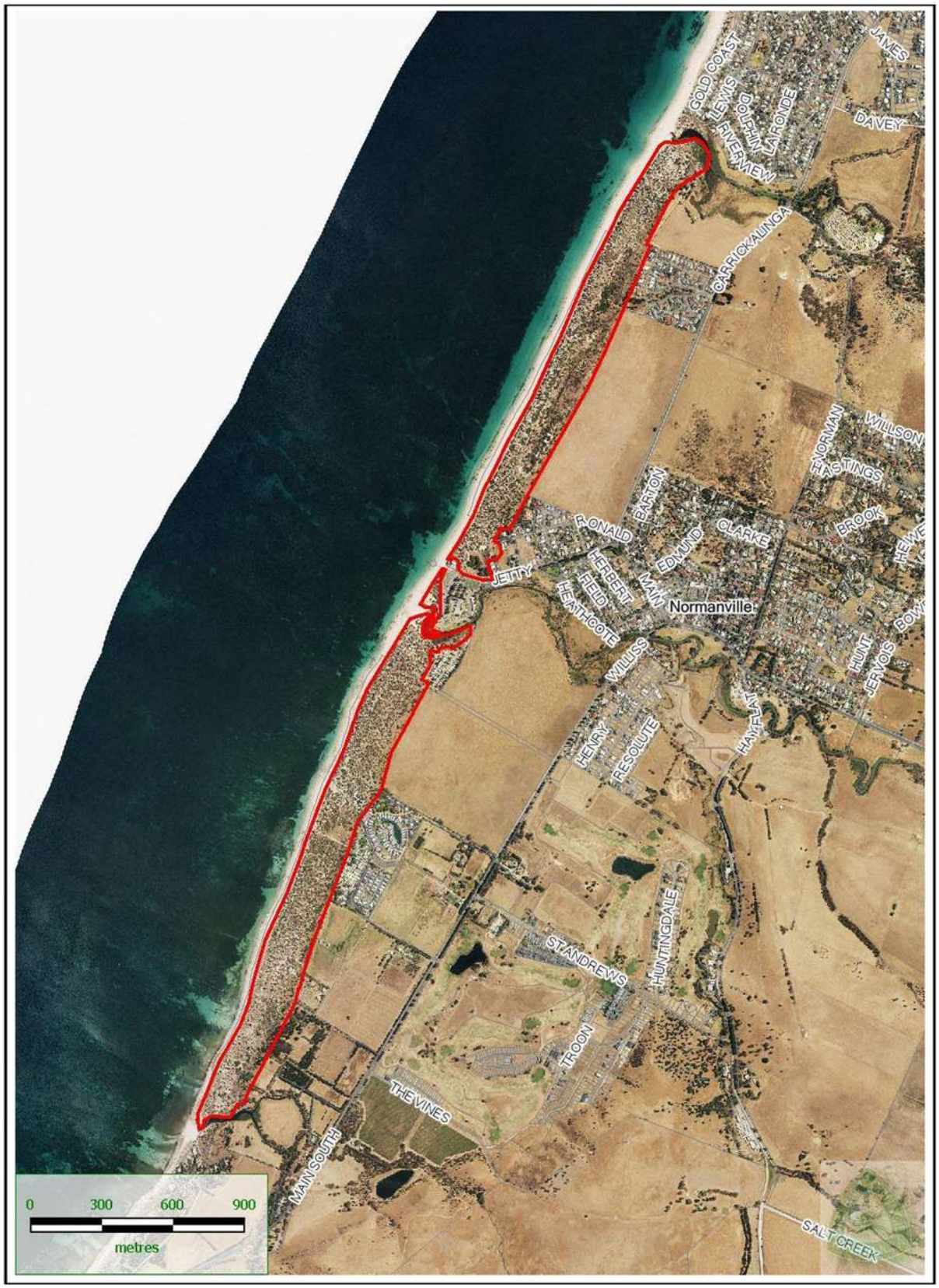


Figure 2: Normanville Dunes – the area within the red margin is the focus of this Plan

2.1 Current land management

The bulk of the Normanville Dunes area is under the management and control of the District Council of Yankalilla as a dedicated Conservation Reserve. Organisations involved in the day to day management of the Dunes include:

- District Council of Yankalilla
- Natural Resources Adelaide & Mount Lofty Ranges (NRAMLR) - statutory authority

2.2 Surrounding and historical land use

Prior to European settlement the area was the home of the Kaurna people and the coastal and inland enviroments would have provided important seasonal food and other resources. Archaelogical remains in the dunes have been dated from 1000-4000 years old, with a number of stratified and scattered deposits registered in the Dunes[7].

Whilst no precise record of grazing history exists, the presence of old fenceposts indicates a long history of grazing. Aerial photographs from 1949 show extensive "blowout" areas – namely large expanses of bare sand, likely to be as a result of loss of vegetation due to grazing (Figure 3). The dunes north of the Bungala River were mined for Silica by ACI from 1969 until the late 1980's[6]. Areas where sand was removed were the focus of rehabilitation activities.

The Normanville Dunes are bounded by the sea to the west, and a mixture of grazing and urbanised areas to the east.

[7] Taylor, R. (1997). An Integrated Weed Strategy for the Normanville Sand Dunes. A report prepared for the District Council of Yankalilla.

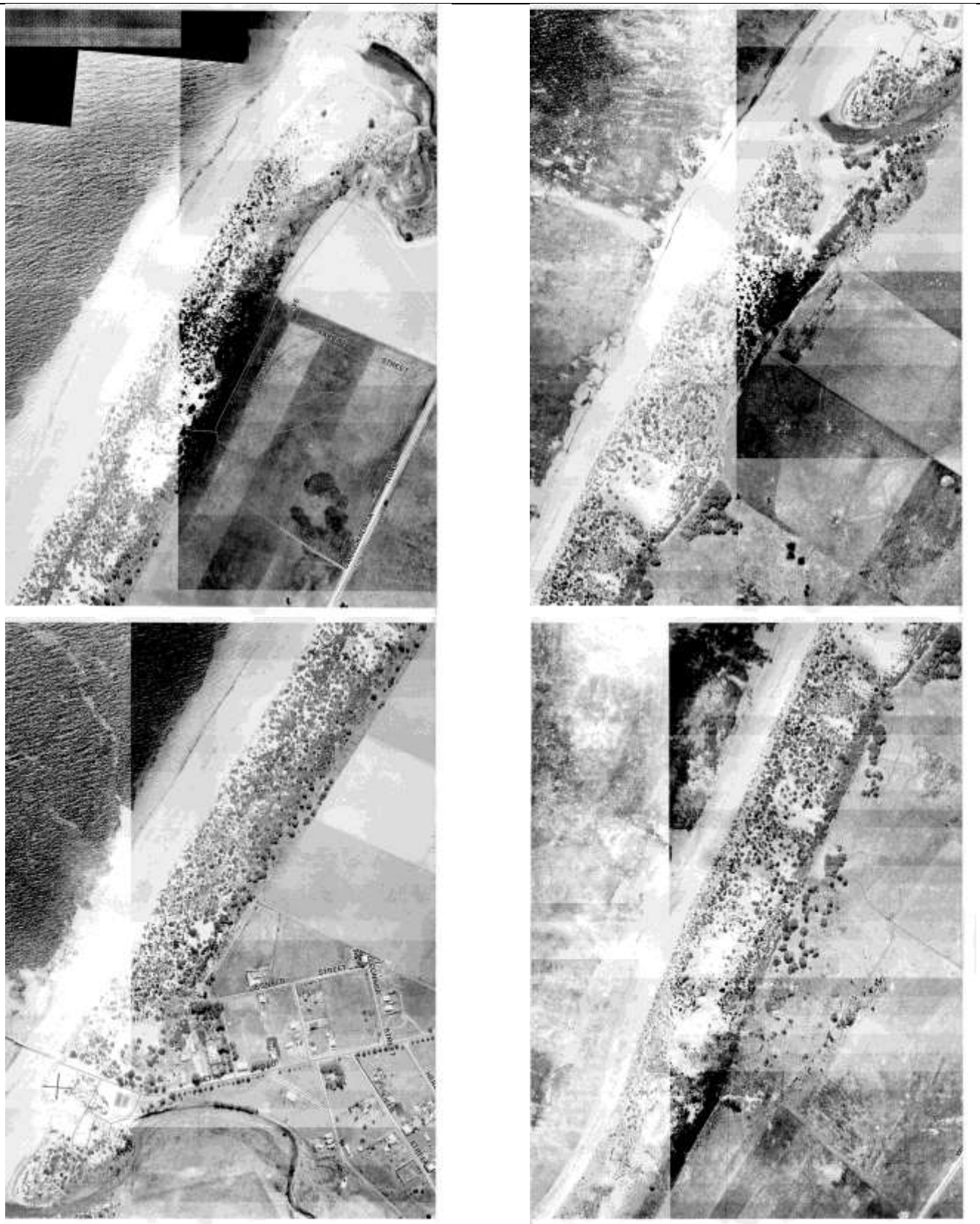


Figure 3: 1949 aerial photography of the Normanville Dunes. Top left: northern section from Carrickalinga Creek. Bottom left: northern section to Bungala River. Top right: southern section from Bungala River. Bottom right: southern section to Yankalilla Creek. Notable in these photographs is the substantial dune blowout areas, plus the woodland areas at the back of the Dunes.

3 AIM AND OBJECTIVES OF THE PLAN

The aim of the Biodiversity Action Plan for Normanville Dunes is primarily to address the focal management issues and actions identified in the Southern Fleurieu Coastal Action Plan (SFCAP) 2007. The SFCAP provides a detailed assessment of the state of natural coastal resources across the region and a major part of the report is the description and analysis of "coastal cells". Local management recommendations and priority actions are listed for each cell. Normanville Dunes are situated within SFCAP's Cell F23 'Lady Bay' and F24 'Bungala to Carrickalinga Creek'. The proposed actions which relate to these cells are:

Proposed Action	Priority	Key Players
F23.2 Implement existing weed strategy for the Normanville Dunes	High	NRAMLR, Council, Community Groups.
F 23.3 Continued effort in dune rehabilitation. Resist further development incursions into dunes.	High	Council, Community, DEWNR (Land Administration Branch, Coast Protection).
F24.2 Community monitoring of Hooded Plover nests on beach and foredunes in spring and summer. Temporary fencing of nests. Interpretation of dangers to birds and request for restraint to dogs by owners.	High	Council, Community, DEWNR.
F24.3 Continued effort in dune revegetation. Resist further development incursions into dunes.	High	Council, Community, DEWNR (Land Administration Branch, Coast Protection).
F24.4 Improve access control through fencing, notices and upgrading existing paths.	High	NRAMLR, Council, Community.
F24.5 Implement existing weed plan for the dunes.	Medium	NRAMLR, Council, Community.
F24.6 Maintain Council effort to inform public of the ban on sandboarding.	Medium	Council.
F24.7 Vegetation rehabilitation to enhance butterfly larvae habitat within the dunes.	Medium	NRAMLR, Council, Community.

NRAMLR = Natural Resources Adelaide and Mount Lofty Ranges, DEWNR = Department for Environment, Water and Natural Resoources

3.1 Plan objectives

The intention of this Biodiversity Action Plan for Normanville Dunes is to provide the information needed to address the local management actions identified in the SFCAP. The objectives are to:

- Clearly identify priority issues relating to the management of remnant vegetation and landforms within the study area;
- Identify priority issues relating to public usage and any actions that are recommended to ensure that human activities as they relate to natural resource management are managed in a sustainable manner; and
- Identify and address other relevant natural resource management matters identified within the study area during the course of the project.

The Plan is intended as a guide for specific and prioritised "on-ground" works over the next 5 years with the aim being to maximise the protection of the biodiversity values of Normanville Dunes.

The preparation of the Action Plan has involved:

- Review of previous biodiversity surveys and related studies;
- Stakeholder consultation and ongoing liaison;
- Field survey to map and record vegetation associations, plants of conservation significance, weeds and other management issues;
- Recording of vertebrate pest evidence;
- Identification and prioritisation of actions necessary to improve the biodiversity values/environmental assets of the Park, with a focus on rare flora and fauna species;
- Identification of issues and actions required in relation to Heritage values of the Dunes;
- Identification of appropriate and cost effective monitoring and research requirements.

4 ENVIRONMENTAL ASSETS

4.1 Landform and soils

The southern part of the Normanville Dunes is part of the Mt Rapid Environmental Association 3.2.1. This is described as " Hills and ridges on interbedded shale and arkose, locally overlain by tillite. Relict fans form broad flat surfaces near Cape Jervis where some coastal cliffs occur." The northern section of the Dunes is part of the Inman Valley Environmental Association 3.2.4, described as "A series of low dissected ridges and spurs on tillite and arkose, with dunes and beaches or cliffs along the coast.".

The dune areas are white silaceous sands, with the rear dune and mined areas being a sandy loam. The presence of *Acacia uncifolia*, which is generally associated with damp environments, suggests that the sand is underlain by impervious material, leading to a perched water table for at least part of the year.

4.2 Vegetation communities

The vegetation of Normanville Dunes was previously mapped as part of the Integrated Weed Strategy for the Normanville Dunes[8]. The vegetation communities mapped in Figure 4 and listed in Table 1 are based on this previous mapping, with minor modifications following ground-truthing. The vegetation essentially consists of a foredune seaward face dominated by wind and salt tolerant species such as *Spinifex hirsutus, Acacia longifolia sophorae, Olearia axillaris*, along with the introduced **Thinopyrum junceiforme* (which is particularly prevalent on the incipient dune). Behind this is a shrubland community on the dune and swale, and seaward side of the secondary dune, which is generally dominated by the shrub species *Leucopogon parviflorus, Olearia axillaris, Acacia longifolia sophorae*, with patches of *Melaleuca lanceolata* and *Alyxia buxifolia*. At the rear of the secondary dune the vegetation tends to a woodland community type. In the mid and northern section of the dunes the dominant tree species are *Acacia uncifolia* and *Allocasuarina verticillata.* These species, along with the introduced **Melaleuca armillaris,* are also dominant where

[8] Taylor, R. (1997). An Integrated Weed Strategy for the Normanville Sand Dunes. A report prepared for the District Council of Yankalilla.

revegetation has been undertaken following sand mining which has removed the secondary dune in the mid northern section of the Dunes. Behind the secondary dune at the southern end of the Dunes, there are small areas of *Eucalyptus camaldulensis, Eucalyptus fasciculosa* woodland. Whilst Pink Gum (*Eucalyptus fasciculosa*) may have been planted (as it is relatively young and appears to be in straight lines in places), the Red Gum (*Eucalyptus camaldulensis*) is very old and gnarled, with hollows, and so is considered likely to be remnant. Aerial photography from 1949 (Figure 3), which show areas that appear to be Red Gums, plus the presence of large,old individuals plus very large, dead tree trunks on the ground also supports this assertion (Figure 5).

Table 1: Vegetation communities, Normanville Dunes

Coastal Dune Grasslands and Shrublands
**Euphorbia paralias, *Thinopyrum junceiforme grassland* with emergent *Olearia axillaris, Acacia longifolia ssp. sophorae ± Leucophyta brownii*
Melaleuca lanceolata ± *Olearia axillaris* shrubland
Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae ± *Melaleuca lanceolata* shrubland
Acacia longifolia ssp. sophorae, Olearia axillaris ± *Leucopogon parviflorus* shrubland
Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae ± Allocasuarina verticillata shrubland
Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae open shrubland
Coastal woodlands
*Acacia uncifolia, Allocasuarina verticillata, *Melaleuca armillaris* open woodland
Allocasuarina verticillata, Acacia uncifolia very open woodland
Eucalyptus camaldulensis, Eucalyptus fasciculosa woodland
**Pinus halepensis ± Allocasuarina verticillata woodland*
Disturbed areas
Pinus spp. woodland
**Ehrharta calycina* grassland with emergent *Myoporum insulare, Adriana quadripartita, Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae*

Figure 4: Vegetation Communities in the Normanville Dunes. This figure is based upon aerial photography and field ground truthing.

Figure 5: Mature Red Gum on the eastern side of the northern section of the dunes. These mature gums provide tree hollows, a resource that is lacking in other parts of the Dunes.

4.3 Significant flora species

Whilst no species of national conservation significance and only one species of State conservation significance are found in the Dunes area, there are 14 species considered Near Threatened, 11 species considered Rare and 2 species considered Vulnerable at a regional level (Table 2). This reflects the scarcity of dune and coastal woodland habitats in the region, and illustrates the importance of the Dune area. Appendix 1 includes a full list of species.

Table 2: List of native plant species of conservation significance found during this study or listed by Taylor (1997) [9]

Species		Conservation Status		
		AUS[10]	SA[11]	AMLR[12]
Acacia cupularis	Cup Wattle			R
*Acacia ligulata**	Umbrella Bush			R
Acacia uncifolia	Coast Silver Wattle			V
Adriana quadripartita	Coast Bitter-bush			R
Alyxia buxifolia	Sea Box			R
Caladenia latifolia	Pink Caladenia			NT
Calandrinia brevipedata	Short-stalked Purslane			R
Calandrinia calyptrata	Pink Purslane			NT
Calandrinia corrigioloides	Strap Purslane			R
Calandrinia granulifera	Pigmy Purslane			NT
Carex bichenoviana	Notched Sedge			R
Crassula sieberiana	Sieber's Crassula			V
Dianella brevicaulis	Short-stem Flax-lily			NT
Eucalyptus camaldulensis ssp. camaldulensis	River Red Gum			NT
Eucalyptus fasciculosa	Pink Gum		R	NT
Eucalyptus leucoxylon ssp. leucoxylon	South Australian Blue Gum			NT
Kunzea pomifera	Muntries			R
Lepidosperma gladiatum	Coast Sword-sedge			NT
Leucophyta brownii	Coast Cushion Bush			NT
Leucopogon parviflorus	Coast Beard-heath			NT
Melaleuca lanceolata	Dryland Tea-tree			R
Myoporum insulare	Common Boobialla			NT
Nitraria billardierei	Nitre-bush			R
Olearia axillaris	Coast Daisy-bush			NT
Parietaria cardiostegia	Mallee Smooth-nettle			R
Pelargonium australe	Austral Stork's-bill			R

[9] Taylor, R. (1997). An Integrated Weed Strategy for the Normanville Sand Dunes. A report prepared for the District Council of Yankalilla.
[10] Environment Protection and Biodiversity Conservation Act 1999
[11] Schedules of the National Parks and Wildlife Act 1972 accessed November 2015
[12] Gillam, S. and Urban, R. (2014) Regional Species Conservation Assessment Project, Phase 1 Report: Regional Species Status Assessments, Adelaide and Mount Lofty Ranges NRM Region. Department of Environment, Water and Natural Resources, South Australia.

Species		Conservation Status		
		AUS[10]	SA[11]	AMLR[12]
Pimelea serpyllifolia ssp. serpyllifolia	Thyme Riceflower			NT
Samolus repens	Creeping Brookweed			NT
Santalum acuminatum	Quandong			R
Sarcocornia quinqueflora	Beaded Samphire			NT
Scaevola crassifolia	Cushion Fanflower			V
Senecio pinnatifolius var. maritimus	Variable Groundsel			R
Setaria constricta	Knotty-butt Paspalidium			NT
Suaeda australis	Austral Seablite			NT
Threlkeldia diffusa	Coast Bonefruit			NT
Triglochin trichophora				V
Rating codes: NT = Near Threatened; R = Rare; V = Vulnerable; E=Endangered				

* note that Taylor[9] indicates that this species may not have been historically present at the dunes. It has been included here for posterity, but has not been included in cumulative totals for the threatened species in the Dunes

4.4 Native Fauna

4.4.1 Mammals

Only two indigenous terrestrial mammal species have previously been recorded in the Normanville Dunes[13]. The following table lists mammals which have been recorded in the Dunes or are considered likely to occur in the Dunes based on the habitats that are present.

Table 3: Terrestrial mammal species that may or do occur in Normanville Dunes

Species	Common Name	Conservation status			Recorded in dunes
Terrestrial Mammals		AUS[14]	SA[15]	AMLR[16]	
Hydromys chrysogaster	Water-rat			R	N, but may be present in association with estuarine areas. Few records on the southern Fleurieu, so perhaps unlikely.
Macropus fuliginosus	Western Grey Kangaroo				Y, commonly seen
Pseudocheirus peregrinus	Common Ringtail Possum			R	N, but possibly present in woodland areas

[13] www.ala.org.au accessed 22/11/15
[14] Environment Protection and Biodiversity Conservation Act 1999
[15] Schedules of the National Parks and Wildlife Act 1972 accessed November 2015
[16] Gillam, S. and Urban, R. (2014) Regional Species Conservation Assessment Project, Phase 1 Report: Regional Species Status Assessments, Adelaide and Mount Lofty Ranges NRM Region. Department of Environment, Water and Natural Resources, South Australia.

Species	Common Name	Conservation status			Recorded in dunes
Terrestrial Mammals		**AUS[17]**	**SA[18]**	**AMLR[19]**	
Rattus fuscipes	Bush Rat			NT	Y, but may no longer be present
Trichosurus vulpecula	Common Brushtail Possum		R	R	N, but possibly present in woodland areas
Tachyglossus aculeatus	Short-beaked Echidna			NT	Observed in dunes 3/9/15
Rating codes: NT = Near Threatened; R = Rare; V = Vulnerable; E=Endangered; EX = Extinct					

Figure 6: Short-beaked Echidna (*Tachyglossus aculeatus*) observed in the Normanville Dunes 3/9/15. The Dunes would form a significant refuge for species such as this.

Armstrong et al[20] consider there to be 9 resident bat species in the Southern Mount Lofty Ranges. Of these 9 species, eight are commonly observed (Table 4). Some of these species are likely to be

[17] Environment Protection and Biodiversity Conservation Act 1999
[18] Schedules of the National Parks and Wildlife Act 1972 accessed November 2015
[19] Gillam, S. and Urban, R. (2014) Regional Species Conservation Assessment Project, Phase 1 Report: Regional Species Status Assessments, Adelaide and Mount Lofty Ranges NRM Region. Department of Environment, Water and Natural Resources, South Australia.
[20] Armstrong, D.M., Croft, S.J., and Foulkes, J.N. (2003). A biological Survey of the Southern Mount Lofty Ranges, South Australia , 2000-2001. Department for Environment and Heritage, South Australia.

present at Normanville Dunes. There is only one recorded bat observation within 10km of Normanville, which most likely represents a lack of survey effort rather than a true indication of the species that would be present. It is recommended that survey work is undertaken to ascertain which bat species are present at the Dunes.

Table 4: Resident bat species that commonly in the Southern Mount Lofty Ranges. Survey work is recommended to ascertain which of these species occur at Normanville Dunes.

Species	Common Name	Conservation status			Recorded within 10km radius[21]
Bats		**AUS[22]**	**SA[23]**	**AMLR[24]**	
Chalinolobus gouldii	Gould's Wattled Bat				
Chalinolobus morio	Chocolate Wattled Bat				
Mormopterus planiceps	Southern Freetail Bat				
Nyctophilus geoffroyi	Lesser Long-eared Bat				Yes
Tadarida australis	White-striped Freetail bat				
Vespadelus darlingoni	Large Forest Bat				
Vespadelus regretus	Southern Forest Bat				
Vespadelus vulturnus	Little Forest Bat				
Rating codes: NT = Near Threatened; R = Rare; V = Vulnerable; E=Endangered; EX = Extinct					

4.4.2 Birds

Table 5 lists the bird species that were observed, or are considered likely to be utilising the habitats of Normanville Dunes. This list was compiled from field survey in November 2015, along with a search of the Atlas of Living Australia and a consideration of past disturbance, isolation and the remnant habitats present in the Normanville Dunes. A report on the bird survey is provided in Appendix 2. The bird species recorded, both during the survey and at other times, have a diverse range of requirements for food, shelter and nesting. The woodland habitat in the reserve provides an abundance of lateral branches for perching and dense shrubs for shelter. Dead trees (particularly *Acacia uncifolia*) are common and provide perching habitat for numerous birds including kookaburra, crested pigeons, Australian magpie and Nankeen kestrel. As there are limited to no tree hollows present in the reserve, most of the resident birds did not rely on hollows for nesting. Those birds requiring hollows for nesting, likely nest elsewhere and frequent the reserve for feeding.

Aquatic and Shorebirds are likely to be found in association with the estuarine and beach/reef environment, but these areas are outside the scope of this Plan. Mention should also be made of the Hooded Plover (*Thinornis rubricollis*). Hooded Plovers nest on beaches between the high water mark and the dunes and are therefore vulnerable to the impacts of people and predators such as

[21] www.ala.org.au 4/2/16
[22] Environment Protection and Biodiversity Conservation Act 1999
[23] Schedules of the National Parks and Wildlife Act 1972 accessed November 2015
[24] Gillam, S. and Urban, R. (2014) Regional Species Conservation Assessment Project, Phase 1 Report: Regional Species Status Assessments, Adelaide and Mount Lofty Ranges NRM Region. Department of Environment, Water and Natural Resources, South Australia.

dogs and foxes. In 2015 a pair of Hooded Plovers nested at the mouth of the Bungala River[25]. It is estimated that there are 50-70 Hooded Plovers remaining on the Fleurieu coastline.

Table 5: Birds observed and/or likely to be utilising Normanville Dunes as habitat

Species	Common Name	Observed	Conservation Status		
			AUS[26]	SA[27]	AMLR[28]
Cracticus tibicen	Australian Magpie	Y			
Coracina novaehollandiae	Black-faced Cuckoo-shrike	Y			
Elanus axillaris	Black-shouldered Kite	Y			
Falco berigora	Brown Falcon				
Acanthiza pusilla	Brown Thornbill				V
Phaps chalcoptera	Common Bronzewing	Y			
Ocyphaps lophotes	Crested Pigeon	Y			
Platycercus elegans	Crimson (Adelaide) Rosella	Y			
Neophema elegans	Elegant Parrot			R	V
Eolophus roseicapillus	Galah	Y			
Strepera versicolor	Grey Currawong	Y			
Rhipidura albiscapa	Grey Fantail				
Colluricincla harmonica	Grey Shrike-thrush				
Thinornis rubricollis	Hooded Plover			V	E
Dacelo novaeguineae	Laughing Kookaburra	Y			
Corvus mellori	Little Raven	Y			
Anthochaera chrysoptera	Little Wattlebird	Y			NT
Dicaeum hirundinaceum	Mistletoebird				
Falco cenchroides	Nankeen Kestrel	Y			
Phylidonyris novaehollandiae	New Holland Honeyeater	Y			
Trichoglossus haematodus	Rainbow Lorikeet	Y			
Anthochaera carunculata	Red Wattlebird	Y			
Zosterops lateralis	Silvereye	Y			V
Gavicalis virescens	Singing Honeyeater	Y			
Pardalotus striatus	Striated Pardalote				
Coturnix pectoralis	Stubble Quail	Y			NT
Malurus cyaneus	Superb Fairy-wren	Y			
Aquila audax	Wedge-tailed Eagle				
Hirundo neoxena	Welcome Swallow	Y			
Sericornis frontalis	White-browed Scrubwren				

[25] Corey Jackson pers. comm.
[26] Environment Protection and Biodiversity Conservation Act 1999
[27] Schedules of the National Parks and Wildlife Act 1972 accessed November 2015
[28] Gillam, S. and Urban, R. (2014) Regional Species Conservation Assessment Project, Phase 1 Report: Regional Species Status Assessments, Adelaide and Mount Lofty Ranges NRM Region. Department of Environment, Water and Natural Resources, South Australia.

Species	Common Name	Observed	Conservation Status		
			AUS[26]	SA[27]	AMLR[28]
Ptilotula penicillata	White-plumed Honeyeater	Y			
Rhipidura leucophrys	Willie Wagtail	Y			NT
Acanthiza chrysorrhoa	Yellow -rumped Thornbill				NT
Calyptorhynchus funereus	Yellow-tailed Black Cockatoo	Y		V	V
Acanthiza nana	Yellow Thornbill	Y			NT
Rating codes: NT = Near Threatened; R = Rare; V = Vulnerable; E=Endangered; EX = Extinct					

4.4.3 Reptiles and Amphibians

There are no formal reptile species records in the Normanville Dunes area[29]. The Southern Fleurieu Coastal Action Plan and Conservation Priority Study identified 35 reptile and amphibian species that might occur in the vicinity of Normanville Dunes. Tables 6 and 7 show the species which are considered to be possibly, or likely to be present in the Dunes area, based on this list and a consideration of past disturbance, isolation and the remnant habitats present in the Normanville Dunes.

Table 6: Reptiles observed and/or likely to be utilising Normanville Dunes as habitat

Scientific Name	Common Name	Observed 2015	Rating			Comments[30]
			AUS[31]	SA[32]	AMLR[33]	
Christinus marmoratus	Marbled Gecko					Nocturnal gecko. Considered likely to be present, particularly in woodland area. Common and widespread on Southern Fleurieu coast.
Hemiergis decresiensis	Three-toed Earless Skink					Possibly present. Requires rocks, logs and natural ground debris for shelter. Common in loamy soils.
Hemiergis peronii	Four-toed Earless Skink	X			R	Considered likely to be present. Requires rocks, logs and natural ground debris for shelter. Common in sandy soils.
Lerista bougainvillii	Bougainville's Skink					Possibly present. Requires rocks, logs and natural ground debris for shelter. Common and widespread on Southern Fleurieu coast.
Lerista dorsalis	Four-toed Slider				R	Possibly present. Requires rocks, logs and natural ground debris for shelter. Restricted distribution on Southern Fleurieu coast

[29] Atlas of Living Australia: www.ala.org.au accessed 24/11/15
[30] Dr Tim Milne, Herpetologist and Caton et al, 2007.
[31] Environment Protection and Biodiversity Conservation Act 1999
[32] Schedules of the National Parks and Wildlife Act 1972 accessed November 2015
[33] Gillam, S. and Urban, R. (2014) Regional Species Conservation Assessment Project, Phase 1 Report: Regional Species Status Assessments, Adelaide and Mount Lofty Ranges NRM Region. Department of Environment, Water and Natural Resources, South Australia.

Scientific Name	Common Name	Observed 2015	Rating			Comments[30]
			AUS[31]	SA[32]	AMLR[33]	
Menetia greyii	Dwarf Skink				NT	Considered likely to be present. Small, active diurnal skink. Widespread across Australia. Common and widespread on Southern Fleurieu coast.
Morethia obscura	Mallee Snake-eye				R	Possibly present in woodland area. Common but with restricted distribution on Southern Fleurieu coast.
Pogona barbata	Eastern Bearded Dragon	X				Observed during fieldwork. Semi-arboreal species. Common and widespread on Southern Fleurieu coast.
Pseudechis porphyriacus	Red-bellied Black Snake					Possibly present, especially in association with estuary areas. Common and widespread on Southern Fleurieu coast.
Pseudonaja textilis	Eastern Brown Snake					Certain to be present. Common diurnal snake. Common and widespread on Southern Fleurieu coast.
Tiliqua rugosa	Sleepy Lizard	X				Observed during fieldwork. Widely distributed large skink. Shelters under "fallen timber, leaf litter, spinifex and other grasses[34]". Common and widespread on Southern Fleurieu coast.
Tiliqua scincoides	Eastern Bluetongue					Considered likely to be present. Widely distributed large skink. "Shelters at night in hollow logs, ground debris etc. [35]" Common and widespread on Southern Fleurieu coast.

Table 7: Frog species observed and/or likely to be utilising Normanville Dunes as habitat

Scientific Name	Common Name	Observed 2015	Rating			Comments
			AUS[36]	SA[37]	AMLR[38]	
Crinia signifera	Common Froglet	X				Calls heard August 2015
Limnodynastes dumerilii	Banjo Frog					Possibly present especially in proximity of creek systems.

[34] Cogger, H.G. (1992). *Reptiles and Amphibians of Australia*. Reed Books, Chatswood.
[35] Cogger, H.G. (1992). *Reptiles and Amphibians of Australia*. Reed Books, Chatswood.
[36] Environment Protection and Biodiversity Conservation Act 1999
[37] Schedules of the National Parks and Wildlife Act 1972 accessed November 2015
[38] Gillam, S. and Urban, R. (2014) Regional Species Conservation Assessment Project, Phase 1 Report: Regional Species Status Assessments, Adelaide and Mount Lofty Ranges NRM Region. Department of Environment, Water and Natural Resources, South Australia.

Scientific Name	Common Name	Observed 2015	Rating			Comments
						Burrowing frog, often found well away from freshwater bodies, but requires standing water to breed.
Limnodynastes tasmaniensis	Spotted Marsh Frog					Likely present especially in proximity of creek systems. Medium sized frog, found in close proximity to fresh water.
Litoria ewingii	Southern Brown Tree Frog				R	Possibly present, especially in proximity of creek systems
Neobatrachus pictus	Burrowing Frog				R	Possibly present in woodland area. Burrowing frog, often found well away from freshwater bodies, but requires standing water to breed.
Rating codes: R = Rare; V = Vulnerable; E=Endangered; EX = Extinct						

4.4.4 Insects

The Normanville Dunes provide remnant butterfly habitat with valuable hostplant patches. Butterflies for which suitable host plants occur, or which have been recorded in the Dunes are included in Table 8[39].

Table 8 Butterfly species which do or may occur in the Normanville Dunes

Species	Common Name	Recorded in the Dunes	Vulnerability	Larval Foodhost found in the Dunes
Jalmenus icilius	Icilius Blue	Y	Rare	*Acacia spp.* including *pycnantha, uncifolia*
Theclinesthes albocincta	Grund's Blue	N	Local	*Adriana quadripartita*
Anisynta cynone cynone	Cynone Skipper	N	Vulnerable	Native & introduced grasses
Anisynta cynone gracilis	Cynone Skipper	N	Rare	Native & introduced grasses
Ogyris amaryllis meridionalis	Amarylis Azure	N	Local	*Amyema* species
Ogyris otanes	Small brown Azure	N	Vulnerable	*Santalum acuminatum*

4.5 Aboriginal Heritage

Prior to European settlement the area was the home of the Kaurna people and the coastal and inland enviroments would have provided important seasonal food and other resources. Archaelogical remains in the dunes have been dated from 1000-4000 years old, with a number of stratified and scattered deposits registered in the Dunes[40].

[39] Caton, B., Fotheringham, D., Lock, C., Royal, M., Sandercock, R. and Taylor, R. (2007). Southern Fleurieu Coastal Action Plan and Conservation Priority Study. Prepared for Adelaide and Mount Lofty NRM Board, Alexandrina Council, City of Victor Harbor, District Council of Yankalilla, Goolwa to Wellington Local Action Plan and Department for Environment and Heritage.

[40] Taylor, R. (1997). An Integrated Weed Strategy for the Normanville Sand Dunes. A report prepared for the District Council of Yankalilla.

5 ENVIRONMENTAL THREATS (management issues)

Management issues identified in the SFCAP which are of particular concern in terms of biodiversity conservation in the Normanville Dunes include:

- Weed infestation;
- Unmanaged beach access;
- Development incursions into dunes;
- Sandboarding

Other management issues which are of concern include:

- Grazing and predation by pest animals (i.e. foxes, cats, rabbits, hares, rats, mice); and
- Erosion

5.1 Invasive weeds

The diversity and structure of the native vegetation communities in the Normanville Dunes are threatened by a range of introduced weed species and the following table lists the weeds of concern which have been recorded in the Dunes and have also been documented in an Integrated Weed Management Plan developed for the Yankalilla Council. A full list of weeds recorded in the Dunes is included in Appendix 1.

Table 8: List of Priority Weeds for control in Normanville Dunes

Species	Common Name	[41]Declared	[42]WONS	[43]SFCAP Threat Level	[44]Red Alert Weed Rating	Identified Priority[45]
**Acacia longifolia ssp. longifolia*	Sallow Wattle			5	3	
**Acacia cyclops*	Western Coastal Wattle			7	2	*
**Acacia saligna*	Golden Wreath Wattle			5	2	✓
**Ammophila arenaria*	Marram Grass			-	3	
**Arctotheca calendula*	Capeweed			1	1	
**Arctotis stoechadifolia*	White Arctotis			4	3	✓
**Argyranthemum frutescens ssp. foeniculaceum*	Teneriffe Daisy			4	3	✓
**Asparagus asparagoides*	Bridal Creeper	Y	Y	9	5	✓
**Atriplex prostrata*	Creeping Saltbush			1	2	
**Avena barbata*	Wild Oat			1	2	
**Brassica tournefortii*	Wild Turnip			3	2	
**Bromus spp.*	Brome			1	1	
**Cakile maritima*	Two-horned Sea Rocket			-	2	

[41] Biosecurity SA Weeds and Pest Animals. Declared plants in South Australia, October 2012 http://www.pir.sa.gov.au/biosecuritysa/nrm_biosecurity/weeds/declared_plants_in_south_australia,_october_2012

[42] Australian Weeds Committee (2012), Weeds of National Significance 2012. Department of Agriculture, Fisheries and Forestry, Canberra, ACT http://www.weeds.org.au/WoNS/

[43] Metropolitan and Northern Coastal Action Plan, AMLR Natural Resources Management Board

[44] Refer to Croft, S.J., J.A. Pedler & T.I. Milne (2005 – 2008) Bushland Condition Monitoring Manual. Nature Conservation Society of SA Inc.

[45] Taylor, R. (1997). An Integrated Weed Strategy for the Normanville Sand Dunes. A report prepared for the District Council of Yankalilla.

Species	Common Name	[41]Declared	[42]WONS	[43]SFCAP Threat Level	[44]Red Alert Weed Rating	Identified Priority[45]
**Carpobrotus edulis ssp. edulis*	Hotentot Fig			4	2	
**Cenchrus clandestinum*	Kikuyu	?		2	3	
**Chenopodium album*	Fat Hen			1	1	
**Cynodon dactylon*	Couch			3	2	
**Dittrichia graveolens*	Stinkweed				2	✓
**Echium plantagineum*	Salvation Jane			2	2	✓
**Ehrharta calycina*	Perrennial Veldt Grass			4	3	
**Ehrharta longiflora*	Annual Veldt Grass			2	2	
**Emex australis*	Three-corner Jack	Y			1	✓
**Euphorbia paralias*	Sea Spurge			5	3	
**Euphorbia terracina*	False Caper	Y		5	3	✓
**Feraria crispa*	Black Flag			3	1	
**Galenia pubescens*	Coastal Galenia			3	2	
**Gazania linearis*	Gazania	Y		8	3	*
**Gomphocarpus cancellatus*	Broad-leaf Cotton-bush			1	2	
**Hypochaeris spp.*	Cat's Ear			1	1	
**Lagurus ovataus*	Hare's Tail Grass			2	2	
**Leptospermum laevigatum*	Coastal Tea-tree			6	3	*
**Lolium spp.*	Ryegrass			1	1	
**Lycium ferocissium*	African Boxthorn	Y	Y	7	3	✓
**Malva arborea*	Tree Mallow			3		
**Malva parviflora*	Small-flower Marshmallow			3	1	
**Marrubium vulgare*	Horehound	?		4	3	✓
**Medicago spp.*	Medic			1	2	
**Melaleuca armillaris*	Bracelet Honey-myrtle					
**Mesembryanthemum crystallinum*	Common Iceplant			3	2	
**Moraea flaccida*	One-leaf Cape Tulip	Y			3	
**Oenothera stricta*	Evening Primrose			1	2	
**Olea europaea*	Olive	Y		5	4	✓
**Oxalis pes-caprae*	Soursob	Y		5	3	
** Pinus halepensis*	Aleppo Pine			4	3	
**Pinus radiata*	Radiata Pine			4	3	
**Plantago spp.*	Plantain			3	2	
**Reichardia tingitana*	False Sow-thistle			3	2	
**Rhamnus alaternus*	Blowfly Bush			6	3	✓
**Rosa canina*	Dog Rose			2	3	✓
**Sonchus spp.*	Sow-thistle			1	1	
**Solanum nigrum*	Black Nightshade				2	✓
**Tamarix sp.*	Tamarix			2	2	
**Tetragonia decumbens*	Sea Spinach			2		
**Thinopyrum junceiforme*	Sea Wheat-grass			1	4	
**Trifolium spp.*	Clover			1	2	
**Verbascum virgatum*	Twiggy Mullein			3	2	

Species	Common Name	[41]Declared	[42]WONS	[43]SFCAP Threat Level	[44]Red Alert Weed Rating	Identified Priority[45]
SFCAP Threat Levels: The threat value allocation process undertaken as part of the SFCAP identified a total of 89 priority environmental weeds for the Southern Fleurieu coastal region, each featuring a weed threat value between 1 and 9.						
Red Alert Weed Categories: 1 – Generally only invade disturbed bushland. Often widespread and abundant but not considered a significant threat to native biodiversity, unless present at very high densities. 2 - Generally only invade disturbed bushland, but may spread rapidly. However, generally only a slight potential to reduce native species diversity, unless present at very high densities. 3 – Invasive in intact bushland with moderate potential to reduce native species diversity. Rate of spread is slower than Category 4 and 5 weeds but once present will persist and threaten biodiversity. May produce dense stands over a wide area but can be controlled with sustained effort. 4 – Highly invasive in either disturbed or intact remnant bushland, with the potential to spread rapidly and produce very dense stands given favourable habitat and/or vectors. High potential to reduce native species diversity and abundance. Can be controlled with sustained effort. 5 – Highly invasive in either disturbed or intact bushland, spreads rapidly producing very dense stands and a blanket cover. Potential to eliminate almost all native understorey species. Very difficult to control without outside help.						

* Not included as a priority in the plan by Taylor[42], but are considered a priority in this plan.

Figure 7: *Argyranthemum frutescens ssp. foeniculaceum* - Teneriffe Daisy. Whilst only in relatively low numbers currently, this species has the ability to spread through the dune system and so should be a priority for control.

Also of concern is the potential for the introduction and spread of weed species into the dunes from adjoining housing developments. This is currently most evident at the interface of the Dunes with some sections of the Beachside Caravan Park. Examples of some plants observed in the Dunes in this area are provided in Figure 8.

Figure 8: Weed spread noted from adjacent properties into the dune. Top left: coastal vegetation on the right, vegetation on properties in the Beachside Caravan Park on the left, including *Melaleuca nesophila* and *Corymbia ficifolia*. Top right: *Corymbia ficifolia*, Bottom left *Aeonium* sp., Bottom right *Geranium* sp. These individuals have established in the dunes, and demonstrate the ability of garden plants to spread into the dunes. All of these photographs taken adjacent to Beachside Caravan Park.

5.2 Pest animals

The following table lists the introduced animal species which have been recorded, or are considered likely to be present, in the Normanville Dunes.

Table 9: List of introduced animal species present, or considered likely to be present, at Normanville Dunes

Species	Common Name	Recorded in Dunes
Mammals		
Felis catus	Feral Cat	
Lepus capensis	Brown Hare	Y
Mus musculus	House Mouse	
Oryctolagus cuniculus	European Rabbit	Y
Rattus rattus	Black Rat	
Vulpes vulpes	Fox	
Canis familiaris	Dog	Y (this study)
Birds		
Alauda arvensis	Skylark	Y
Columba livia	Common Rock Dove	
Carduelis carduelis	European Goldfinch	Y
Passer domesticus	House Sparrow	Y
Spilopelia chinensis	Spotted Dove	Y

Species	Common Name	Recorded in Dunes
Sturnus vulgaris	Common Starling	Y
Turdus merula	Blackbird	Y

Of these introduced animals fox, rabbit and cat populations are considered to be a significant threat to the Dunes' biodiversity and are a high priority in terms of active management strategies. Warrens, which could be used by both foxes and cats, were observed in the Dunes (Figure 9). Domestic dog tracks were also common (Figure 10), particularly in the areas of the dunes close to the Normanville Jetty.

Figure 9: Warren entrance in the woodland area north of Beach Caravan Park. These warrens may be used by both foxes and rabbits.

Figure 10: Evidence of dogs loose in the Dunes near the Normanville Jetty. Dogs will disturb native fauna, and cause erosion.

5.3 Kangaroos

Western Grey Kangaroo (*Macropus fuliginosus*) frequent the open grazing areas adjacent to the dunes, and were noted during site inspections. Whilst not currently considered to be at excess levels, the nature of the setting of the Dunes (an area of remnant vegetation adjoining cleared grazing paddocks) lends itself to a proliferation of kangaroos, as they are able to emerge from sheltered areas of remnant vegetation at dusk to graze in the open, but then retreat to these remnants at other times. It is recommended that kangoroo numbers are monitored to ensure they do not become excessive. One indicator that could be used is the impact of kangaroos on revegetation, for example if all shrub species being planted as revegetation plants are being heavily or severely grazed[46] then kangaroo management needs to be investigated.

5.4 Fire

The Australian environment has evolved in the presence of fire for thousands of years. However, wildfires can have a negative impact on native flora and fauna if fire frequency is too high. Some plant species may not recover well after fire, while other more fire-tolerant species may thrive and become abundant. Fauna species which have a limited distribution or are already at risk due to low numbers may also be negatively impacted.

[46] Refer to diagrams contained within Croft, S.J., J.A. Pedler & T.I. Milne (2005) Bushland Condition Monitoring Manual: Southern Mount Lofty Ranges. Nature Conservation Society of SA Inc.

5.5 Adjacent grazing activities

Much of the eastern boundary of the Dunes area is open grazing land. There have been occasions where grazing animals have penetrated the dune boundary fencing and entered the Dune area, with both Dorper Sheep and cattle entering in recent times.[47] These animals will selectively graze palatable plants, introduce weeds, trample and crush vegetation, and potentially increase erosion. They will also compromise management activities (and associated investment) such as revegetation. The impact of grazing animals should be viewed as a key threat that needs to be addressed. Figures 11 and 12 show examples of the fencing in sections of the Dunes.

Figure 11: Older fencing just south of Jetty Caravan Park. It is recommended this fencing is replaced/upgraded to help prevent unwanted stock access to Dune areas

[47] Corey Jackson pers. comm. 2015

Figure 12: Fencing in northern section. Whilst fundamentally sound, the fencing requires some maintenance to be effective to help prevent unwanted stock access to Dune area

5.6 Recreation activities

There are many visitors to the Normanville Beach, which is accentuated by the presence of two caravan parks and urban housing along some sections of the boundary of the dunes. Recreational activities include surfing, swimming, fishing and beachwalking.

Beach access points are consolidated to help prevent unwanted impacts, such as:

- trampling or crushing vegetation;
- compacting soil which limits natural regeneration;
- disturbance of soil/erosion which encourages weeds;
- introduction of weed seed;
- disturbance to sensitive fauna species such as the beach-nesting Hooded Plover; and
- disturbance/predation on native animals by domestic pets such as dogs

The Southern Fleurieu Coastal Action Plan notes that a high priority action is "F24.4 Improve access control through fencing, notices and upgrading existing paths." From a biodiversity perspective, it is desirable that no further beach access points are created in the Normanville Dunes.

Horses currently use trails in the southern section of the Dunes to access the beach (Figure 13). Horses have the potential to cause the same negative impacts as grazing animals. Taylor[48] identified that trails running parallel to the dunes (ie north to south) are a significant threat, and should be discontinued, whereas the east-west trails used for beach access may be of less concern. However, the northern-most of the horse trails noted during the current study shows significant deep erosion, which is likely to cause long term impacts on the vegetation in the vicinity of the trail.

Figure 13: Impacts of horse trails in the dunes. Top left: fresh horse dung, which may spread weed seed. Top right: east-west trail through the dunes, showing substantial deep erosion. The She-oak (*Allocasuarina verticillata*) to the left of the track has many of its roots exposed, which is likely to compromise its long term survival. Bottom left : trail at the back of the southern end of the dunes. Bottom right: more than one trail exists in some sections, increasing impacts.

5.7 Erosion

Dune systems are easily exposed to erosion, particularly if the vegetation that helps bind the soil is damaged or removed. Aerial photography from 1949 shows that there were many more blowouts in the dune system at that time, most likely caused by ongoing grazing pressure (Figure 3). As previously discussed, management of pedestrian access, horses and grazing animals is required to help prevent ongoing issues with erosion within the dunes. Currently there is one main area where a significant dune blowout is occurring towards the southern end of the site. However, management intervention has been very successful in helping to stabilise this area. Fencing, based upon a series of connected square-shaped sections, along with a fence along the incipient dune was commenced in 2007. Revegetation undertaken in this area has largely been successful (Figure 14).

[48] Taylor, R. (1997). An Integrated Weed Strategy for the Normanville Sand Dunes. A report prepared for the District Council of Yankalilla.

Figure 14: Box fencing which has proved succcesful in helping reduce erosion and increase native plant cover

5.8 Death of tree species and lack of regeneration

Whilst perhaps more a symptom than a threat in itself, the overstorey dominants in the woodland areas (*Acacia uncifolia, Allocasuarina verticillata*) are clearly dying at a faster rate than they are regenerating (refer to Figure 15 for an indicative photograph). A loss of this open overstorey layer would reduce the available habitats for woodland birds, and greatly change the nature of the Dunes. Possible causes include old age, extended periods of low rainfall, and competition with introduced species. Supplementary planting of these species may be required.

5.9 Note regarding climate change

Climate change is an overarching threat that may exacerbate many of the aforementioned threats. Caton et al (2007) note that "Changing climatic trends shown by the current records constitute a stress factor for natural and semi-natural habitats within coastal Fleurieu region."

It is expected that the current mean sea level rise of 3mm/year in the region will accelerate over the next 50-100 years. Increases in mean annual temperatures and a corresponding decrease in annual rainfall for coastal areas are also forecast.

The following information has been taken from the SFCAP and summarises the threats which may be posed by climate change at Normanville Dunes:

- Increasing temperatures and aridity will affect the structure and composition of vegetation communities;

- Reductions in geographic range of species and ecological communities and increased risk of extinction for species that are already vulnerable;
- Increasing CO_2 concentrations may impact on germination, establishment, growth and regeneration of native species;
- Highly invasive exotic plant and animal species may become more dominant;
- Beach recession and foredune erosion may be exacerbated

This plan has been written with reference to these predicted changes, and aims to build the resilience of natural systems in the Dunes area to be able to cope with the impacts of climate change.

Figure 15: Dieback of Allocasuarina verticillata and Acacia uncifolia in some of the woodland sections of the Dunes

6 Biodiversity management strategies

6.1 Biodiversity management objectives

The biodiversity management objectives for Normanville Dunes are to manage the native vegetation of the reserve in such a manner as to:

- Prevent any further loss of biodiversity; and
- Strengthen the long term viability of the existing biodiversity assets.

In order to monitor whether these objectives are being met, the Bushland Rapid Assessment Technique (BushRAT) was used as part of this project. This methodology, which has been developed by the Native Vegetation Management Unit (SA Dept Environment, Water & Natural Resources), gathers data on bushland conditionand the BushRAT monitoring data collected as part of this project is summarised in Appendix 3.

6.2 Management units

To facilitate the ongoing management of threats to biodiversity at Normanville Dunes (most notably weed and pest animal control), the park has been divided into management units (Table 10, Figure 16). Delineation of management units or zones is based largely on the type and condition of vegetation present.

Table 10. Normanville Dunes Management Units

Management Unit	Description
1	Coastal Foredune
2	Dune shrubland between Bungala Creek and Carrackalinga Creek
3a	Northern end previously mined woodland area
3b	Southern end previously mined woodland area
4	Disturbed area adjacent housing
5	Open dune shrubland immediately south Bungala Creek
6	Dune shrubland southern section
7	Dune woodland southern section
8	Open area west of Beachside Caravan Park
9	Red Gum/Pink Gum woodland
10	Degraded Pine woodland adjacent Yankalilla Creek
11a	Open dune shrubland adjacent Yankalilla Creek – southern section
11b	Open dune shrubland adjacent Yankalilla Creek – northern section

Figure 16: Management Units delineated for Normanville Dunes. Management units are based largely on the type and condition of vegetation present. Note the Management Units are essentially numbered from north to south.

6.3 Managing weeds

Weed management is a key priority to help retain the biodiversity values in the Dunes. There are many weed species present that are a high priority for control, as they are actively invading remnant native vegetation and displacing or choking out native plant species:

- ***Asparagus asparagoides* - Bridal Creeper** – this species is widely distributed throughout the dunes, being present in all of the remnant vegetation areas assessed. Whilst its coverage was generally low, it needs to be a priority for control as it has the potential to choke out and suffocate native plant species. Mechanisms for control include spraying with biological control agents (rust and leaf hoppers), spot spraying with herbicide and hand-digging seedlings.
- ***Lycium ferocissimum* – Boxthorn –** this species is widely distributed through the dunes, being present in all remnant vegetation areas, albeit at relatively low levels generally. It is likely to be an ongoing problem as its seed is spread by birds, so the seed source can come from outside the Dunes area. This species can also form a protective barrier for feral pests such as rabbits and foxes. It is particularly prevalent in the Red Gum/ Pink Gum woodland area (Figures 17,20a).

Figure 17: Large Boxthorn (front) in the Red Gum woodland in the northern section of the dunes. Removal of these larger specimens, including on boundaries, is likely to lessen the long term impacts of this species and reduce ongoing management requirements.

- ***Olea europea* – Olive –** present in most of the remnant vegetation areas, albeit sparsely in some. Previous control has been undertaken, but some are re-sprouting. The seed is spread by birds, so even if mature specimens are removed, ongoing vigilance for new seedlings is required. There is significant stands of mature olives close to the eastern boundary in the southern and northern section (Figure 20a), and at the rear of the Jetty Caravan Park.

Figure 18: Mature Olive in the northern section of the dunes. Removal of these larger specimens, including on boundaries, is likely to lessen the long term impacts of this species and reduce ongoing management requirements.

- ***Leptospermum laevigatum* – Coast Tea-tree –** present as scattered individuals, but has the ability to spread through the dune and woodland habitats of the Dunes. Could be relatively easily controlled now before it spreads further.
- ***Rosa canina* – Dog Rose -** particularly abundant in the degraded Pine woodland adjacent the Yankalilla Creek (Figure 19). Appears to be primarily a weed control issue in the woodland areas (Figure 20a), as does not appear to spread readily through the low fertility dune sands.

Figure 19: Dog Rose in the disturbed Pine woodland at the southern end of the Dunes adjacent to Yankalilla Creek.

- ***Arctotis stoechadifolia* - White Arctotis and *Argyranthemum frutescens ssp. foeniculaceum* - Teneriffe Daisy** – whilst only present at relatively low levels, these garden escapes have the capacity to spread widely through the dune system and so should be controlled as a priority. Principally present in Management Unit 3b.
- ***Rhamnus alaternus*** – **Buckthorn –** was noted as a priority in Taylor (1997)[49], and is recognised as an oppressive invader in Southern Fleurieu Dune areas. Virtually eradicated from the dune area, but its presence needs to be monitored.
- ***Ehrhartya calycina*** – **Perennial Veldt Grass and *Ammophila arenaria* - Marram Grass**. These perennial grassy weeds thrive in sandy habitats, and are beneficial as a sand binder[50]. One or both species are present throughout the Dunes, other than at the southern end. Veldt grass is particularly prolific (Figure 20a).
- ***Oxalis pes-caprae* – Soursob.** Soursob is prolific throughout the dunes, especially in the woodland areas (Figure 20b), but is generally only evident in winter and early spring. The existing Weed Strategy notes the presence of Soursob, but makes no indication as to its density at that time. Broad scale management would be extremely costly due to the scale of the issue. At this time, it is recommended that areas where management intervention is

[49] Taylor, R. (1997). An Integrated Weed Strategy for the Normanville Sand Dunes. A report prepared for the District Council of Yankalilla.

[50] Taylor, R. (1997). An Integrated Weed Strategy for the Normanville Sand Dunes. A report prepared for the District Council of Yankalilla.

being undertaken (such as revegetation) are a focus for local treatment of this weed, horse and pedestrian trails are consolidated to help prevent spread, and any new biological control methods are investigated as appropriate.

- ***Melaleuca armillaris* - Bracelet Honey-myrtle*, Acacia saligna* - Golden Wreath Wattle*, Leptospermum laevigatum* - Coast Tea-tree*, Pinus spp* – Pines.** These species have been planted into the Dunes, with *Pinus spp.* at the southern end adjacent Yankalilla Creek and the others in the area revegetated following mining activities (Figure 20b). Whilst none are spreading prolifically, they should be a long term target for removal. Along the track between Management Unit 3a and 3b these species (particularly *Melaleuca armillaris*) form a thick vegetative cover that would help prevent unwanted pedestrian access into the Dune area. It is recommended that these specimens are left in place along the track and shrubby natives are planted behind them. When these planted natives reach sufficient size to provide a similar protective barrier, the *Melaleuca armillaris* could be removed.
- ***Acacia cyclops* – Western Coastal Wattle.** There has been targeted control for this species already in the dunes, and it is present at extremely low numbers[51]. However, it is present in adjoining properties, and has the capacity to spread throughout coastal habitats. Ongoing vigilance and control is recommended.

Source areas for Olives, Dog Rose and Boxthorn

Olives, Dog Rose and Boxthorn are all spread by birds. There are three key areas within or adjacent to the Normanville Dunes that have a high to very high cover of these species that would act as an ongoing source of seed that could potentially be spread by birds into the Dunes (Figure 20b). There are also scattered individuals within the Beachside Caravan Park. It is recommended that the possibility of removing these individuals is investigated, to help lessen the ongoing amount of seed being transported into the Dunes. This may require a co-operative effort with current landholders, as some of these areas are on private land.

Other weeds which are also a high priority for control over the next 5 years are included in the Biodiversity Action Plan table in Section 8.

[51] Corey Jackson pers. comm.

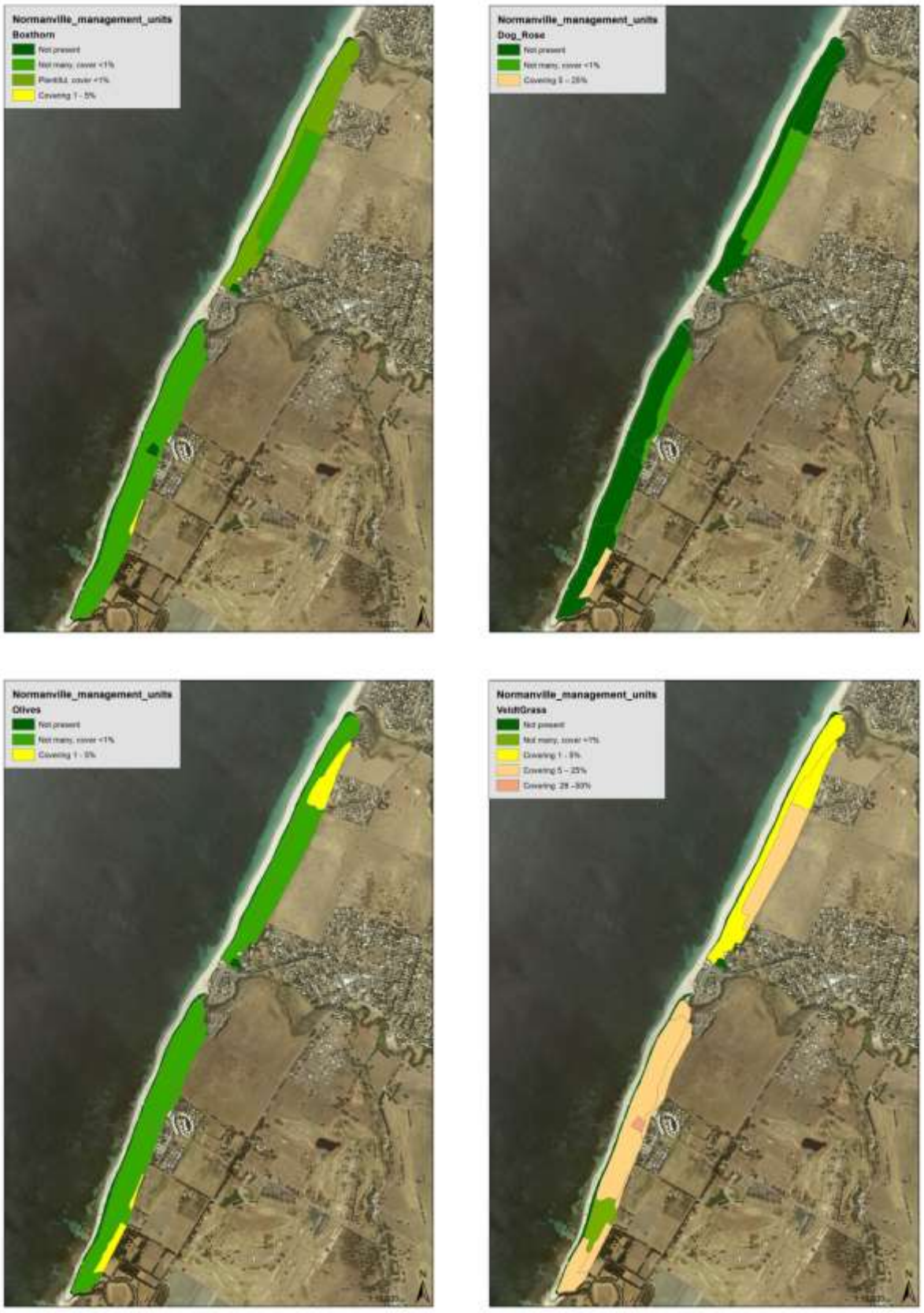


Figure 20a: Weed densities by managent unit for Boxthorn (top left), Dog Rose (top right), Olives (bottom left) and Perennial Veldt Grass (bottom right).

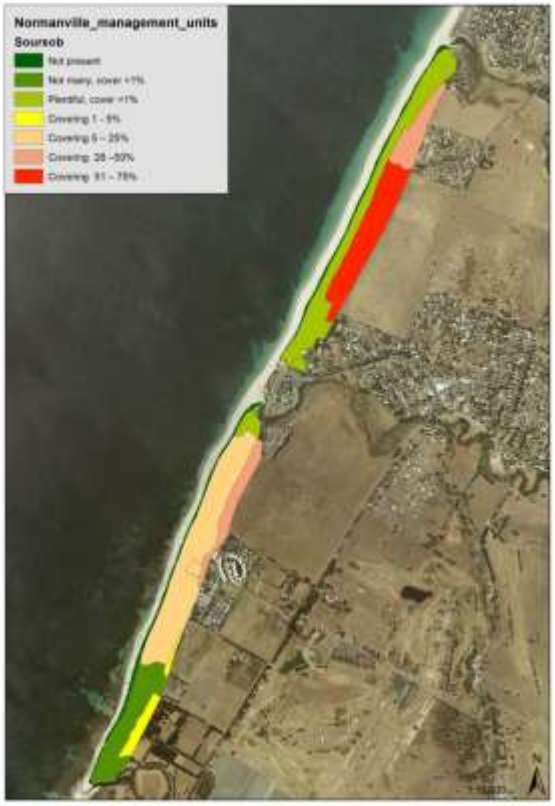


Figure 20b: Weed densities by managent unit for other woody weeds (*Melaleuca armillaris* - Bracelet Honey-myrtle, *Acacia saligna* - Golden Wreath Wattle, *Leptospermum laevigatum* - Coast Tea-tree, *Pinus spp* – Pines) (top left), Soursobs (bottom left). Top right shows key source areas for weeds spread by birds (Olives, Boxthorn, Dog Rose). Bottom right shows *Melaleuca armillaris* providing a shield that would help keep pedestrians out of the Dune area.

6.4 Managing pest animals

At present rabbits are controlled intermittently in the dunes to the immediate south of the the Jetty Caravan Park. They appear to be a problem through much of the dunes, although few warren systems were noted. This may indicate many of the rabbits are using the cover and structure offered by shrubs as areas to shelter and breed rather than warren systems. A survey of rabbit abundance was conducted on the 3rd of September 2015 using the methodology of Mutze *et al*[52, 53], which indicated that rabbit density was 0.84 rabbits per hectare (refer Appendix 6 for a full description of methods and results). At this level, rabbits are likely to be impacting on native flora, especially highly palatable plants[54]. It is recommended that rabbit control is continued to help reduce grazing pressure.

Fox scats were noted in the Dunes, and whilst no signs or observations of cats were made, it is likely they are present. The Dunes provide habitat for species such as the State Vulnerable Hooded Plover which nests on the ground and is at risk of predation by foxes and cats. As such, control of these feral species should be a priority. Baiting for foxes is problematic, as the close proximity of houses and caravan parks means exposure of domestic dogs to the poisons used in the baits would be possible. It is therefore recommended that fox dens/rabbit warrens are mapped and fumigated.

6.5 Managing unwanted stock access

As noted previously, there have been occasions where grazing animals have penetrated the dune boundary fencing and entered the Dune area from the east. Figure 21 shows the condition of the fencing in areas adjoining grazing land. It is recommended that areas shown in red have new fencing installed, and areas shown as green have fencing maintenance conducted to ensure stock cannot enter the dune area.

6.6 Managing land use use conflicts – people and recreation

Overall the management of foot traffic through the dunes has been successful, with most pedestrians using the trails marked on Figure 22. Two sections of trail are recommended to be closed - along the edge of the Bungala Creek to the south, and an unconsolidated trail (that appears to be primarily used by horses) to the west of the Beachside Caravan Park (Figure 22).

Ongoing use of horse trails through and along the back of the dunes is a biodiversity management issue. The depth and uneven nature of the horse trails may also be a risk to pedestrians – on at least one occasion a local resident has sustained injury due to the depth of the tracks created by horses[55]. It is suggested that ongoing damage could be minimised by using a consolidated shared use track as per Figure 23 to access the beach, and the use of the north-south trail at the back of the dunes could be discontinued. The shared use trail traverses an area of more degraded habitat, and has a pre-existing aggregate surface for most of its length, which would lessen erosion. Whilst this may require some infrastructure work to ensure that there are no issues with pedestrian and horse

[52] Mutze, G., Cooke, B., Lethbridge, M. and Jennings, S. (2014). A rapid survey method for estimating population density of European rabbits living in native vegetation. The Rangelands Journal 36, 239-247.
[53] Mutze, G., Cooke, B. and Jennings, S. (in prep.). Demonstrating relationships between density of European rabbits and damage to Australian native vegetation.
[54] Mutze, G., Cooke, B. and Jennings, S. (in prep.). Demonstrating relationships between density of European rabbits and damage to Australian native vegetation.
[55] Corey Jackson, pers. comm.

interactions, it would help minimise the impacts on the dunes whilst still maintaining the ability for horses to be able to access the beach through the dune area.

Figure 21: Condition of fences that adjoin agricultural land. It is recommended that all fences are completely stock proof to help prevent ongoing negative impacts on the Dunes.

Figure 22: Pedestrian access routes through the Normanville Dunes. It is recommended that the trails marked in red are closed to prevent ongoing impacts.

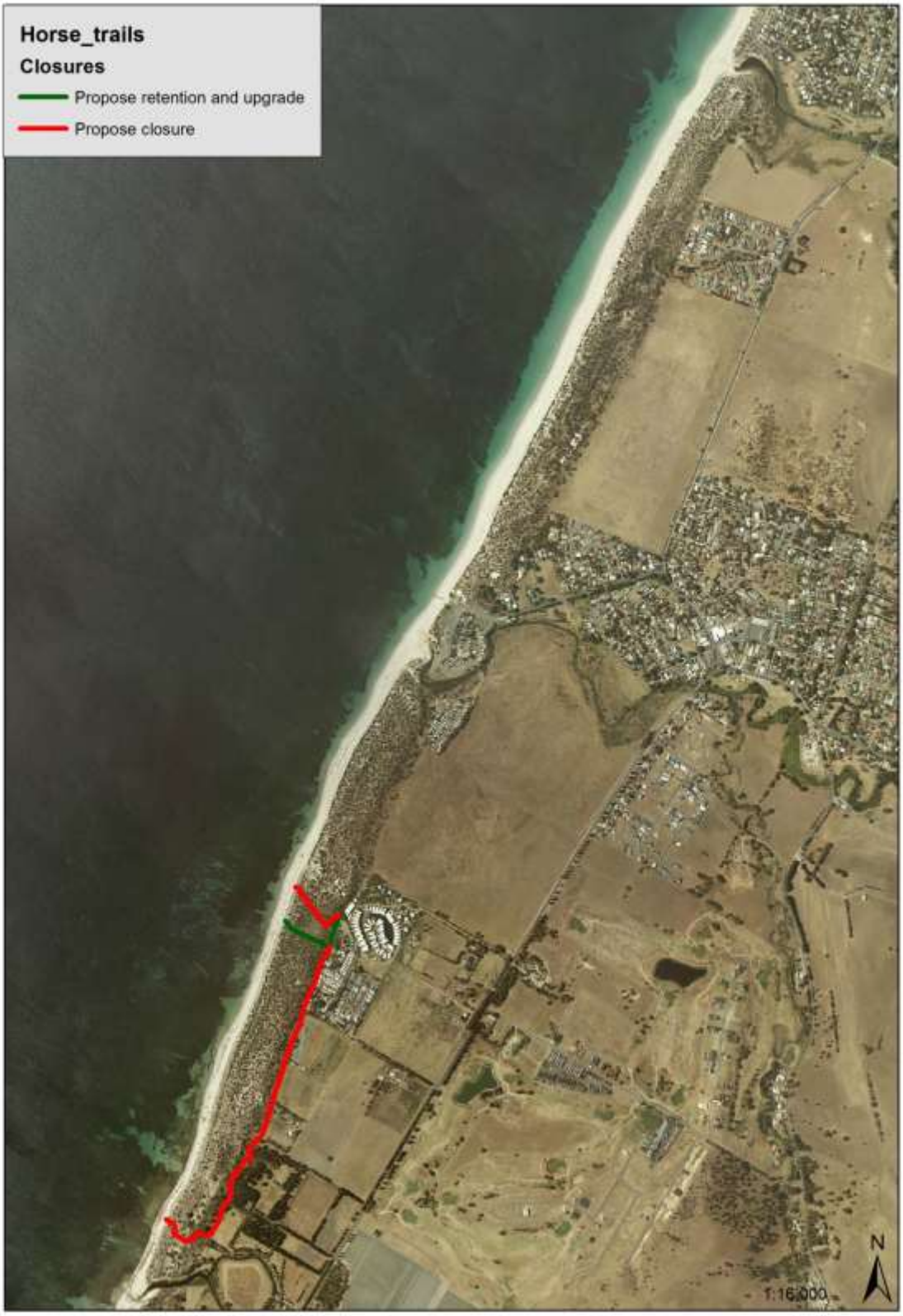


Figure 23: Horse access routes through the Normanville Dunes. It is recommended that the trails marked in red are closed to prevent ongoing impacts.

6.7 Revegetation

It is recommended that revegetation efforts at Normanville Dunes should focus upon supplementing existing habitat, using appropriate species for the vegetation community and planting at appropriate (natural) densities. In the foredune and dune shrubland areas, the vegetation already present in the dune system provides a good benchmark for the appropriate target structure and floristic composition. The hind-dune woodland areas have been modified in the past, and so the densities and species provided in Table 11 aim to recreate a woodland structure that may represent the type and diversity of species that was once present in the area. It should be noted these calculations are based upon a target of adult plants per hectare – any substantial death of tubestock may require further supplementary plantings. Key focus areas for revegetation activities (some of which are already underway) are shown in Figure 24.

In addition to this revegetation using a suite of species, it is also apparent that the overstorey dominants in the woodland areas (*Acacia uncifolia, Allocasuarina verticillata*) are dying at a faster rate than they are regenerating. This open woodland habitat at the back of the dunes is a key feature of the Normanville Dunes, and would provide important habitat for woodland birds in an otherwise denuded landscape. For this reason, supplementary planting at a density of approximately 100 plants per hectare is recommended through these areas.

Table 11: Revegetation plant list, Normanville Dunes

Scientific name	Common name	Form	Foredune	Dune shrubland	Woodland
Acacia cupularis	Cup Wattle	Medium shrub		40	
Acacia longifolia ssp. sophorae	Coastal Wattle	Large shrub	40	40	
Acacia pycnantha	Golden Wattle	Small tree			20
Acacia uncifolia	Coast Silver Wattle	Small tree			100
Adriana quadripartita	Coast Bitter-bush	Medium shrub		40	20
Allocasuarina verticillata	Drooping Sheoak	Small tree			100
Alyxia buxifolia	Sea Box	Medium shrub		40	20
Atriplex cinerea	Coast Saltbush	Medium shrub	40	40	20
Austrostipa flavescens	Coast Spear-grass	Tussock Grass		200	200
Austrostipa scabra ssp. falcata	Slender Spear-grass	Tussock Grass		200	200
Bursaria spinosa ssp. spinosa	Sweet Bursaria	Large shrub			100
Carpobrotus rossii	Native Pigface	Mat plant	200	200	
Dianella brevicaulis	Short-stem Flax-lily	Tussock plant		200	200
Enchylaena tomentosa var. tomentosa	Ruby Saltbush	Small shrub		200	200
Ficinia nodosa	Knobby Club-rush	Tussock plant	400	400	
Kennedia prostrata	Scarlet Runner	Mat plant		50	50
Kunzea pomifera	Muntries	Mat plant		200	100
Lepidosperma gladiatum	Coast Sword-sedge	Tussock plant		200	200
Leucophyta brownii	Coast Cushion Bush	Small shrub		100	
Leucopogon parviflorus	Coast Beard-heath	Medium shrub		100	40
Melaleuca lanceolata	Dryland Tea-tree	Large shrub / small tree		20	
Muehlenbeckia gunnii	Coastal Climbing Lignum	Vine/twiner		100	50
Myoporum insulare	Common Boobialla	Large shrub	40	40	
Olearia axillaris	Coast Daisy-bush	Medium shrub	100	100	40
Pelargonium australe	Austral Stork's-bill	Herb		200	200
Pimelea serpyllifolia ssp. serpyllifolia	Thyme Riceflower	Small shrub		150	150
Poa poiformis var. poiformis	Coast Tussock-grass	Tussock grass		400	400
Rhagodia candolleana ssp. candolleana	Sea-berry Saltbush	Medium shrub		200	100
Santalum acuminatum	Quandong	Small tree		50	50
Scaevola crassifolia	Cushion Fanflower	Medium shrub		40	40
Senecio pinnatifolius var. maritimus	Variable Groundsel	Herb		200	200
Spinifex hirsutus	Rolling Spinifex	Grass	4000	200	
Tetragonia implexicoma	Bower Spinach	Vine/twiner		100	50
Threlkeldia diffusa	Coast Bonefruit	Small shrub		150	150

Figure 24: Key focus areas for revegetation activity (focussing on provision of a broad suite of species).

Figure 25: Areas where revegetation should focus upon provision of overstorey woodland species (*Acacia uncifolia, Allocasuarina verticillata*)

7 Monitoring

7.1 Bushland Rapid Assessment Technique (BushRAT)

As part of this project, the Bushland Rapid Assessment Technique (BushRAT) was used as a method to monitor the progress and success of management actions over time. BushRAT's were undertaken within each vegetation community at Normanville Dunes and the results are included in Appendix 3.

BushRAT assessments are useful as they are rapid and can be easily repeated over time to indicate changes in native plant species diversity, weed cover, regeneration, grazing pressure, etc. Use of the protocol not only provides managers with a way to show the positive impact they might be having on their bushland's condition but it also raises their awareness of the vital natural processes going on in the bush and how to detect the early warning signs of threatening processes. Data from individual monitoring sites can also be collated on a regional basis with NVC data to provide better information on the condition and trends in native vegetation.

The BushRAT data has been used to set relevant milestones and targets in the Action Plan which is included in Section 8. It is recommended that the BushRATs undertaken in 2015/2016 be repeated at Normanville Dunes every five years to monitor the progress and success of management actions.

7.2 Photopoints

Simple, repeatable photo points could be used as a mechanism to provide a visual illustration of changes over time. Photopoints have been established as part of the BushRAT and the GPS coordinates are included in Table 12. Photographs are shown in Appendix 3.

Table 12. Photopoint locations established at Normanville Dunes 2015-2016.

Management Unit	Management Unit Description	Vegetation Community	Easting	Northing	Direction
1	Coastal Foredune	*Euphorbia paralias, Thinopyrum junceiforme grassland* with emergent *Olearia axillaris, Acacia longifolia ssp. sophorae ± Leucophyta brownii*	254953	6072728	S
2	Dune shrubland between Bungala Creek and Carrackalinga Creek	*Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae* ± *Melaleuca lanceolata* shrubland	255911	6074602	SSW
2	Dune shrubland between Bungala Creek and Carrackalinga Creek	*Melaleuca lanceolata* ± *Olearia axillaris* shrubland	256047	6074881	S
3a	Northern end previously mined woodland area	*Acacia uncifolia, Allocasuarina verticillata, *Melaleuca armillaris* open woodland	256460	6075558	SW
3b	Southern end previously mined woodland area	*Acacia uncifolia, Allocasuarina verticillata, *Melaleuca armillaris* open woodland	256200	6075107	SSW
4	Disturbed area	*Pinus* spp. woodland	255843	6074195	NW

Management Unit	Management Unit Description	Vegetation Community	Easting	Northing	Direction
	adjacent housing				
5	Open dune shrubland immediately south Bungala Creek	*Acacia longifolia ssp. sophorae, Olearia axillaris ± Leucopogon parviflorus* shrubland	255526	6073915	S
6	Dune shrubland southern section	*Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae ± Allocasuarina verticillata* shrubland	255501	6073830	S
7	Dune woodland southern section	*Allocasuarina verticillata, Acacia uncifolia* very open woodland	255466	6073582	S
8	Open area west of Beachside Caravan Park	**Ehrharta calycina* grassland with emergent *Myoporum insulare, Adriana quadripartita, Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae*	255239	6073136	S
9	Red/Pink Gum woodland	*Eucalyptus camaldulensis, Eucalyptus fasciculosa* woodland	255151	6072769	S
10	Degraded woodland adjacent Yankalilla Creek	**Pinus halepensis ± Allocasuarina verticillata woodland*	254996	6072341	SSW
11a	Open dune shrubland adjacent Yankalilla Creek – southern section	*Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae* open shrubland	254813	6072255	SSW
11b	Open dune shrubland adjacent Yankalilla Creek – northern section	*Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae* open shrubland	254990	6072594	SSW

7.3 Bushland Condition Monitoring

Four Bushland Condition Monitoring sites[56] have been established by the Adelaide and Mount Lofty Ranges Natural Resources Management Board, as part of regional monitoring processes. Site reports for each of these are provided in Appendix 7. It is recommended that data continues to be collected from these sites, to both provide information on regional scale change, but also to provide an indication of the success of ongoing management interventions in a broader sense.

[56] As per Croft, S.J., J.A. Pedler & T.I. Milne (2005) Bushland Condition Monitoring Manual: Southern Mount Lofty Ranges. Nature Conservation Society of SA Inc., Adelaide.

8 BIODIVERSITY ACTION PLAN

The table below lists the biodiversity management threats/issues for Normanville Dunes, their related objectives, actions already taken to address them, and further actions being proposed. Note that weeds which have been targeted for control over the next 5 years are based on the priorities as described in the Integrated Weed Management Strategy for Normanville Dunes and high threat weeds recorded as part of this project.

ISSUE/THREAT	5-Yr Objective / Milestone	Actions to date – what/ who	Proposed actions - what/ where/how	Priority (H, M, L)	Who Responsible
Priority weeds for control					
Olea europea - Olive, *Lycium ferocissimum*- Boxthorn	Eradicate all mature individuals from Normanville Dunes. Continue to treat emergent seedlings.	Previous control for *Olea europeaea* has been undertaken, but some are re-sprouting. *Lycium ferocissimum* treated late 2015. *Acacia saligna* has been treated in previously mined area. Scattered individuals of *Leptospermum laevigatum* can be found in the dunes.	Mark all mature plants and treat with Garlon 600 mixed with diesel 1:30 through cut and swab or drill and fill. Patrol dunes and remove seedlings upon discovery – grub, cut & swab, or spray with roundup.	VH	Council, NRAMLR , Contractor
Garden escapes (*Arctotis stoechadifolia, Argyranthemum frutescens, Artemisia arborescens Ferraria crispa Gazania linearis, Geranium spp.*)	Eradicate from dunes	These have been the subject of ongoing weed control. Nearby landholders have removed Gazania from areas adjacent to dunes. Few specimens still remain.	All garden escapes to be treated. Treat with Glyphosate 360g/L at a rate of 1:100.	H	Council, NRAMLR
Ehrharta calycina - Perennial Veldt Grass	Prevent incursion into management zone 11a.	No broadscale control undertaken to date.	Use boundaries defined in Figure 20a to check in 2018 whether spread is occurring. If so, treat this area with slash and follow-up spray using Glyphosate in areas where there is no potential for off-target damage and Fusillade where there is. Where the veldt grass is small it should be sprayed (no slashing required). Follow-up in areas previously treated may require careful cut & swab.	H	Council, NRAMLR , Contractor

ISSUE/THREAT	5-Yr Objective / Milestone	Actions to date – what/ who	Proposed actions - what/ where/how	Priority (H, M, L)	Who Responsible
Bridal Creeper	Reduce or contain infestations to following target cover: All Management Zones = few individuals cover < 1%	No broadscale control undertaken to date.	In areas clear of native vegetation – spray with Glyphosate 360g/L and Pulse or grub. Where Bridal Creeper is growing on/through native vegetation (and doesn't already have Rust on it) –spray with Rust. Small seedlings growing in amongst native vegetation to be grubbed (if possible)	H	Council, NRAMLR , Contractor
New weed incursions	No new weeds in dunes.	Ongoing vigilance by Council/NRAMLR staff for any new weed incursions. Some areas of high threat weeds (eg *Gazania linearis*) have been removed from adjoining properties as a result of work done by Council/NRAMLR staff.	Continue ongoing vigilance by NRAMLR/Council staff for any new weed incursions into the Dunes. Continue vigilance for high threat coastal weeds in adjoining gardens / Caravan Park areas. Provide resource and educational materials to landholders as appropriate.	H	Council, NRAMLR, Contractor
Acacia cyclops – Western Coastal Wattle	Eradicate from dunes	This has been a target species for control, and is currently a low number of immature individuals.	Continue vigilance for presence in dunes and in adjoining gardens / Caravan Park areas. Provide resource and educational materials to landholders as appropriate. Mark all mature plants and treat with Garlon 600 mixed with diesel 1:30 through cut and swab or drill and fill. Patrol dunes and remove seedlings upon discovery – grub, cut & swab, or spray with Glyphosate.	H	Council, NRAMLR , Contractor
Olea europea on adjacent properties	Mature individuals removed from adjoining properties (northern section, Jetty Caravan Park).	No actions to date.	Discuss removal options with landowners. Remove if possible. Provide native plant alternatives (eg *Allocasuarina verticillata, Acacia uncifolia*). Treat Olives with Garlon 600 mixed with diesel 1:30 through cut and swab or drill and fill.	M	Landowners, contractor
Melaleuca armillaris - Bracelet Honey-myrtle, *Acacia saligna* - Golden	Eradicate all mature individuals from Normanville Dunes.	Some staged removal of plants used for mine site rehabilitation has already been undertaken, being mindful of retaining structure and cover by revegetating with more appropriate species.	In Management Zone 3a and 3b – adjacent to access track to beach – plant native species prior to removal of mature weedy species, to ensure cover is retained and to help stop people leaving the trail to the beach. Commence revegetation 2016 and aim for removal by 2020.	M	Council NRAMLR

ISSUE/THREAT	5-Yr Objective / Milestone	Actions to date – what/ who	Proposed actions - what/ where/how	Priority (H, M, L)	Who Responsible
Wreath Wattle, *Leptospermum laevigatum* - Coast Tea-tree			Mark all mature plants and treat with Garlon 600 mixed with diesel 1:30 through cut and swab or drill and fill. Patrol dunes and remove seedlings upon discovery – grub, cut & swab, or spray with Glyphosate.		
Rosa canina – Dog Rose	Eradicate all mature individuals from Normanville Dunes.	Some work has commenced to remove from the area at the southern end of the dunes (Management Zone 10). Has been controlled in other woodland areas (Zones 3a, 3b, 7).	Mark all mature plants and treat with Garlon 600 mixed with diesel 1:30 through cut and swab or drill and fill.	M	Council NRAMLR
Oxalis pes-caprae - Soursob	Infestations not compromising revegetation activities. No increase in spread or cover.	Localised spraying of soursobs in revegetation areas prior to planting. Trail consolidation has, and will continue, to help prevent vegetative spread.	Spot-spraying just prior to or early in flowering period. Repeat applications over a 2-5 year period may be necessary	M	Contractor
Other priority weeds: *Dittrichia graveolens, Euphorbia terracina, Echium plantagineum, Solanum nigrum*	Maintain at or below scattered indiduals at <1% cover across all management units	No action to date	Spray / grub opportunistically. Treat as per Integrated Weed Strategy.	L/M	Council Contractor
Access and fencing					
Damage from unconsolidated pedestrian trails	No new trails in Dune area (as detected through aerial photography).	This has been a focus of activity. Pedestrian access is now confined to four main trails.	Continue vigilance for new trails. Ensure signage to indicate issues is in good repair. Ensure fencing along sides of trails remains in good repair.	H	Council

ISSUE/THREAT	5-Yr Objective / Milestone	Actions to date – what/ who	Proposed actions - what/ where/how	Priority (H, M, L)	Who Responsible
Grazing animals from adjacent properties	New fencing in marked sections along eastern edge. All fencing maintained at a level to prevent stock access. No reported stock incursions.	Existing fencing was repaired (new wires) in 2015 for some sections[57].	Negotiate with adjoining landholder for new fencing to be installed along section to the south of the Jetty Caravan Park. Negotiate with adjoining landholder to ensure other sections of fencing are suitably maintained.	H	Council, landowner
Damage from horse trails	Consolidate to one main beach access trail. No other horse trails being used.		Communicate directly with adjoining property owners regarding horse trail closure. Fence off as required. Investigate and implement a shared use trail as per Figure 23. Install signage to raise awareness of issues.	H	Council
Pest animals					
Rabbits	Reduce rabbit numbers/density to < 0.5 per hectare in monitored area. Anecdotal evidence that rabbit density has decreased.	Rabbits were baited in dunes south of the Jetty Caravan Park in 2015/16.	Utilise appropriate human resources (eg Green Army team) to traverse the dunes and map rabbit warrens. Employ contractor to fumigate warrens. Continue rabbit baiting program.	VH	Council, contractor
Foxes	No active fox dens.		Utilise appropriate human resources (eg Green Army team) to traverse the dunes and map fox dens. Employ contractor to fumigate warrens. Continue rabbit baiting program.	H	Council, contractor

[57] Corey Jackson, pers. comm.

ISSUE/THREAT	5-Yr Objective / Milestone	Actions to date – what/ who	Proposed actions - what/ where/how	Priority (H, M, L)	Who Responsible
Stray and domestic cats	Anecdotal evidence suggests that cat numbers have reduced	-	Managers investigate options for effective control, i.e. signage, fines	M	Council
Dogs	No evidence of dog tracks within Dunes.	Signage re control of dogs in the dunes at strategic locations throughout the dunes. Several dog litter stations installed at strategic locations throughout the dunes.	Installation of signs which include why dogs need to be on leash at all times.	M	Council
Kangaroos	Kangaroo numbers are not negatively impacting on management activities (eg revegetation).	No actions to date as not currently considered a management issue.	Council staff anecdotally monitor kangaroo numbers and impacts on native vegetation and revegetation. If numbers are considered to be excessive, hold discussions with NRAMLR regarding control options.	M	Council, NRAMLR
Erosion					
	Reduced level of erosion as evidenced by aerial photography analysis.	Trails have been fairly well consolidated but there is still unconsolidated trail use south of the Beachside Caravan Park, particularly by horses.	Refer "Access and Fencing" above		
Revegetation					
	Increase species richness (R) and structural diversity (SD)[58] in revegetation areas (Figure 24) to the following levels: Foredune: R>6, SD>8	Some revegetation has been undertaken in degraded areas.	Continue supplementary planting, with densities and species appropriate for the habitat type.	M	NRAMLR, Council

[58] Based on scoring as per the BushRAT methodology

ISSUE/THREAT	5-Yr Objective / Milestone	Actions to date – what/ who	Proposed actions - what/ where/how	Priority (H, M, L)	Who Responsible
	Shrubland: R>20, SD >18 Woodland: R>25, SD>20				
	Open woodland structure (cover 10-40% of small trees) maintained/improved in Management Zones 3a, 3b, 7.	Some revegetation has already been undertaken.	Plant out She-oaks (*Allocasuarina verticillata*) and Coast Silver Wattle (*Acacia uncifolia*) to maintain woodland structure (10-40% cover). Suggested planting density is 100-200 plants per hectare.	H	NRAMLR, Council
Monitoring					
	Progress and success of works undertaken is monitored on an ongoing and regular basis. Plan reviewed on this basis at end of 5 years.	BushRATs undertaken in each Management Zone as part of this project (see Appendix 6)	Re-do BushRATs in each Management Zone every 3-5 years	M	Contractor
		Ongoing data gathered in four Bushland Condition Monitoring sites	Repeat BCM sites (including photopoints) previously established prior to Plan review.	M	NRAMLR
		Rabbit monitoring undertaken in September 2015 as part of this project	Repeat rabbit monitoring annually	M	Contractor

NRAMLR: Natural Resources Adelaide and Mount Lofty Ranges

Appendix 1: Plant species lists

NATIVE PLANT SPECIES – NORMANVILLE DUNES

Note: Plant lists for management units are based upon a 2 hectare search around the photopoint.

*Conservation Status

AUS = Australia *EPBC Act 1999*: CR = Critically Endangered, EN = Endangered, VU = Vulnerable

SA = South Australia *NPW Act 1972:* E = Endangered, V = Vulnerable, R = Rare

AMLR = Adelaide and Mount Lofty Botanical Region:[59] CR = Critically Endangered**,** EN=Endangered, VU=Vulnerable, R=Rare, NT = Near Threatened

Species name	Common name	Rating			Management Unit												
		AUS	SA	AMLR	1	2	2*	3a	3b	5	6	7	8	9	10	11a	11b
Acacia cupularis	Cup Wattle			R													
Acacia ligulata	Umbrella Bush			R					1								
Acacia longifolia ssp. sophorae	Coastal Wattle				1	1		1	1	1	1	1	1	1	1	1	1
Acacia pycnantha	Golden Wattle								1								
Acacia uncifolia	Coast Silver Wattle			VU				1	1			1					
Adriana quadripartita	Coast Bitter-bush			R									1				
Allocasuarina verticillata	Drooping Sheoak							1	1		1	1			1	1	1
Alyxia buxifolia	Sea Box			R		1	1					1					
Arthropodium strictum	Common Vanilla-lily																
Atriplex cinerea	Coast Saltbush				1										1		
Austrostipa flavescens	Coast Spear-grass																
Austrostipa scabra ssp. falcata	Slender Spear-grass																
Banksia marginata	Silver Banksia																
Baumea juncea	Bare Twig-rush																
Boerhavia dominii	Tar-vine																
Bursaria spinosa ssp. spinosa	Sweet Bursaria																
Caladenia latifolia	Pink Caladenia			NT													
Calandrinia brevipedata	Short-stalked Purslane			R		1					1						

[59] Gillam, S. and Urban, R. (2014) Regional Species Conservation Assessment Project, Phase 1 Report: regional Species Status Assessments, Adelaide and Mount Lofty Ranges NRM Region. Dept. of Environment, Water and Natural resources, South Australia.

Species name	Common name	Rating			Management Unit												
Calandrinia calyptrata	Pink Purslane			NT							1						
Calandrinia corrigioloides	Strap Purslane			R													
Calandrinia eremaea	Dryland Purslane			NT		1					1						
Calandrinia granulifera	Pigmy Purslane			NT													
Carex bichenoviana	Notched Sedge			R													
Carpobrotus rossii	Native Pigface					1	1	1		1	1	1	1			1	1
Cassytha pubescens	Downy Dodder-laurel																
Centrolepis strigosa ssp. strigosa	Hairy Centrolepis					1											
Chloris truncata	Windmill Grass																
Clematis microphylla	Old Man's Beard			NE													
Crassula colligata ssp. lamprosperma						1											
Crassula decumbens var. decumbens	Spreading Crassula									1	1						
Crassula sieberiana	Sieber's Crassula			VU													
Crassula sp.	Crassula																
Cyperus vaginatus	Stiff Flat-sedge													1			
Daucus glochidiatus	Native Carrot									1							
Dianella brevicaulis	Short-stem Flax-lily			NT				1	1				1			1	1
Dodonaea viscosa ssp. spatulata	Sticky Hop-bush							1				1					
Dysphania pumilio	Small Crumbweed																
Einadia nutans ssp. nutans	Climbing Saltbush																
Enchylaena tomentosa var. tomentosa	Ruby Saltbush					1	1	1						1		1	1
Eucalyptus camaldulensis ssp. camaldulensis	River Red Gum			NT										1			
Eucalyptus fasciculosa	Pink Gum		R	NT										1			
Eucalyptus leucoxylon ssp. leucoxylon	South Australian Blue Gum			NT													
Euphorbia drummondii																	

Species name	Common name	Rating			Management Unit												
Ficinia nodosa	Knobby Club-rush				1	1	1	1	1	1	1	1	1	1	1	1	1
Juncus kraussii	Sea Rush																
Juncus pallidus	Pale Rush													1			
Juncus subsecundus	Finger Rush													1			
Kennedia prostrata	Scarlet Runner							1									
Kunzea pomifera	Muntries			R		1		1	1	1	1						
Lepidosperma gladiatum	Coast Sword-sedge			NT		1	1	1	1		1	1		1		1	1
Leucophyta brownii	Coast Cushion Bush			NT	1	1	1						1				
Leucopogon parviflorus	Coast Beard-heath			NT		1	1	1	1	1	1	1	1	1	1	1	1
Lythrum hyssopifolia	Lesser Loosestrife																
Melaleuca lanceolata	Dryland Tea-tree			R		1	1	1	1			1					
Muehlenbeckia gunnii	Coastal Climbing Lignum					1	1	1	1	1	1	1	1	1	1	1	1
Myoporum insulare	Common Boobialla			NT		1		1		1		1	1				
Nitraria billardierei	Nitre-bush			R													
Olearia axillaris	Coast Daisy-bush			NT	1	1	1	1	1	1	1	1	1		1	1	1
Parietaria cardiostegia	Mallee Smooth-nettle			R						1	1						
Parietaria debilis	Smooth-nettle																
Pelargonium australe	Austral Stork's-bill			R		1		1			1						
Phragmites australis	Common Reed																
Pimelea serpyllifolia ssp. serpyllifolia	Thyme Riceflower			NT		1		1			1						
Poa poiformis var. poiformis	Coast Tussock-grass																
Portulaca oleracea	Common Purslane																
Rhagodia candolleana ssp. candolleana	Sea-berry Saltbush				1	1	1	1	1	1	1	1	1	1	1	1	1
Rytidosperma caespitosum	Common Wallaby-grass																
Samolus repens	Creeping Brookweed			NT													
Santalum acuminatum	Quandong			R		1	1										
Sarcocornia quinqueflora	Beaded Samphire			NT													

Species name	Common name	Rating			Management Unit													
Scaevola crassifolia	Cushion Fanflower			VU		1		1					1					
Senecio pinnatifolius var. maritimus	Variable Groundsel			R		1		1		1	1						1	1
Setaria constricta	Knotty-butt Paspalidium			NT														
Spinifex hirsutus	Rolling Spinifex					1				1	1						1	1
Sporobolus virginicus	Salt Couch																	
Suaeda australis	Austral Seablite			NT														
Tetragonia implexicoma	Bower Spinach					1	1	1	1	1	1	1		1	1			
Threlkeldia diffusa	Coast Bonefruit			NT	1					1	1						1	1
Triglochin trichophora				VU														

WEED SPECIES NORMANVILLE DUNES Note: Weed lists for management units are based upon a 2 hectare search around the photopoint.

Species name	Common name	Management Unit												
		1	**2**	**2***	**3a**	**3b**	**5**	**6**	**7**	**8**	**9**	**10**	**11a**	**11b**
Acacia longifolia	Sallow Wattle											1		
Acacia saligna	Golden Wreath Wattle				1	1								
Acetosella vulgaris	Sorrel													
Aira cupaniana	Small Hair-grass						1a							
Amaranthus muricatus	Rough-fruit Amaranth													
Ammophila arenaria	Marram Grass	2	1				1a				1a		1a	3
Anagallis arvensis	Pimpernel						1a	1						
Aptenia cordifolia	Heart-leaf Iceplant													
Arctotheca calendula	Cape Weed		1a											
Arctotis stoechadifolia	White Arctotis													
Argyranthemum frutescens ssp. foeniculaceum	Teneriffe Daisy		1											
Artemisia arborescens	Silver Wormwood													
Arundo donax	Giant Reed													
Asparagus asparagoides	Bridal Creeper		1	1	1	1a	1	1	1	1	1a	1a	1	1
Asparagus officinalis	Asparagus													
Atriplex prostrata	Creeping Saltbush													
Avena barbata	Bearded Oat				1a			1a		3		2		
Brassica tournefortii	Wild Turnip		1a	1a	1a	1a								
Briza maxima	Large Quaking-grass						1		1a					
Bromus catharticus	Prairie Grass													
Bromus diandrus	Great Brome									2				
Bromus madritensis	Compact Brome													
Bromus rubens	Red Brome													
Cakile maritima	Two-horned Sea Rocket	1a		1										
Carpobrotus edulis	Hottentot Fig													
Casuarina glauca	Grey Buloak					1								

Species name	Common name	Management Unit												
Cenchrus clandestinus	Kikuyu				1						3			
Cenchrus longisetus	Feather-top													
Cerastium glomeratum	Common Mouse-ear Chickweed						1a	1a						
Cerastium pumilum	Chickweed													
Chenopodium album	Fat Hen													
Cirsium vulgare	Spear Thistle													
Citrullus lanatus	Bitter Melon													
Cotula coronopifolia	Water Buttons													
Cynodon dactylon	Couch													
Dittrichia graveolens	Stinkweed													
Echium plantagineum	Salvation Jane													
Ehrharta calycina	Perennial Veldt Grass		2	2	3	2	3	3	3	4	3	3	1a	3
Ehrharta longiflora	Annual Veldt Grass				1a	2	1a	1a	2					
Emex australis	Three-corner Jack													
Eragrostis cilianensis	Stink Grass													
Erodium botrys	Long Heron's-bill													
Erodium cicutarium	Cut-leaf Heron's-bill						1a	1a						
Eucalyptus conferruminata														
Eucalyptus gomphocephala														
Euphorbia paralias	Sea Spurge	3	1					1		1			1a	1a
Euphorbia terracina	False Caper		1a		1a	1a				2	1a	1a	1a	1a
Ferraria crispa	Black Flag													
Ficus carica	Edible Fig													
Fumaria muralis	Wall Fumitory						1a							
Galenia pubescens	Coastal Galenia													
Galium murale	Small Bedstraw													
Gazania linearis	Gazania													
Geranium molle	Soft Geranium													

Species name	Common name	Management Unit												
Geranium purpureum	Little-robin													
Gladiolus tristis	Evening-flower Gladiolus						1							
Gomphocarpus cancellatus	Broad-leaf Cotton-bush													
Helminthotheca echioides	Ox-tongue													
Hypochaeris glabra	Smooth Cat's Ear					1	1	1	1a		1a			
Hypochaeris radicata	Rough Cat's Ear						1	1a	1a					
Lactuca serriola	Prickly Lettuce													
Lagurus ovatus	Hare's Tail Grass		1a	1a	1a	1a	1a	1a		2	1a	2	1a	1a
Lepidium africanum	Common Peppercress													
Leptospermum laevigatum	Coast Tea-tree									1			1	1
Lycium ferocissimum	African Boxthorn		1a	1a	1	1	1	1			2	1a	1	1
Malva arborea	Tree Mallow													
Malva parviflora	Small-flower Marshmallow													
Marrubium vulgare	Horehound													
Medicago polymorpha	Burr-medic				1a									
Medicago sativa	Lucerne													
Melaleuca armillaris	Bracelet Honey-myrtle				1	2								
Melianthus comosus	Tufted Honey-flower													
Mesembryanthemum crystallinum	Common Iceplant													
Monoculus monstrosus	Tripteris													
Moraea flaccida	One-leaf Cape Tulip					1								
Nicotiana glauca	Tree Tobacco													
Oenothera stricta	Common Evening Primrose				1			1		1a			1a	1a
Olea europaea	Olive				2	1	1		1	1	2	2		
Opuntia spp.	Prickly Pear													
Oxalis pes-caprae	Soursob		1a	1a	4	5	1a	3	4		2			
Pinus halepensis	Aleppo Pine											3		
Pinus radiata	Radiata Pine													

Species name	Common name	Management Unit												
Piptatherum miliaceum	Rice Millet				1									
Plantago coronopus	Bucks-horn Plantain										1a			
Plantago lanceolata	Ribwort										1a			
Polygonum aviculare	Wireweed													
Reichardia tingitana	False Sowthistle		1								1a			
Rhamnus alaternus	Blowfly Bush													
Rosa canina	Dog Rose											3		
Rumex crispus	Curled Dock													
Rumex pulcher	Fiddle Dock													
Ruschia tumidula	Pigface													
Sagina apetala	Annual Pearlwort													
Salvia verbenaca	Wild Sage													
Solanum nigrum	Black Nightshade													
Sonchus oleraceus	Common Sow-thistle										1a			
Stellaria media	Chickweed													
Symphyotrichum subulatum	Aster-weed													
Tamarix sp.	Tamarix													
Tetragonia decumbens	Sea Spinach													
Thinopyrum junceiforme	Sea Wheat-grass	3												
Trifolium arvense	Hare's-foot Clover									1a	1a			
Trifolium campestre	Hop Clover									1a	1a			
Trifolium scabrum	Rough Clover													
Verbascum virgatum	Twiggy Mullein													
Vicia sativa	Common Vetch				1a				1					
Vulpia fasciculata	Sand Fescue									2				
Watsonia meriana	Bulbil Watsonia				1									

* Section dominated by *Melaleuca lanceolata*

Cover Rating

Cover Rating			
not many, cover <1%	1	Covering 26 –50%	4
Plentiful, cover <1%	1a	Covering 51 – 75%	5
Covering 1 - 5%	2	Covering > 75%	6
Covering 5 – 25%	3		

Appendix 2: Bird survey report 2015

Normanville Dunes Avifauna Report

All information in this document based on field observations conducted 11-12/11/2015 by Tim & Sonia Croft, with additional research from electronic and printed literature.

General Comments

This report has been compiled from results of field observations in early November 2015 in the Normanville to Carrickalinga coastal dune reserve, and from an electronic and printed literature research. It aimed to determine the avifauna present, habitat preference, and potential avifauna that may or could use the reserve, at least for part of the year.

The survey involved two consultants walking through the reserve over two consecutive days, recording the numbers and activity of the avifauna. Only bird species directly associated with the reserve vegetation were recorded. Shorebirds such as plovers that would be unlikely to use the dune vegetation, and water birds such as cormorant, plovers, black ducks, etc. were not included in the survey results.

The reserve comprised two distinct habitats:

1. Coastal Shrubland foredune composed of *Leucopogon parviflorus*, *Acacia longifolia* var. *sophorae*, *Olearia axilaris* Shrubland, and

2. Open Low Woodland of flat areas and/or swale behind the foredune, planted with Australian and native plants dating back to 1973, with some remnant vegetation or natural regeneration.

Leucopogon parviflorus, *Acacia longifolia var. sophorae*, *Olearia axillaris* Shrubland over *Ehrharta calycina* (Perennial Veldt Grass) typical of the reserve foredune.

At times, *Melaleuca lanceolata* (Dryland Teatree) formed a thick Shrubland on the crest of the northern section of the reserve. This was less pronounced in the southern section of the reserve.

Planted *Allocasuarina verticillata* (Drooping Sheoak) Low Open Woodland located in both the northern and southern sections of the reserve.

Acacia retinodes (Wirilda) Low Open Woodland over an annual introduced grass groundcover, in the northern section of the reserve.

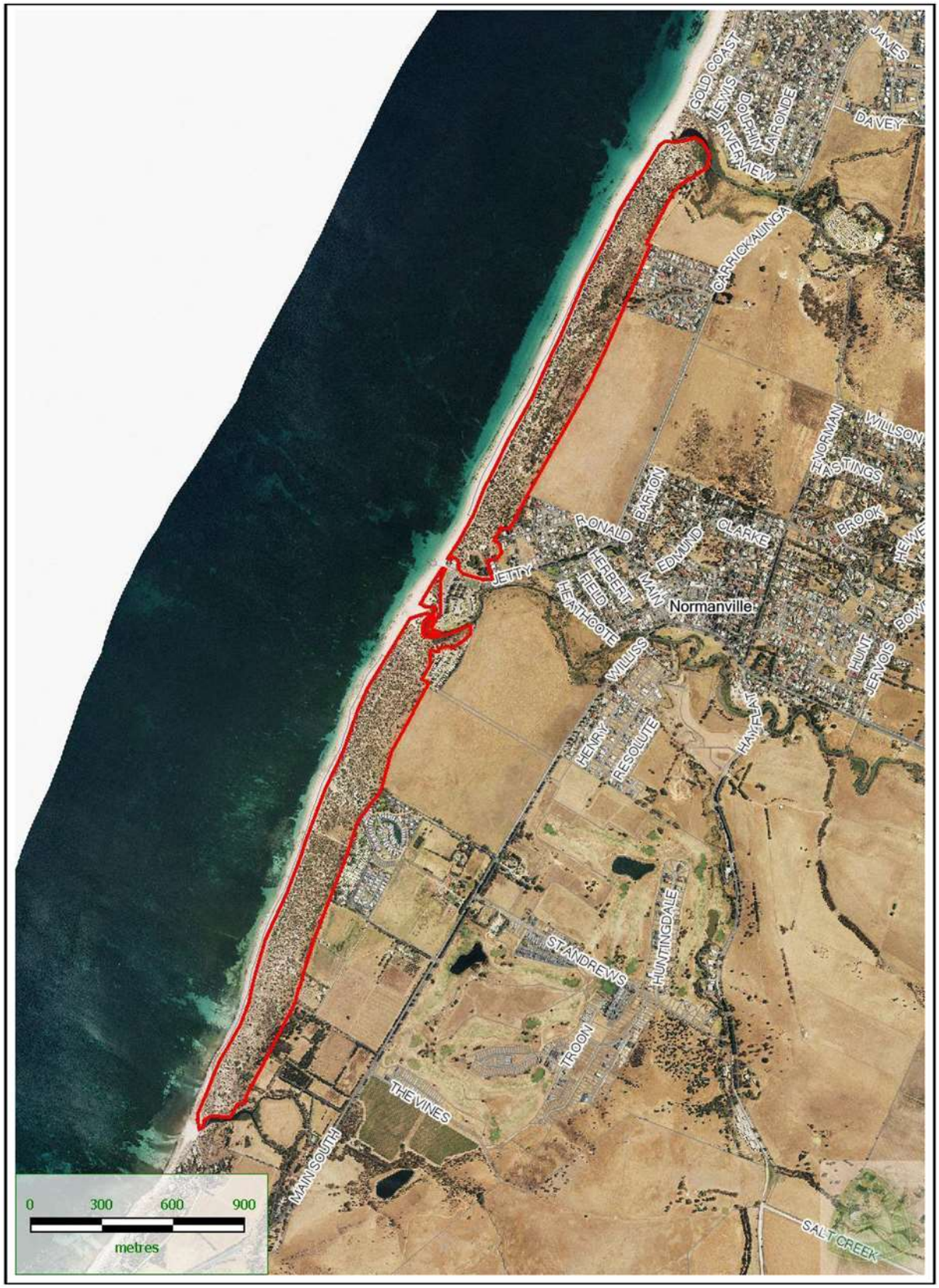
Old Eucalyptus camaldulensis ssp. camaldulensis (River Red Gum) tree, presumed a remnant tree rather than planted, in the southern section of the reserve. Other old River Red Gum trees were located in this area.

The Woodland area contained more diverse vegetation, although with prominent *Allocasuarina verticillata* and *Acacia retinodes*, and in the southern section, some remnant and planted *Eucalyptus* species and exotic pines.

Groundcover of both habitats largely comprised introduced species, particularly the grasses *Ehrharta calycina* and *Lagurus ovatus*.

Avifauna likely to be observed can vary depending on the time of year, particularly if plant species are generally flowering, and weather conditions. At time of survey, few plants were in flower, and annual plants were dead or dying back. The survey intended to avoid excessively hot weather or days of very strong wind. A survey in late afternoon to dusk and early to late morning was conducted for the reserve, avoiding the middle of the day. For both days of the survey, weather was dry with maximum temperature below 30^0 C. The morning survey was conducted in cool conditions below 20^0 C. On both days, a noticeable breeze (from the landward side on November 11th and off the Gulf on November 12th) was present.

Normanville Dunes



Area surveyed is outlined in red, comprising coastal dune shrubland; and woodland largely planted with Australian and native plants in flat areas behind the dune.

The reserve is essentially long and narrow, about 200 to 250m in width, between Carrickalinga Creek in the north and Yankalilla River in the south. The Bungala River and Jetty Caravan Park effectively divided the reserve into two halves. The reserve was backed by agricultural land, including a vineyard, and urban development. An area of adjacent mature pines, some of which occur in the reserve, was located in the more southern area. The western side of the reserve has beach frontage with a different suite of birds present. Four access walkways bisected the reserve, three of which were fenced as was the reserve generally, to restrict public access and encourage vegetation natural regeneration.

Results and Discussion

Twenty seven (27) different bird species were observed during the survey, comprising 24 native species and 3 introduced species. These species, their preferred habitat and conservation ratings are listed in Table 1. The reserve is in the Fleurieu IBRA sub-region and the Adelaide and Mt Lofty Ranges (AMLR) IBRA region, (but just south (2 km) from the boundary of the Mt Lofty Ranges IBRA sub-region).

The avifauna assemblage was typical of other similar semi-urbanised coastal areas to the north (Hallett Cove Conservation Park; Aldinga Scrub Conservation Park) with some foredune shrubland and woodland backing the dunes. Little was flowering at the time of survey limiting bird activity, especially for nectar feeding species. A further six native and three introduced bird species have been recorded for the area (Atlas of Living Australia WWW site; Birdlife Australia WWW site).

Most avifauna diversity, with nearly all species recorded, was in the narrow area of vegetation between the dunes and adjacent urbanised areas, open farmland, and some introduced pine trees. This area, largely through older revegetation, formed a mixed Woodland of *Allocasuarina verticillata*, *Acacia retinodes*, *Melaleuca armillaris* ssp. *armillaris*, and eucalypt species. The species recorded, both during the survey and at other times, have a diverse range of requirements for food, shelter, nesting (see below for ecological attributes). The woodland habitat in the reserve provides an abundance of lateral branches for perching and dense shrubs for shelter. Dead trees (particularly *Acacia retinodes*) were common but provided perching habitat for numerous birds including kookaburra, crested pigeons, Australian magpie and Nankeen kestrel.

As there were limited to no tree hollows present in the reserve, most of the resident birds did not rely on hollows for nesting. Those birds requiring hollows for nesting, likely nest elsewhere and frequent the reserve for feeding.

The reserve vegetation (and hence bird habitat), and particular the woodland vegetation lacks floristic and structural elements that would have occurred prior to European

settlement, with limited regeneration occurring. Contributing to the degraded nature of the reserve, was a high cover of introduced plants, particularly introduced grasses such as *Ehrharta calycina* (Perennial Veldt Grass), and shrubs such as *Lycium ferocissimum* (African Boxthorn), *Olea europaea* ssp. (Olive). For the latter, control had been undertaken, although some Olives had subsequently regrown. Nearly all the African Boxthorn had been flagged, but had yet to be controlled. This is strongly encouraged.

Birds Potentially Occurring

Potential bird species which could use the reserve include *Neophema elegans* (Elegant Parrot) listed as Rare under the State *National Parks and Wildlife Act 1972*. It is rated Vulnerable for the Fleurieu IBRA sub-region, although there is insufficient data to determine whether the population is stable, or declining. It feeds on grass and low shrub seeds on the ground in open areas and has been recorded nearby in the Normanville area (within 5kms along Yankalilla River, June 2001). Within the Normanville Reserve, it is most likely to occur in the woodland habitat.

Other Thornbill species such as Brown Thornbill and Yellow-rumped Thornbill, as well as Striated Pardalote could also use the reserve (both have several records in areas near the reserve over several years). The Brown thornbill prefers dense shrubby habitat including watercourses, parks and gardens feeding on seeds, fruit nectar mostly in shrubs, while the Yellow-rumped Thornbill prefers open habitats, including Open Woodland, watercourses, and farmland, feeding on seeds on the ground. The Yellow-rumped Thornbill would be expected to use the reserve given its habitat preference.

Management Actions

Primary management actions should be aimed at encouraging native bird use of the reserve, and retaining existing populations through maintaining and improving remnant habitat condition. A Biodiversity Action Plan for the reserve, for planning weed control, revegetation and improving the quality of the habitat, rabbit and cat control, and encouraging regeneration of native plant species is in preparation.

Lack of nesting hollows may also be limiting the potential of the reserve as bird habitat. Management Actions could include:

- regular surveys to monitor if Elegant Parrot are present;
- inserting nest boxes into eucalypts;
- discouraging Common Starling use and destroying their nests;
- maintaining the health of the River Red Gums and
- encouraging regeneration and revegetation in the area where they already occur.

Control and eradication of African Boxthorn and follow-up control of European Olive should be undertaken to improve the habitat quality of the reserve, especially if followed up with revegetation of understorey native plants. The African Boxthorn was largely already flagged and identified. The introduced annual and perennial grasses should over time be replaced by perennial grasses.

Table 1: Avifauna Observed during Survey 11th and 12th November 2015 by Sonia and Tim Croft. Bird species are listed in alphabetic order of common names

Species preceded by an asterisk are introduced

Bird species Common Name (*Scientific Name*)	Relative Abundance	Activity	Rating *	North/ South**	Habitat
Australian Magpie (*Cracticus tibicen*)	Few including juvenile	On ground & tree canopy	LC	S	Woodland
Black-faced Cuckoo-shrike (*Coracina novaehollandiae*)	Few	Tree canopy	LC	N	Woodland
Black-shouldered Kite (*Elanus axillaris*)	1	Hovering (hunting) overhead	LC	S	Woodland
*Common Blackbird (*Turdus merula*)	Several	On ground	-	N & S	Dune; Woodland
Common Bronzewing (*Phaps chalcoptera*)	Several	On ground, on tree branches, or flying low	LC	N & S	Woodland
*Common Starling (*Sturnus vulgaris*)	Several	Flying fast out of reserve or overhead. At times with food in beak.	-	N	Woodland
Crested Pigeon (*Ocyphaps lophotes*)	Common	On ground or in dead shrub canopy	LC	N & S	Woodland
Crimson (Adelaide) Rosella (*Platycercus elegans*)	4	Tree branches; flying out of reserve	LC	N	Woodland
Galah (*Eolophus roseicapillus*)	Few	On ground or in tree branches	LC	N	Dune; Woodland
Grey Currawong (*Strepera versicolor*)	3 including juvenile	Tree branches	LC	N	Woodland
*House Sparrow (*Passer domesticus*)	Several including group of 10	On ground; in dead shrub	-	N & S	Dune; Woodland
Laughing Kookaburra (*Dacelo novaeguineae*)	2	Tree branches	LC	S	Woodland
Little Raven (*Corvus mellori*)	Several	On ground, shrub and tree canopy	LC	N & S	Dune; Woodland
Little Wattlebird (*Anthochaera chrysoptera*)	Few	In and on tree and shrub canopy	NT	N & S	Dune Woodland
Nankeen Kestrel (*Falco cenchroides*)	Few	Hovering (hunting) overhead	LC	N & S	Dune Woodland

Bird species Common Name (*Scientific Name*)	Relative Abundance	Activity	Rating *	North/ South**	Habitat
New Holland Honeyeater (*Phylidonyris novaehollandiae*)	3	Dead shrub	LC	S	Woodland
Rainbow Lorikeet (*Trichoglossus haematodus*)	Few	Tree canopy or flying fast through reserve	LC	N	Woodland
Red Wattlebird (*Anthochaera carunculata*)	Frequent dunes; common woodland	In and on tree and shrub canopy	LC	N & S	Dune; Woodland
Silvereye (*Zosterops lateralis*)	Few	Shrub and tree canopy	V	N	Dune; Woodland
Singing Honeyeater (*Gavicalis virescens*)	Frequent dunes; few woodland	In or on canopy of shrubs	LC	N & S	Dune; Woodland
Stubble Quail (*Coturnix pectoralis*)	2	Flushed from ground	NT	S	Dune
Superb Fairy-wren (*Malurus cyaneus*)	Two family groups	Ground and in dense shrubs	LC	N & S	Woodland
Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*)	2	Landing in trees	V	N	Woodland
Yellow Thornbill (*Acanthiza nana*)	2	In sheoak tree canopy	NT	N	Woodland
Welcome Swallow (*Hirundo neoxena*)	Several	Flying in 'circles' low overhead	LC	N & S	Woodland
White-plumed Honeyeater (*Ptilotula penicillata*)	2	Eucalypt tree canopy	LC	S	Woodland
Willie Wagtail (*Rhipidura leucophrys*)	1	Edge of reserve and in adjacent Beachside Caravan park	NT	S	Woodland

*Rating = Conservation Status for Fleurieu IBRA Region (Gillam & Urban 2014). Codes can be found in Appendix A.

** North and South refer to the area north and south of the Bungala River

Table 2: Additional Birds Recorded for the Dune Area

Source: Atlas of Living Australia WWW site; Birdlife Australia WWW site

Bird species Common Name (*Scientific Name*)	Likely Activity	Likely Habitat	Rating
Brown Falcon (*Falco berigora*)	Searching for prey from exposed perch. Feeds on small mammals (especially rabbits), insects, reptiles, and at times small birds.	Woodland	LC
*Eurasian Skylark (*Alauda arvensis*)	Open grassy areas on ground feeding on seeds and invertebrates. More likely in agricultural paddocks.	Dune; Woodland	-
*European Goldfinch (*Carduelis carduelis*)	On ground feeding on seeds and insects	Dune; Woodland	-

Bird species Common Name (*Scientific Name*)	Likely Activity	Likely Habitat	Rating
Grey Fantail (*Rhipidura albiscapa*)	Tree canopy. Feeds on flying insects caught on the wing on the edge of tree canopy.	Woodland	LC
Grey Shrike-thrush (*Colluricincla harmonica*)	On ground and in trees. **It feeds on ground, especially around fallen timber, and on tree limbs and trunks on invertebrates, small mammals, frogs, lizards, bird eggs and young.**	Woodland	LC
Mistletoebird (*Dicaeum hirundinaceum*)	Tree canopy, especially where mistletoe occurs. Feeds largely on mistletoe berries.	Woodland	LC
*Spotted Dove (*Spilopelia chinensis*)	Mostly on ground feeding on seeds in open areas, but also shrub canopy where it nests and can feed on some seeds still on the shrubs.	Woodland	-
Wedge-tailed Eagle (*Aquila audax*)	Searching high overhead. Feeds on dead and live prey, especially rabbits and hares.	Dune; Woodland	LC
White-browed Scrubwren (*Sericornis frontalis*)	Low down in thick shrubs. Feeds on invertebrates and at times some seeds.	Dune	LC

Native Bird Ecology

Source: Includes information compiled from Birdlife Australia, Biology and Ecology, WWW site

Australian Magpie: It requires trees for perching, large trees for nesting. It feeds on the ground on insects and their larvae. Nest a stick and twig platform high in outer branches of tall trees, usually eucalypts. In the reserve this habitat is provided by dead trees, open grassy areas, and adjacent farmland.

Black-faced Cuckoo-shrike: lives in various wooded habitats. Feeds on invertebrates caught in the air, from foliage and on the ground. At times eats fruits. Nest a shallow saucer of sticks and bark built high on tree limbs. The Open Woodland of the reserve provided good habitat for the species.

Black-shouldered Kite: Can be found over grasslands and other open habitats, including treed grasslands. It feeds mainly on rodents, especially House Mice, but also insects such as grasshoppers. Nest is an untidy cup of sticks built high on a tree or built structure, such as poles. The open grassed areas, especially of the Open Woodland and adjacent farmland, provides good habitat for the species and their prey.

Common Bronzewing: Found in widespread remnant native vegetation habitats. Feeds on ground on seeds and other vegetable matter. Nest an untidy platform of sticks and twigs low down in tree or taller shrub. The reserve's Open Woodland provided both good feeding and nesting habitat, supplemented by the foredune vegetation.

Crested Pigeon: Found in lightly wooded areas and some open areas. Feeds on seeds, and at times insects. It makes a fragile nest of twigs in dense foliage of tree or shrub. The open

grassy nature of the Open Woodland provided good habitat for the species as well as nesting sites.

Crimson (Adelaide) Rosella: Usually eucalypt Woodlands. Here it was associated with remnant and planted eucalypts in the reserve and adjacent planted trees. Feeds on seeds of eucalypts, grasses, shrubs, and at times insects and flowers. Nests in tree hollows found high in the trees.

Galah: Found in various open timbered habitats, usually near water. It feeds on the ground on mostly grass seeds. Nests usually in tree hollows. The species is unlikely to breed in the reserve (due to lack of hollows), but as observed would readily feed on the ground, especially in the more open areas of the Open Woodland.

Grey Currawong: Found in a wide range of habitats from coastal heath to semi-arid Woodlands. It is an omnivore, feeding on both animals (including dead animals), such as birds, rodents, frogs, eggs, insects, and plants, such as seeds and fruits. It feeds both on the ground and in the trees. Builds a large shallow bowl-shaped nest of sticks and twigs in the outer canopy of a tree. With a juvenile observed, likely bred in the area. The reserve would likely provide feed for the species, primarily in the Open Woodland area.

Laughing Kookaburra: Found in wooded areas. Feeds by pouncing from perch on insects, worms, crustaceans, and also some snakes, mammals, frogs, small birds. Nests in tree hollows. Unlikely to nest in the reserve due to lack of hollows, although a suitable hollow may have been located in the River Red Gum trees in the area where the birds were observed. These trees and the pines provided suitable perches from which they could observe and pounce on their prey.

Little Raven: Widespread habitats. Mostly carnivorous feeding on small animals including dead, insects, eggs, but also seeds, fruits and refuse. Builds a large untidy nest of sticks and twigs high in a tree. Larger stick nests were observed in the woodland trees, which may have been used by the Little Raven, although other birds present may have made the nests. As mostly carnivorous, including on dead animals, the reserve and surrounding areas provide suitable feed for the species.

Little Wattlebird: Found in various habitats including forest, woodlands, heath, urban parks and gardens. Feeds on nectar, and also insects, berries and some seeds. Builds a large cup nest of twigs and grass lined with feathers and wool, usually in a shrub. Considered regionally Near Threatened for the Mt Lofty Ranges. The reserve and surrounds, especially the urban gardens, provide feeding opportunities for the species.

Nankeen Kestrel: Found in lightly wooded and open agricultural areas. Feeds on small mammals, reptiles, small birds and insects, found from perches or by hovering. Nests in various sites from a scrape on ground to tree hollows, including caves and ledges. The open grassed areas, especially of the Open Woodland and adjacent farmland, provides good habitat for the species and their prey.

New Holland Honeyeater: Found in forests, woodland to urban gardens. It feeds primarily on nectar and flowers, but also fruit, insects and spiders. Builds a small cup nest of twigs and grass lined with feathers and wool in a shrub. Considered regionally Near Threatened for the

Mt Lofty Ranges. The reserve and surrounds, especially the urban gardens, provide feeding opportunities for the species.

Rainbow Lorikeet: Found in a wide range of habitats from rainforest, woodlands to well treed urban gardens. It primarily feeds on nectar and pollen, but also fruits, seeds and some insects. Nests in eucalypt hollow. Considered regionally Near Threatened for the Mt Lofty Ranges. Unlikely to nest in the reserve due to lack of tree hollows, but use the reserve primarily when the eucalypts are flowering. A range of eucalypts, including South Australian Blue Gum and Pink Gum, would be suitable nectar and pollen producing trees over an extended time of the year.

Red Wattlebird: Found in forests, woodlands and urban gardens. Feeds primarily on nectar, but also insects, berries and honeydew produced by some insects. Builds a large cup nest of twigs and grass lined with feathers and wool, usually in a shrub. Given the high numbers observed, the species is likely resident and breeding throughout the reserve, which with adjacent urban gardens, provides feeding opportunities.

Silvereye: Found in most wooded habitat including orchards and urban parks and gardens. Feeds on insects, fruit and nectar. Builds a small, neat cup shaped nest of grasses and hair in the horizontal tree branch forks. Considered regionally Vulnerable for the Mt Lofty Ranges. The woodland and adjacent treed urban areas provides good habitat for feeding and nesting.

Singing Honeyeater: Found mostly in shrubby habitats, but also low woodlands especially dominated by acacias, and urban gardens. Feeds on nectar, insects and fruit. Builds a cup nest of grasses, lined with wool and mammal hair in shrubs. The coastal shrubland typically provides important habitat for the Singing Honeyeater in South Australia. Given the high numbers observed, the species is considered resident and breeding in the reserve.

Stubble Quail: Found in grasslands and shrublands, preferring dense grassy vegetation. Feeds on seeds including grain. Nests on ground in small scrapes lined with grasses, including under small shrubs. Considered regionally Near Threatened for the Mt Lofty Ranges. The open grassy areas and adjacent farmland would provide suitable feeding habitat, while the low shrubs could provide cover for nesting.

Superb Fairy-wren: Found in most habitats where there is suitable dense cover of shrubs. Occurs in social groups, feeding on insects and small arthropods caught mostly on the ground or in foliage. Builds a dome-shaped nest of grasses, usually low in a shrub. The shrub understorey for shelter and nesting surrounded by open areas for feeding provides some good habitat for the wrens.

Yellow-tailed Black Cockatoo: Mostly found in eucalypt woodland and pine plantations. It feeds on the seeds of native trees and shrubs (*Banksia* spp, *Hakea* spp), and pine cones, and some insect larvae and insects. Some pine trees were located adjacent the southern part of the reserve, although the two birds sighted were in the northern part. With no suitable nesting hollows, the species would not breed in the area, and there is generally limited feeding opportunity. Listed as Vulnerable under the State *National Parks and Wildlife Act 1972*. Nests in large tree hollows.

Yellow Thornbill: A small bird found in open forests, woodland and shrublands dominated by *Allocasuarina*, *Acacia* or *Melaleuca* species rather than eucalypts. Usually seen in trees gleaning insects and other invertebrates among the leaves twigs and small branches, also feeds on some seeds. Builds a rounded dome nest of grass and bark lined with feathers, in upper tree canopy. Considered regionally Near Threatened for the Mt Lofty Ranges. The reserve woodland provides good habitat for the species.
Welcome Swallow: Found in a wide range of habitats from urban areas, grasslands, wetlands to woodland and forests. Feeds on a wide range of insects, usually in flight. Builds an open cup of mud and grass attached to vertical rock or building/structure. The open woodland areas in particular provide good habitat for the species, but limited or no nesting opportunity. This could be provided in the adjacent urban areas.
White-plumed Honeyeater: Found in open forests and woodlands usually associated with River Red Gum, but also urban parks and gardens. Feeds on nectar, insects and honeydew produced by insects, also some fruits and seeds. Builds a small cup-shaped nest of grass and spider webs, lined with wool, hair and feathers, usually high in the tree canopy. The eucalypt area of the southern reserve section and adjacent urban gardens, provide feeding and nesting opportunities for the species.
Willie Wagtail: Found in widespread areas and habitats, including urban areas. It feeds on insects on the ground and also captured in the air. Builds a neatly woven cup nest of grasses, covered with spider web, lined with soft material usually on a horizontal tree branch. The birds recorded were closely associated with the treed and built area of the Beachside Caravan Park. Due to the habitat present, the birds are not expected to occur generally through the reserve. Considered regionally Near Threatened for the Mt Lofty Ranges.

Introduced Bird Species

Three introduced bird species were recorded during the survey, with a further three species recorded for the dunal system. Most of the introduced birds were recorded near built structures (walkways) and adjacent built-up urban areas, although the Common Blackbird could be observed throughout. However numbers were higher near built areas.

The most serious introduced bird is considered to be the Common Starling, due to its more aggressive nature and taking up the limited resource of nesting hollows. The bird seemed to be nesting at the time, as birds were observed flying from the reserve with food in their beaks to an area of adjacent housing.

References

Atlas of Living Australia WWW site include URLs

BirdLife Australia, Bird data, WWW site

Birdlife Australia, Biology and Ecology, WWW site

Owens, H. and Graham, A. (eds.) (2009) Census of South Australian Vertebrates. (Department of Environment and Natural Resources, South Australia and South Australian Museum.) eBook (2013); Horton, P, Blaylock, B, Black, A: Birds.

Gillam, S. and Urban, R. (2014) *Regional Species Conservation Assessment Project, Phase 1 Report: regional Species Status Assessments, Adelaide and Mount Lofty Ranges NRM Region*. Dept. of Environment, Water and Natural resources, South Australia.

Appendix 3: BushRAT monitoring data

It is not the intent of this report to provide an extensive overview of the use and application of the BushRAT methodology. A full description of the method and its application can be found within DEWNR (2012)[60]. The following is a simple overview of the contribution of different scoring components to the BushRAT overall score. Note: A low score indicates poor condition for that attribute, a high score indicates good condition. Thus a very high weed score means there are very few weeds, and a very low weed score means there is a profusion of threatening weeds.

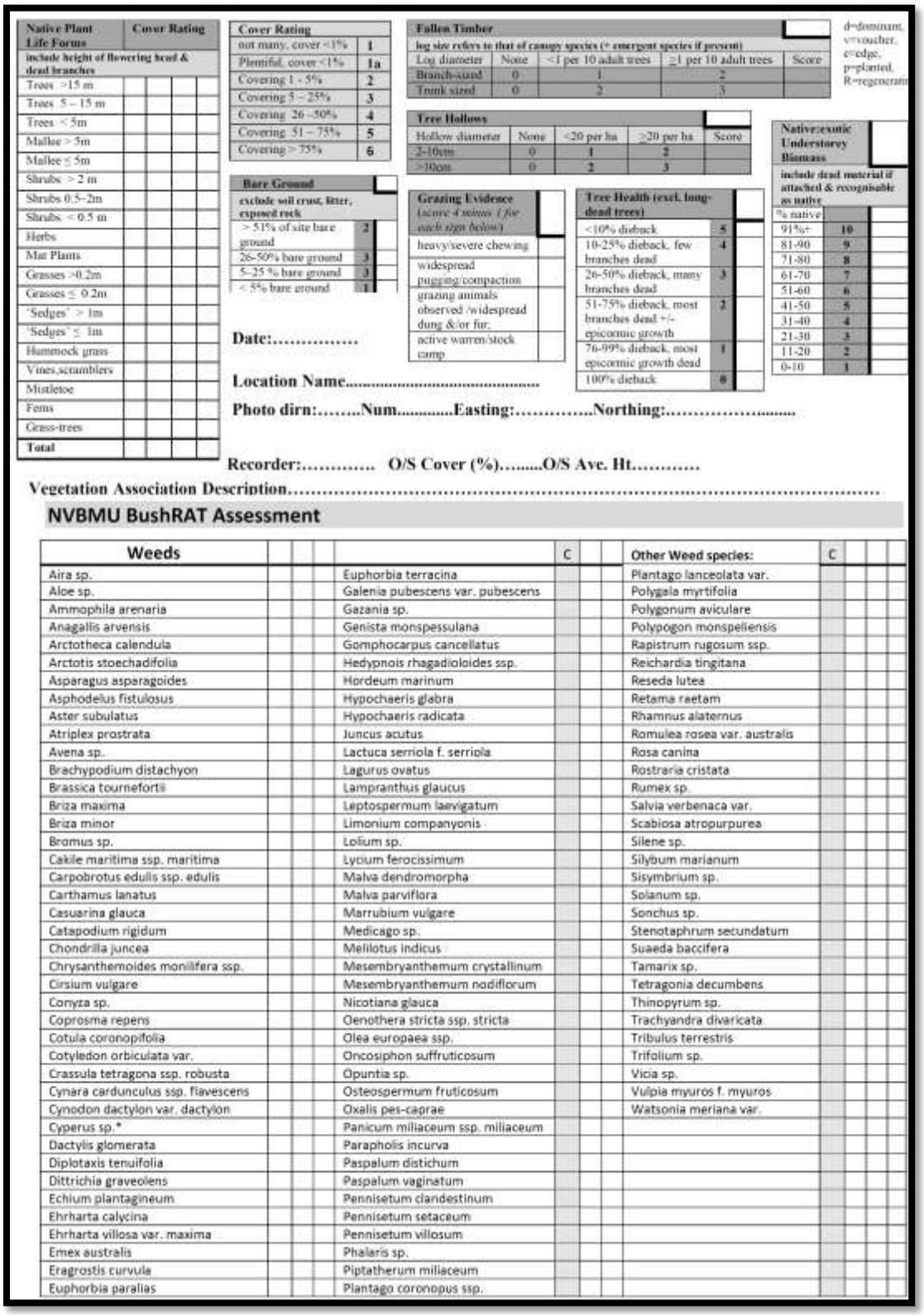
Vegetation Condition Scores

<table>
<tr><th>Vegetation condition component</th><th>Overview description</th></tr>
<tr><td>Native Plant Species Diversity (15)</td><td>A count of the number of species present is compared to a “benchmark” value for that vegetation type. This is then allocated a score from 0-15.</td></tr>
<tr><td>Weed Score (15)</td><td>The cover and abundance of all weed species present is recorded as per the cover rating table below. The 5 weeds with the highest product of threat rating and cover are summed to provide a score. This is then compared to a “benchmark” value for that vegetation type, and allocated a score from 0-15.
<table>
<tr><th colspan="2">Cover Rating</th></tr>
<tr><td>not many, cover <1%</td><td>1</td></tr>
<tr><td>Plentiful, cover <1%</td><td>1a</td></tr>
<tr><td>Covering 1 - 5%</td><td>2</td></tr>
<tr><td>Covering 5 – 25%</td><td>3</td></tr>
<tr><td>Covering 26 –50%</td><td>4</td></tr>
<tr><td>Covering 51 – 75%</td><td>5</td></tr>
<tr><td>Covering > 75%</td><td>6</td></tr>
</table></td></tr>
<tr><td>Native Plant Life Forms (10)</td><td>The cover of different native plant life forms is compared to a “benchmark” value for that vegetation type. This is then allocated a score from 0-10.</td></tr>
<tr><td>Regeneration (8)</td><td>The total number of woody native species in juvenile or seedling form is recorded and compared to a “benchmark” value for that vegetation type. This is then allocated a score from 0-8.</td></tr>
<tr><td>Native:exotic Understorey Biomass (10)</td><td>The percentage of the total vegetative biomass of shrubs and groundcover plants < 2m high that is native is noted. This is then allocated a score from 0-10.</td></tr>
<tr><td>Bare Ground (3)</td><td>The percentage of the grounds surface that is truly bare is noted and allocated a score from 0-3.</td></tr>
<tr><td>Tree Health (5)</td><td>Average overall overstorey canopy health is allocated to a category, and then a score from 0-5. NOTE: NOT SCORED FOR COASTAL SHRUBLAND VEGETATION.</td></tr>
<tr><td>Tree Hollows (5)</td><td>This score relates to the number of small and large tree hollows present, with a rating of 0-5. NOTE: NOT SCORED FOR COASTAL SHRUBLAND VEGETATION.</td></tr>
<tr><td>Fallen timber (5)</td><td>This score relates to the amount of branch and trunk sized logs present, with a rating of 0-5. NOTE: NOT SCORED FOR COASTAL</td></tr>
</table>

[60] DEWNR (2012) NVBMU BushRAT assessment and scoring Manual. Unpublished document, Department for Environment, Water and Natural Resources, Waite.

	SHRUBLAND VEGETATION.
Grazing Evidence (4)	This score relates to evidence of grazing pressure, including pugging, compacting and chewing. The score is from 0-4.

BushRAT Scoresheet



Native Plant Life Forms (include height of flowering head & dead branches)	Cover Rating
Trees >15 m	
Trees 5 – 15 m	
Trees < 5m	
Mallee > 5m	
Mallee ≤ 5m	
Shrubs > 2 m	
Shrubs 0.5–2m	
Shrubs < 0.5 m	
Herbs	
Mat Plants	
Grasses >0.2m	
Grasses ≤ 0.2m	
'Sedges' > 1m	
'Sedges' ≤ 1m	
Hummock grass	
Vines,scramblers	
Mistletoe	
Ferns	
Grass-trees	
Total	

Cover Rating	
not many, cover <1%	1
Plentiful, cover <1%	1a
Covering 1 - 5%	2
Covering 5 – 25%	3
Covering 26 –50%	4
Covering 51 – 75%	5
Covering > 75%	6

Fallen Timber (log size refers to that of canopy species (+ emergent species if present))				
Log diameter	None	<1 per 10 adult trees	≥1 per 10 adult trees	Score
Branch-sized	0	1	2	
Trunk sized	0	2	3	

d=dominant, v=voucher, e=edge, p=planted, R=regenerant

Tree Hollows				
Hollow diameter	None	<20 per ha	≥20 per ha	Score
2-10cm	0	1	2	
>10cm	0	2	3	

Native:exotic Understorey Biomass (include dead material if attached & recognisable as native)	
% native	
91%+	10
81-90	9
71-80	8
61-70	7
51-60	6
41-50	5
31-40	4
21-30	3
11-20	2
0-10	1

Bare Ground (exclude soil crust, litter, exposed rock)	
> 51% of site bare ground	2
26-50% bare ground	3
5–25 % bare ground	3
< 5% bare ground	1

Grazing Evidence (score 4 minus 1 for each sign below)	
heavy/severe chewing	
widespread pugging/compaction	
grazing animals observed /widespread dung &/or fur;	
active warren/stock camp	

Tree Health (excl. long-dead trees)	
<10% dieback	5
10-25% dieback, few branches dead	4
26-50% dieback, many branches dead	3
51-75% dieback, most branches dead +/- epicormic growth	2
76-99% dieback, most epicormic growth dead	1
100% dieback	0

Date:……

Location Name……

Photo dirn:……..Num……..Easting:……..Northing:……..

Recorder:…… O/S Cover (%)……..O/S Ave. Ht……

Vegetation Association Description……

NVBMU BushRAT Assessment

Weeds		C	Other Weed species:	C
Aira sp.	Euphorbia terracina		Plantago lanceolata var.	
Aloe sp.	Galenia pubescens var. pubescens		Polygala myrtifolia	
Ammophila arenaria	Gazania sp.		Polygonum aviculare	
Anagallis arvensis	Genista monspessulana		Polypogon monspeliensis	
Arctotheca calendula	Gomphocarpus cancellatus		Rapistrum rugosum ssp.	
Arctotis stoechadifolia	Hedypnois rhagadioloides ssp.		Reichardia tingitana	
Asparagus asparagoides	Hordeum marinum		Reseda lutea	
Asphodelus fistulosus	Hypochaeris glabra		Retama raetam	
Aster subulatus	Hypochaeris radicata		Rhamnus alaternus	
Atriplex prostrata	Juncus acutus		Romulea rosea var. australis	
Avena sp.	Lactuca serriola f. serriola		Rosa canina	
Brachypodium distachyon	Lagurus ovatus		Rostraria cristata	
Brassica tournefortii	Lampranthus glaucus		Rumex sp.	
Briza maxima	Leptospermum laevigatum		Salvia verbenaca var.	
Briza minor	Limonium companyonis		Scabiosa atropurpurea	
Bromus sp.	Lolium sp.		Silene sp.	
Cakile maritima ssp. maritima	Lycium ferocissimum		Silybum marianum	
Carpobrotus edulis ssp. edulis	Malva dendromorpha		Sisymbrium sp.	
Carthamus lanatus	Malva parviflora		Solanum sp.	
Casuarina glauca	Marrubium vulgare		Sonchus sp.	
Catapodium rigidum	Medicago sp.		Stenotaphrum secundatum	
Chondrilla juncea	Melilotus indicus		Suaeda baccifera	
Chrysanthemoides monilifera ssp.	Mesembryanthemum crystallinum		Tamarix sp.	
Cirsium vulgare	Mesembryanthemum nodiflorum		Tetragonia decumbens	
Conyza sp.	Nicotiana glauca		Thinopyrum sp.	
Coprosma repens	Oenothera stricta ssp. stricta		Trachyandra divaricata	
Cotula coronopifolia	Olea europaea ssp.		Tribulus terrestris	
Cotyledon orbiculata var.	Oncosiphon suffruticosum		Trifolium sp.	
Crassula tetragona ssp. robusta	Opuntia sp.		Vicia sp.	
Cynara cardunculus ssp. flavescens	Osteospermum fruticosum		Vulpia myuros f. myuros	
Cynodon dactylon var. dactylon	Oxalis pes-caprae		Watsonia meriana var.	
Cyperus sp.*	Panicum miliaceum ssp. miliaceum			
Dactylis glomerata	Parapholis incurva			
Diplotaxis tenuifolia	Paspalum distichum			
Dittrichia graveolens	Paspalum vaginatum			
Echium plantagineum	Pennisetum clandestinum			
Ehrharta calycina	Pennisetum setaceum			
Ehrharta villosa var. maxima	Pennisetum villosum			
Emex australis	Phalaris sp.			
Eragrostis curvula	Piptatherum miliaceum			
Euphorbia paralias	Plantago coronopus ssp.			

Management Zone: 1 Coastal Foredune

**Vegetation Community: ***Euphorbia paralias, *Thinopyrum junceiforme* grassland with emergent *Olearia axillaris, Acacia longifolia ssp. sophorae ± Leucophyta brownii*

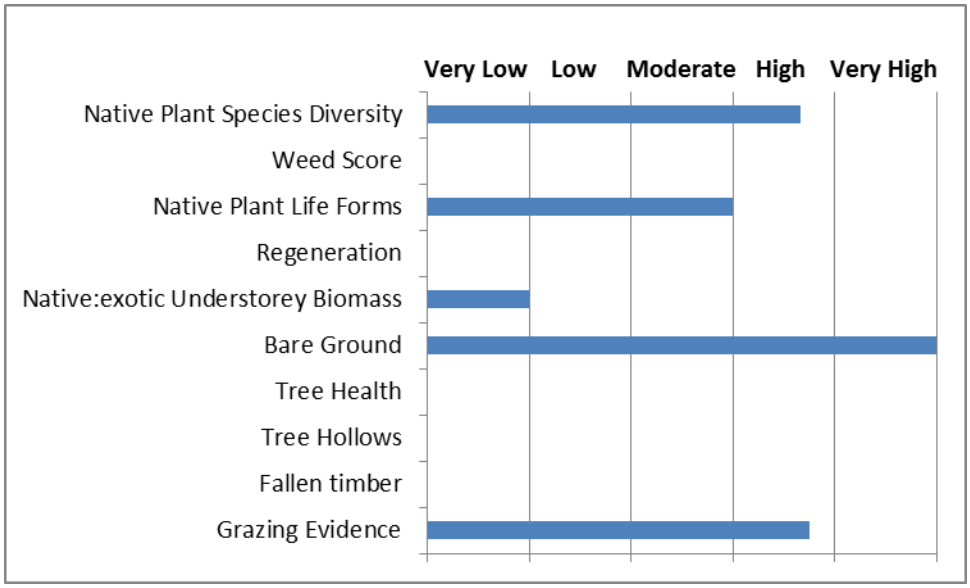
Date of assessment: 9/2/16

GPS Location of Photograph: 254953 6072728 **Direction:** S

Benchmark Vegetation Community Type: SMLR Co 7.1 Coastal Tussock Grasslands

Site photograph:

Scores for Individual BushRAT Components:



Note: no score is expected for Tree Health, Tree Hollows or Fallen Timber as this is a treeless community type

BushRAT score sheet

SITE: 1 Coastal Foredune	
Euphorbia paralias, Thinopyrum junceiforme **grassland with emergent** ***Olearia axillaris, Acacia longifolia ssp. sophorae*** **±**	
VEGETATION CONDITION SCORE (max. in	**score**
Native Plant Species Diversity (15)	11
Weed Score (15)	0
Native Plant Life Forms (10)	6
Regeneration (8)	NA
Native:exotic Understorey Biomass (10)	2
Bare Ground (3)	3
Tree Health (5)	NA
Tree Hollows (5)	NA
Fallen timber (5)	NA
Grazing Evidence (4)	3
TOTAL (ADD UP ALL POINTS)	25
If community is naturally treeless x TOTAL by 1.23	34.133
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	34.133

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Thinopyrum junceiforme	3	3	9
Euphorbia paralias	3	3	9
Ammophila arenaria	*2*	*3*	6
Cakile maritima ssp. maritima	*1a*	*1*	1
		Total Cover x Threat Invasion	25

Management Zone: 2 Dune shrubland between Bungala Creek and Carrackalinga Creek

Vegetation Community: *Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae ± Melaleuca lanceolata* shrubland

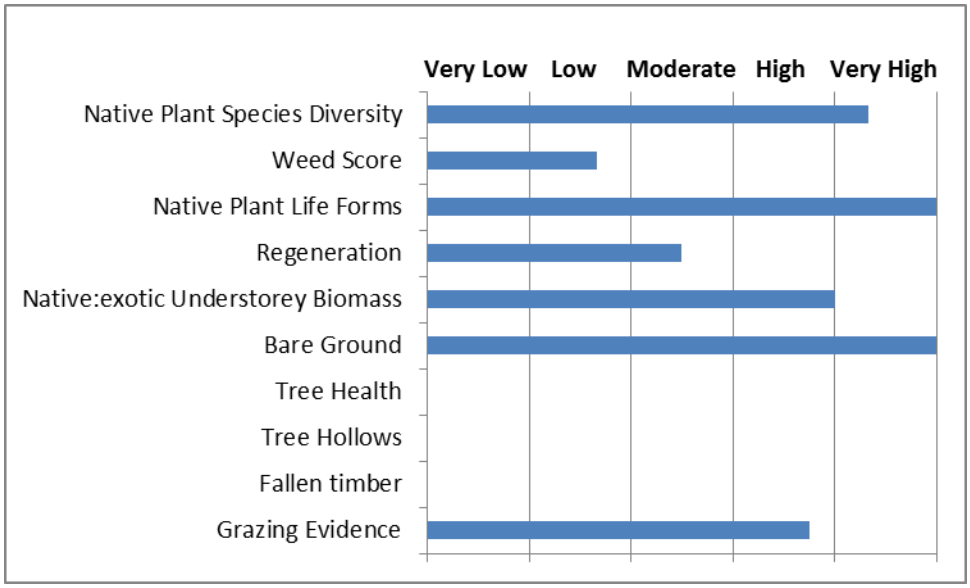
Date of assessment: 26/8/2015

GPS Location of Photograph: 255911 6074602 **Direction:** SSW

Benchmark Vegetation Community Type: SMLR Co 7.2 - Coastal Shrublands & Tall Shrublands

Site photograph:

Scores for Individual BushRAT Components:



Note: no score is expected for Tree Health, Tree Hollows or Fallen Timber as this is a treeless community type

BushRAT score sheet

SITE: 2 Dune shrubland between Bungala Creek and Carrackalin	
***Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae ± Melaleuca lanceolata* shrubland**	
VEGETATION CONDITION SCORE (max. in	**score**
Native Plant Species Diversity (15)	13
Weed Score (15)	5
Native Plant Life Forms (10)	10
Regeneration (8)	4
Native:exotic Understorey Biomass (10)	8
Bare Ground (3)	3
Tree Health (5)	
Tree Hollows (5)	
Fallen timber (5)	
Grazing Evidence (4)	3
TOTAL (ADD UP ALL POINTS)	46
If community is naturally treeless x TOTAL by 1.23	56.58
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	56.58

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Oxalis pes-caprae	1a	4	4
Ehrharta calycina	2	4	8
Asparagus asparagoides forma	1	5	5
Ammophila arenaria	1	3	3
Lycium ferocissimum	1a	3	3
		Total Cover x Threat Invasion	23

Management Zone: 2 Dune shrubland between Bungala Creek and Carrackalinga Creek

Vegetation Community: *Melaleuca lanceolata ± Olearia axillaris* shrubland

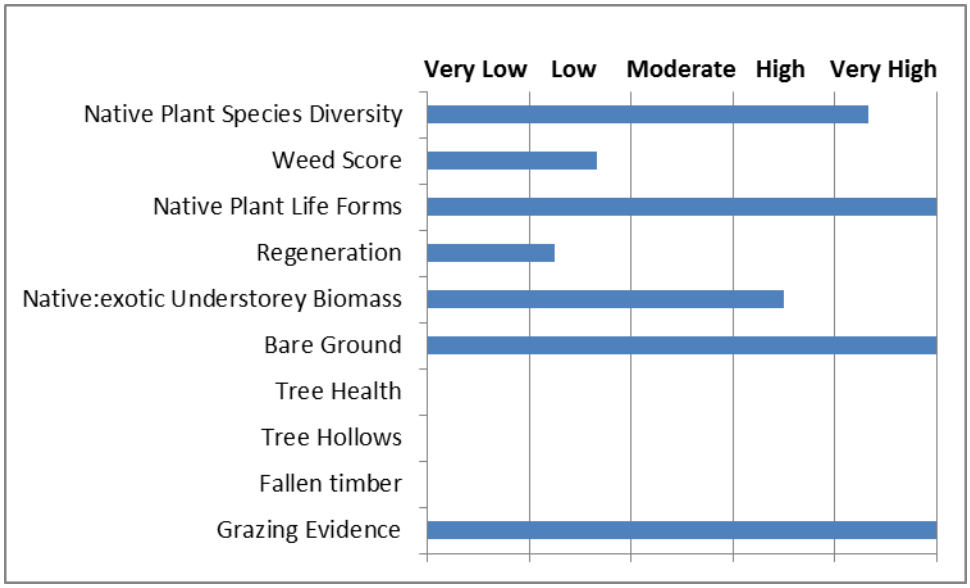
Date of assessment: 26/8/2015

GPS Location of Photograph: 256047 6074881 **Direction:** S

Benchmark Vegetation Community Type: SMLR Co 7.2 - Coastal Shrublands & Tall Shrublands

Site photograph:

Scores for Individual BushRAT Components:



Note: no score is expected for Tree Health, Tree Hollows or Fallen Timber as this is a treeless community type

BushRAT score sheet

SITE: 2 Dune shrubland between Bungala Creek and Carrackalin	
***Melaleuca lanceolata* ± *Olearia axillaris* shrubland**	
VEGETATION CONDITION SCORE (max. in	**score**
Native Plant Species Diversity (15)	13
Weed Score (15)	5
Native Plant Life Forms (10)	10
Regeneration (8)	2
Native:exotic Understorey Biomass (10)	7
Bare Ground (3)	3
Tree Health (5)	
Tree Hollows (5)	
Fallen timber (5)	
Grazing Evidence (4)	4
TOTAL (ADD UP ALL POINTS)	44
If community is naturally treeless x TOTAL by 1.23	54.12
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	54.12

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Oxalis pes-caprae	1a	4	4
Ehrharta calycina	2	4	8
Asparagus asparagoides forma	1	5	5
Lagurus ovatus	1a	2	2
Lycium ferocissimum	1a	3	3
		Total Cover x Threat Invasion	22

Management Zone: 3a Northern end previously mined woodland area

Vegetation Community: *Acacia uncifolia, Allocasuarina verticillata, *Melaleuca armillaris* open woodland

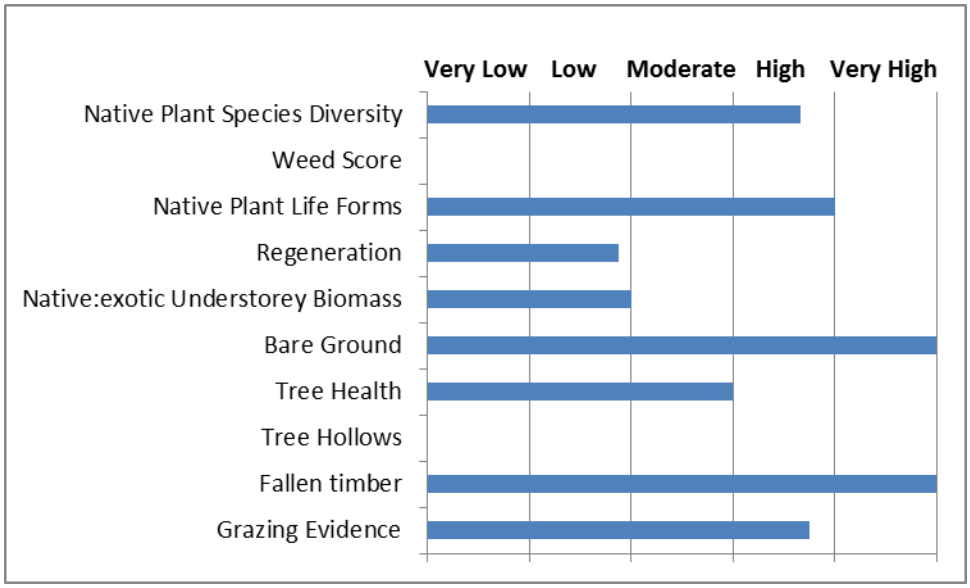
Date of assessment: 26/8/2015

GPS Location of Photograph: 256460 6075558 **Direction:** SW

Benchmark Vegetation Community Type: SMLR Co 7.3 Non-eucalypt Coastal Low Woodlands

Site photograph:

Scores for Individual BushRAT Components:



BushRAT score sheet

SITE: 3a Northern end previously mined woodland area

DESCRIPTION: *Acacia uncifolia, Allocasuarina verticillata, *Melaleuca armillaris* open woodland

VEGETATION CONDITION SCORE (max. in brackets)	**score**
Native Plant Species Diversity (15)	11
Weed Score (15)	0
Native Plant Life Forms (10)	8
Regeneration (8)	3
Native:exotic Understorey Biomass (10)	4
Bare Ground (3)	3
Tree Health (5)	3
Tree Hollows (5)	0
Fallen timber (5)	5
Grazing Evidence (4)	3
TOTAL (ADD UP ALL POINTS)	40
If community is naturally treeless x TOTAL by 1.23	
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	40

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Oxalis pes-caprae	4	4	16
Ehrharta calycina	3	4	12
Asparagus asparagoides forma	1	5	5
Lycium ferocissimum	1	3	3
Olea europaea ssp.	2	4	8
		Total Cover x Threat Invasion	44

Management Zone: 3b Southern end previously mined woodland area

Vegetation Community: *Acacia uncifolia, Allocasuarina verticillata, *Melaleuca armillaris* open woodland

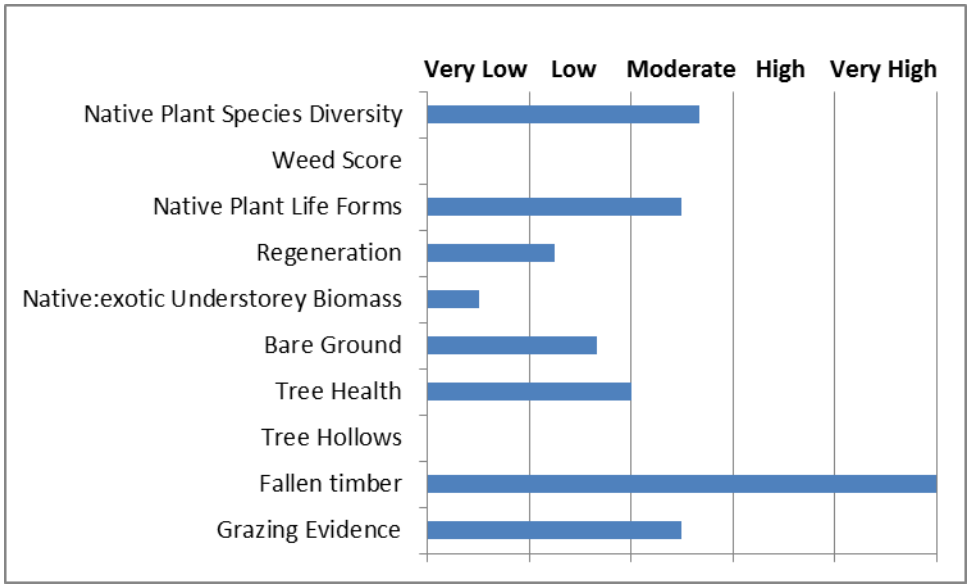
Date of assessment: 26/8/2015

GPS Location of Photograph: 256200 6075107 **Direction:** SSW

Benchmark Vegetation Community Type: 7.3 Non-eucalypt Coastal Low Woodlands

Site photograph:

Scores for Individual BushRAT Components:



BushRAT score sheet

SITE: 3b Southern end previously mined woodland area		
DESCRIPTION: *Acacia uncifolia, Allocasuarina verticillata, Melaleuca armillaris* open woodland		
VEGETATION CONDITION SCORE (max. in	**score**	
Native Plant Species Diversity (15)	8	
Weed Score (15)	0	
Native Plant Life Forms (10)	5	
Regeneration (8)	2	
Native:exotic Understorey Biomass (10)	1	
Bare Ground (3)	1	
Tree Health (5)	2	
Tree Hollows (5)	0	
Fallen timber (5)	5	
Grazing Evidence (4)	2	
TOTAL (ADD UP ALL POINTS)	26	
If community is naturally treeless x TOTAL by 1.23		
If community is not benchmarked for regen x 1.11		
ADJUSTED TOTAL SCORE	26	

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Oxalis pes-caprae	5	4	20
Ehrharta calycina	2	4	8
Asparagus asparagoides forma	*1a*	*5*	5
Melaleuca armillaris ssp. armillaris	*2*	*2*	4
Ehrharta longiflora	*2*	*2*	4
		Total Cover x Threat Invasion	41

Management Zone: 4 Disturbed Area adjacent housing

Vegetation Community: *Pinus/Eucalyptus* spp. woodland

Date of assessment: 9/2/16

GPS Location of Photograph: 255843 6074195 **Direction:** NW

Benchmark Vegetation Community Type: NA

Site photograph:

Note: No BushRAT assessment undertaken in this highly modified area

Management Zone: 5 Open dune shrubland immediately south Bungala Creek

Vegetation Community: *Acacia longifolia ssp. sophorae, Olearia axillaris ± Leucopogon parviflorus* shrubland

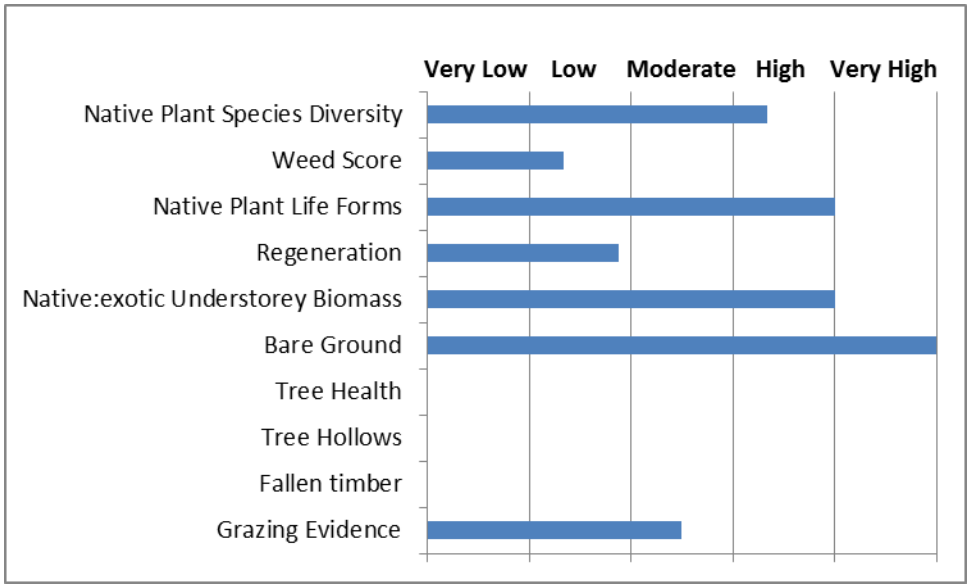
Date of assessment: 3/9/2015

GPS Location of Photograph: 255526 6073915 **Direction:** S

Benchmark Vegetation Community Type: SMLR Co 7.2 - Coastal Shrublands & Tall Shrublands

Site photograph:

Scores for Individual BushRAT Components:



Note: no score is expected for Tree Health, Tree Hollows or Fallen Timber as this is a treeless community type

BushRAT score sheet

SITE: 5 Open dune shrubland immediately south Bungala Creek ***Acacia longifolia ssp. sophorae, Olearia axillaris* ± *Leucopogon parviflorus* shrubland**	
VEGETATION CONDITION SCORE (max. in	**score**
Native Plant Species Diversity (15)	10
Weed Score (15)	4
Native Plant Life Forms (10)	8
Regeneration (8)	3
Native:exotic Understorey Biomass (10)	8
Bare Ground (3)	3
Tree Health (5)	
Tree Hollows (5)	
Fallen timber (5)	
Grazing Evidence (4)	2
TOTAL (ADD UP ALL POINTS)	38
If community is naturally treeless x TOTAL by 1.23	46.74
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	46.74

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Oxalis pes-caprae	1a	4	4
Ehrharta calycina	3	4	12
Asparagus asparagoides forma	*1*	*5*	5
Lagurus ovatus	*1a*	*2*	2
Lycium ferocissimum	*1*	*3*	3
		Total Cover x Threat Invasion	26

Management Zone: 6 Dune shrubland southern section

Vegetation Community: *Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae ± Allocasuarina verticillata* shrubland

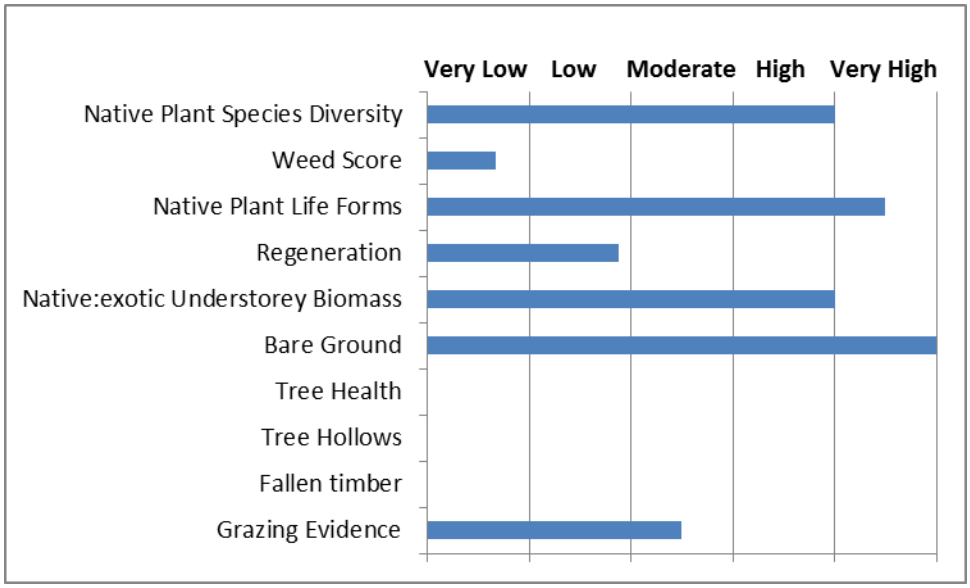
Date of assessment: 3/9/2015

GPS Location of Photograph: 255501 6073830 **Direction:** S

Benchmark Vegetation Community Type: SMLR Co 7.2 - Coastal Shrublands & Tall Shrublands

Site photograph:

Scores for Individual BushRAT Components:



Note: no score is expected for Tree Health, Tree Hollows or Fallen Timber as this is a treeless community type

BushRAT score sheet

SITE: 6 Dune shrubland southern section	
Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae ± Allocasuarina verticillata **shrubland**	
VEGETATION CONDITION SCORE (max. in	**score**
Native Plant Species Diversity (15)	12
Weed Score (15)	2
Native Plant Life Forms (10)	9
Regeneration (8)	3
Native:exotic Understorey Biomass (10)	8
Bare Ground (3)	3
Tree Health (5)	
Tree Hollows (5)	
Fallen timber (5)	
Grazing Evidence (4)	2
TOTAL (ADD UP ALL POINTS)	39
If community is naturally treeless x TOTAL by 1.23	47.97
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	47.97

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Oxalis pes-caprae	3	4	12
Ehrharta calycina	3	4	12
Asparagus asparagoides forma	*1*	*5*	5
Lagurus ovatus	*1a*	*2*	2
Lycium ferocissimum	*1*	*3*	3
		Total Cover x Threat Invasion	34

Management Zone: 7 Dune woodland southern section

Vegetation Community: *Allocasuarina verticillata, Acacia uncifolia* very open woodland

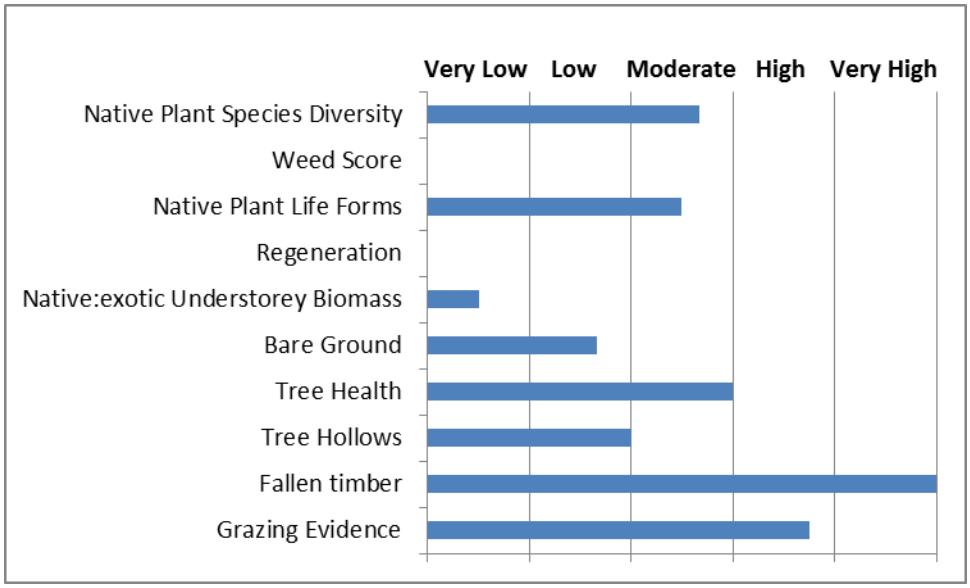
Date of assessment: 3/9/2015

GPS Location of Photograph: 255466 6073582 **Direction:** S

Benchmark Vegetation Community Type: 7.3 Non-eucalypt Coastal Low Woodlands

Site photograph:

Scores for Individual BushRAT Components:



BushRAT score sheet

SITE: 7 Dune woodland southern section		
Allocasuarina verticillata, Acacia uncifolia **very open woodland**		
VEGETATION CONDITION SCORE (max. in	**score**	
Native Plant Species Diversity (15)	8	
Weed Score (15)	0	
Native Plant Life Forms (10)	5	
Regeneration (8)	0	
Native:exotic Understorey Biomass (10)	1	
Bare Ground (3)	1	
Tree Health (5)	3	
Tree Hollows (5)	2	
Fallen timber (5)	5	
Grazing Evidence (4)	3	
TOTAL (ADD UP ALL POINTS)	28	
If community is naturally treeless x TOTAL by 1.23		
If community is not benchmarked for regen x 1.11		
ADJUSTED TOTAL SCORE	28	

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Oxalis pes-caprae	4	4	16
Ehrharta calycina	3	4	12
Asparagus asparagoides forma	*1*	*5*	5
Ehrharta longiflora	*2*	*2*	4
Olea europaea ssp.	*1*	*4*	4
		Total Cover x Threat Invasion	41

Management Zone: 8 Open area west of Beachside Caravan Park

**Vegetation Community: ***Ehrharta calycina* grassland with emergent *Myoporum insulare, Adriana quadripartita, Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae*

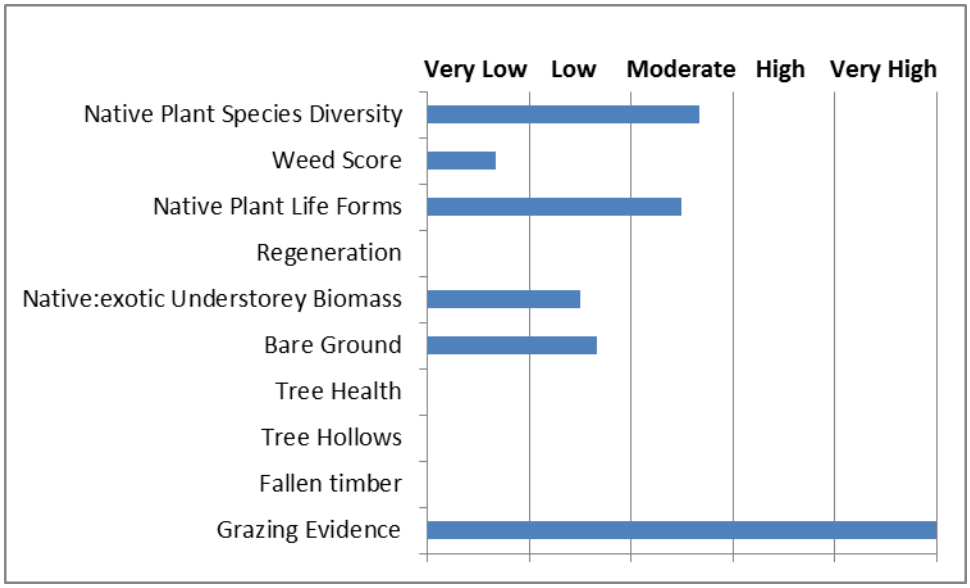
Date of assessment: 9/2/16

GPS Location of Photograph: 255239 6073136 **Direction:** S

Benchmark Vegetation Community Type: SMLR Co 7.2 - Coastal Shrublands & Tall Shrublands

Site photograph:

Scores for Individual BushRAT Components:



Note: no score is expected for Tree Health, Tree Hollows or Fallen Timber as this is a treeless community type

BushRAT score sheet

SITE: 8 Open area west of Beachside Caravan Park	
Ehrharta calycina* grassland with emergent *Myoporum insulare, Adriana quadripartita, Leucopogon parviflorus, Olearia axillaris,	
VEGETATION CONDITION SCORE (max. in	**score**
Native Plant Species Diversity (15)	8
Weed Score (15)	2
Native Plant Life Forms (10)	5
Regeneration (8)	0
Native:exotic Understorey Biomass (10)	3
Bare Ground (3)	1
Tree Health (5)	
Tree Hollows (5)	
Fallen timber (5)	
Grazing Evidence (4)	4
TOTAL (ADD UP ALL POINTS)	23
If community is naturally treeless x TOTAL by 1.23	28.29
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	28.29

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Avena spp.	2	2	4
Ehrharta calycina	4	4	16
Asparagus asparagoides forma	1	5	5
Lagurus ovatus	2	2	4
Euphorbia terracina	2	3	6
		Total Cover x Threat Invasion	35

Management Zone: 9 Red/Pink Gum woodland

Vegetation Community: *Eucalyptus camaldulensis, Eucalyptus fasciculosa* woodland

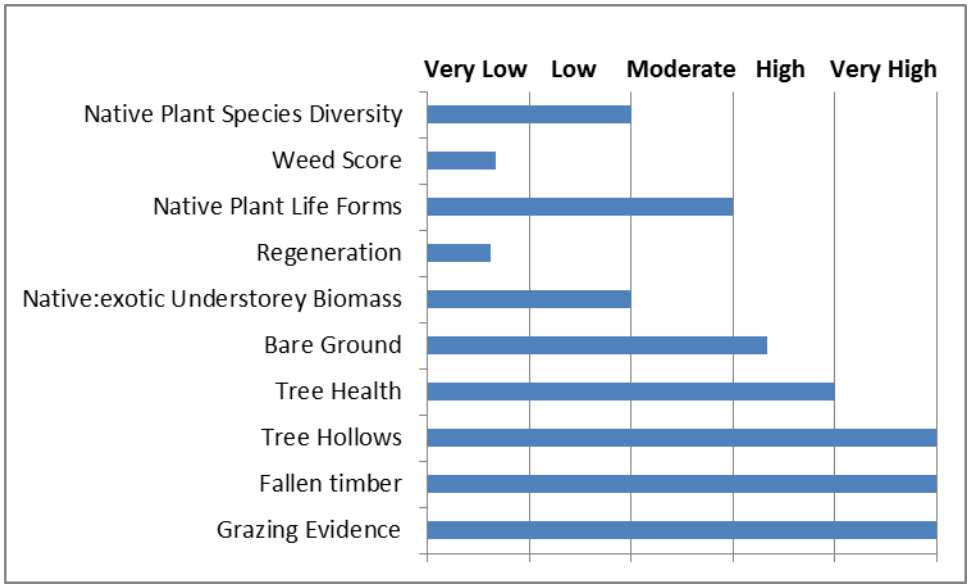
Date of assessment: 9/2/16

GPS Location of Photograph:255151 6072769 **Direction:** S

Benchmark Vegetation Community Type: SMLR Co Community 2- Forests & Woodlands with an Open Sclerophyll Shrub Understorey

Site photograph:

Scores for Individual BushRAT Components:



BushRAT score sheet

SITE: 9 Red/Pink Gum woodland		
***Eucalyptus camaldulensis, Eucalyptus fasciculosa* woodland**		
VEGETATION CONDITION SCORE (max. in	**score**	
Native Plant Species Diversity (15)	6	
Weed Score (15)	2	
Native Plant Life Forms (10)	6	
Regeneration (8)	1	
Native:exotic Understorey Biomass (10)	4	
Bare Ground (3)	2	
Tree Health (5)	4	
Tree Hollows (5)	5	
Fallen timber (5)	5	
Grazing Evidence (4)	4	
TOTAL (ADD UP ALL POINTS)	39	
If community is naturally treeless x TOTAL by 1.23		
If community is not benchmarked for regen x 1.11		
ADJUSTED TOTAL SCORE	39	

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Lycium ferocissimum	2	3	6
Ehrharta calycina	3	4	12
Olea europaea ssp.	2	4	8
Oxalis pes-caprae	2	4	8
Pennisetum clandestinum	3	3	9
		Total Cover x Threat Invasion	43

Management Zone: 10 Degraded woodland adjacent Yankalilla Creek

Vegetation Community: **Pinus halepensis ± Allocasuarina verticillata* woodland

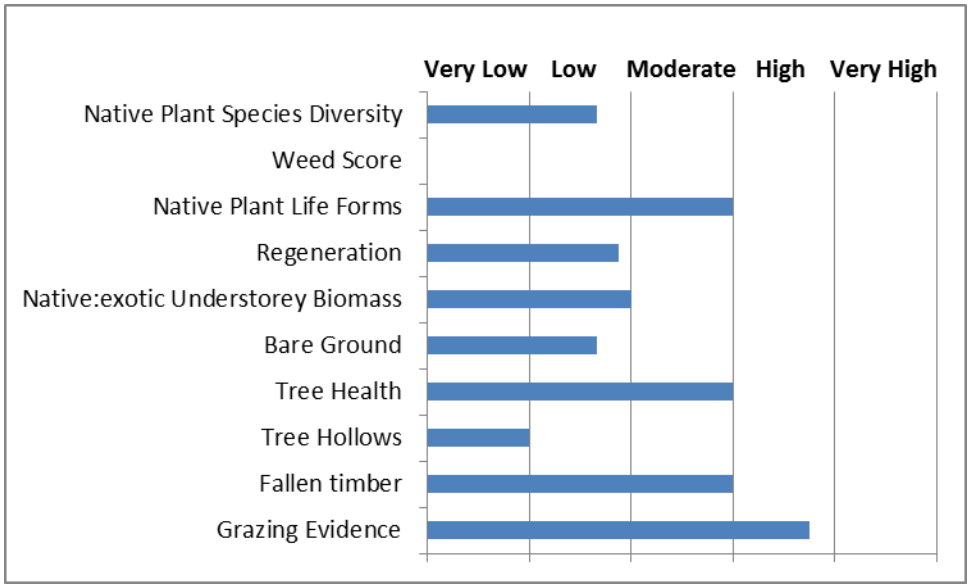
Date of assessment: 9/2/16

GPS Location of Photograph: 254996 6072341 **Direction:** SSW

Benchmark Vegetation Community Type: 7.3 Non-eucalypt Coastal Low Woodlands

Site photograph:

Scores for Individual BushRAT Components:



BushRAT score sheet

SITE: 10 Degraded Pine woodland adjacent Yankalilla Creek ***Pinus halepensis* ± *Allocasuarina verticillata* woodland**	
VEGETATION CONDITION SCORE (max. in	**score**
Native Plant Species Diversity (15)	5
Weed Score (15)	0
Native Plant Life Forms (10)	6
Regeneration (8)	3
Native:exotic Understorey Biomass (10)	4
Bare Ground (3)	1
Tree Health (5)	3
Tree Hollows (5)	1
Fallen timber (5)	3
Grazing Evidence (4)	3
TOTAL (ADD UP ALL POINTS)	29
If community is naturally treeless x TOTAL by 1.23	
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	29

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Rosa canina	3	3	9
Ehrharta calycina	3	4	12
Asparagus asparagoides forma	*1*	*5*	5
Pinus halepensis	*3*	*2*	6
Olea europaea ssp.	*2*	*4*	8
		Total Cover x Threat Invasion	40

Management Zone: 11a Open dune shrubland adjacent Yankalilla Creek – southern section

Vegetation Community: *Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae* open shrubland

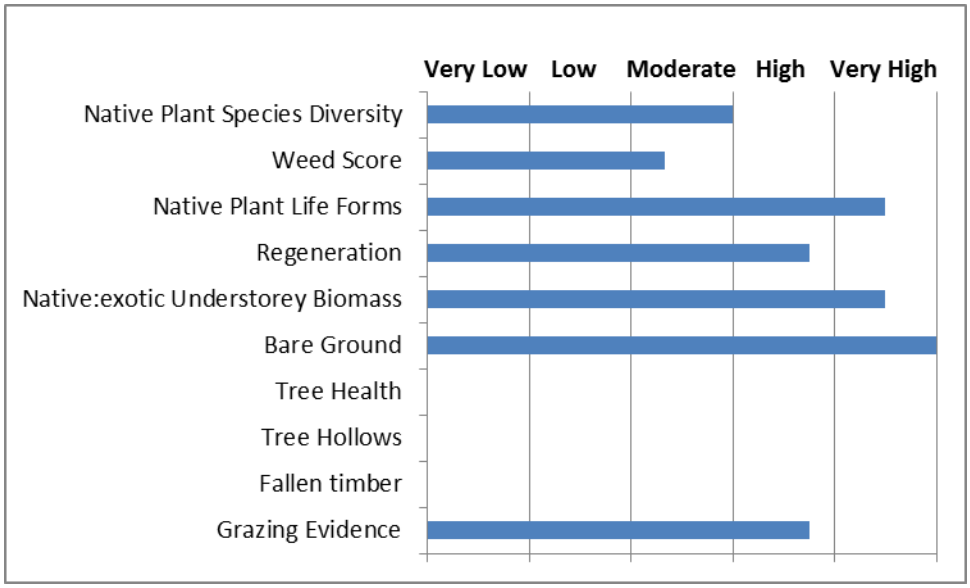
Date of assessment: 9/2/16

GPS Location of Photograph: 254813 6072255 **Direction:** SSW

Benchmark Vegetation Community Type: SMLR Co 7.2 - Coastal Shrublands & Tall Shrublands

Site photograph:

Scores for Individual BushRAT Components:



Note: no score is expected for Tree Health, Tree Hollows or Fallen Timber as this is a treeless community type

BushRAT score sheet

SITE: 11a Open dune shrubland adjacent Yankalilla Creek - southe		
***Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae* open shrubland**		
VEGETATION CONDITION SCORE (max. in	**score**	
Native Plant Species Diversity (15)	9	
Weed Score (15)	7	
Native Plant Life Forms (10)	9	
Regeneration (8)	6	
Native:exotic Understorey Biomass (10)	9	
Bare Ground (3)	3	
Tree Health (5)	NA	
Tree Hollows (5)	NA	
Fallen timber (5)	NA	
Grazing Evidence (4)	3	
TOTAL (ADD UP ALL POINTS)	46	
If community is naturally treeless x TOTAL by 1.23	56.58	
If community is not benchmarked for regen x 1.11		
ADJUSTED TOTAL SCORE	56.58	

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Leptospermum laevigatum	1	3	3
Ehrharta calycina	1a	4	4
Asparagus asparagoides forma	*1*	*5*	5
Olea europaea ssp.	*1*	*4*	4
Lycium ferocissimum	*1*	*3*	3
		Total Cover x Threat Invasion	19

Management Zone: 11b Open dune shrubland adjacent Yankalilla Creek – northern section

Vegetation Community: *Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae* open shrubland

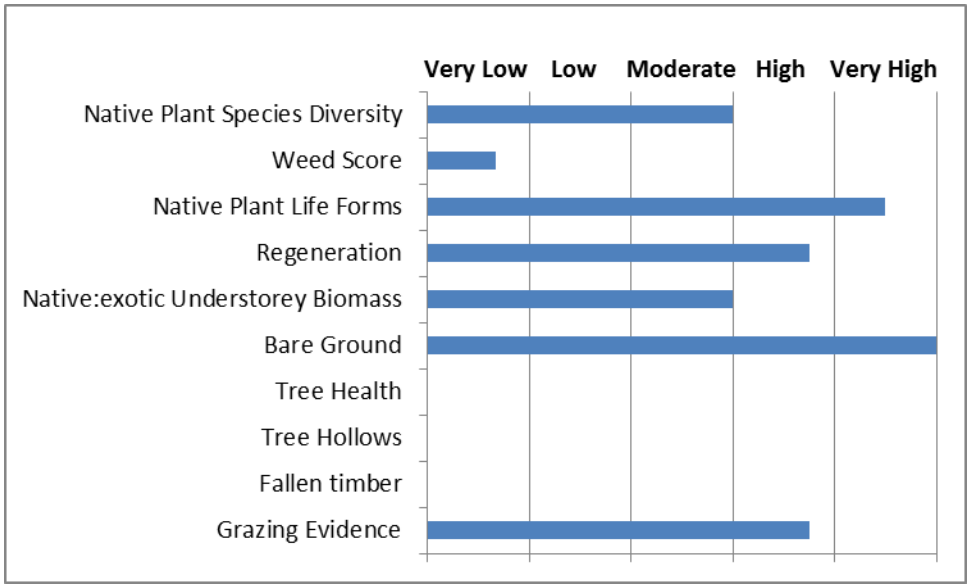
Date of assessment: 9/2/16

GPS Location of Photograph: 254990 6072594 **Direction:** SSW

Benchmark Vegetation Community Type: SMLR Co 7.2 - Coastal Shrublands & Tall Shrublands

Site photograph:

Scores for Individual BushRAT Components:



Note: no score is expected for Tree Health, Tree Hollows or Fallen Timber as this is a treeless community type

BushRAT score sheet

SITE: 11b Open dune shrubland adjacent Yankalilla Creek - northe		
***Leucopogon parviflorus, Olearia axillaris, Acacia longifolia ssp. sophorae* open shrubland**		
VEGETATION CONDITION SCORE (max. in	**score**	
Native Plant Species Diversity (15)	9	
Weed Score (15)	2	
Native Plant Life Forms (10)	9	
Regeneration (8)	6	
Native:exotic Understorey Biomass (10)	6	
Bare Ground (3)	3	
Tree Health (5)	NA	
Tree Hollows (5)	NA	
Fallen timber (5)	NA	
Grazing Evidence (4)	3	
TOTAL (ADD UP ALL POINTS)	38	
If community is naturally treeless x TOTAL by 1.23	46.74	
If community is not benchmarked for regen x 1.11		
ADJUSTED TOTAL SCORE	46.74	

Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max. 6)	**Invasive Threat Category** (max. 5)	**C x I**
Ammophila arenaria	3	3	9
Ehrharta calycina	3	4	12
Asparagus asparagoides forma	*1*	*5*	5
Olea europaea ssp.	*1*	*4*	4
Lycium ferocissimum	*1*	*3*	3
		Total Cover x Threat Invasion	33

Appendix 4: Photopoint monitoring

Photopoint Monitoring (adapted from DEWNR's Native Vegetation & Biodiversity Unit – BushRAT methodology)

1. PHOTOPOINT RECORD SHEET - instructions

- Your photopoint locations may have already been established for you – however, if they are not permanently marked with a stake you will need to relocate them using a GPS unit and a combination of the photo that was taken and the recorded photo direction. You can then permanently mark them if you wish.

- If not yet established, select at least one site per Vegetation Association, preferably at locations where you will expect to observe significant changes, either in the short term (e.g. through woody weed removal) or longer term (e.g. through revegetation).

- The "camera point" is where you take the photo from, the "target point" is where you aim the camera. Either or both can be marked 10m apart with a survey peg, or could be a designated tree, fence post or other permanent feature. You could also mark the site (approximately) on one of the maps in your Management Plan

- Record details in the table below.

- Take photos a minimum of once each year, preferably at the same time(s) each year.

- Photos should be accompanied by notes that will provide further information, such as the names of plants in the photographs (as these may not be able to be determined from the photos alone) and possible explanations for why a photo differs from the last one (e.g. drought year). Enter these additional details/observations into the table. Other observations that could be recorded to help document and/or explain changes occurring at the site may include things like:

    - Improved condition of the native vegetation compared to that shown in the original photos.
    - Natural regeneration of native plant species eg. native grasses and wattle seedlings.
    - The appearance (natural regeneration) of plant species not previously recorded.
    - Accumulation of leaf litter and fallen timber which show signs of increased insect activity and decomposition.
    - Re-establishment of a moss or lichen crust.

MANAGEMENT UNIT*:* _____ Year*:*

Vegetation Assocation/Site	Photopoint Location	Photo taken by:	Direction camera point to target point	Distance camera point to target point	Date	Notes/Observations

Appendix 5: Bushland weeding code

Bushland weeding code

From: Robertson, M., Grant, I., Craigie, A.I. (2005) *Stop Bushland Weeds: A Guide to Successful Weeding in South Australia's Bushland*. Nature Conservation Society of South Australia.

- Look before you weed—know where the native plants are.
- Choose the most effective and selective weeding technique for the plant and the location.
- Disturb soil as little as possible. Replace any disturbed soil, press it down and replace plant litter.
- Adapt to the season and weather conditions. Don't pull or grub weeds when the soil is dry and roots break off when pulled, or tramp through when soil is so soft that your feet damage plants at each step.
- Minimise the amount of trampling over the site and scatter the team of workers so that they do not form a new trail. Wear soft soled shoes and clothes which do not carry weed seeds or drag on foliage. Wear gloves.
- Before you pull, grub or poison large weeds, pull the small weeds which are growing underneath them.
- Avoid damage to native plants. Don't drop or fell large weeds onto native plants or drag boughs through the bush.
- Remove from the bush any parts of weeds which could regrow: ripe fruits, seed heads, bulbs, rhizomes and runners. Break up the rest into small pieces and leave them scattered to form mulch, especially over the spots where weeds have been removed.
- Do follow up work before moving on to weed a new area.
- Remove weed seeds or bulbils which could scatter into the weeded zone.
- Where native plants are regenerating among dense weeds, clear them some growing space but do not create large openings.

Appendix 6: Rabbit monitoring methodology and data

Methods:

Rabbit Dung Counts

The following method has been derived from Mutze *et al*[61, 62]. The number of rabbit dung within a 0.1m^2 (31.6cm x 31.6cm) quadrat were counted. Quadrats of were dropped at intervals of 5 paces along a series of linear transects walked across the site to give an approximately even distribution throughout the survey area. The survey areas was 0.5 hectares (100m by 50m). To avoid bias, we stayed as close to the chosen line of walk as the vegetation permitted and took care not to look down and select the position relative to dung density. Once dropped, the quadrat was adjusted to free it from vegetation that held it above the soil surface without changing its lateral position. Areas underneath dense low shrubs were not included. Each quadrat was thoroughly searched, and the total number of dung pellets per species for the quadrat was counted. Where dung counts were 40 or more the quadrat was recorded as a latrine. The initial survey was conducted on the 3rd of September 2015.

Dung Count Data Analysis

Dung counts were converted to estimated rabbit densities per hectare using the treatments and conversions described by Mutze *et al* 2014. Whilst the full description of the underpinning reasoning for the data treatment is provided in that paper, the relevant formulae have been reproduced below:

Rabbit density (Den) can be estimated from the mean density outside of latrines (DO, pellets quadrat^{-1}) as:

Equation 1: $Den = -0.0008 \times DO^3 + 0.0565 \times DO^2 + 0.86 \times DO$

Site location

Data was gathered in an area of approximately 70 metres by 70 metres (on-ground), or approximately one half hectare area. The GPS points of the corners are as follows: NW corner 255534 6073921, SW corner 255495, 6073872, SE corner 255534 6073826, NE corner 255570 6073826. The site was chosen in this location as it was in close proximity to the area being baited for rabbits, and would thus provide a good indicator of success if monitoring in the future.

Results:

Table 1: Rabbit density in the Normanville Dunes

Site Number	Date	Average dung density outside latrines (DO)	Estimated rabbit density (rabbits/ha.)
Site 1	3/9/2015	0.92	0.84

[61] Mutze, G., Cooke, B., Lethbridge, M. and Jennings, S. (2014). A rapid survey method for estimating population density of European rabbits living in native vegetation. The Rangelands Journal 36, 239-247.
[62] Mutze, G., Cooke, B. and Jennings, S. (in prep.). Demonstrating relationships between density of European rabbits and damage to Australian native vegetation.

Discussion:

Estimated rabbit density in the area surveyed was 0.84 rabbits per hectare. Mutze et al (in prep) [63] noted recruitment failure in semi-arid areas, as exemplified by missing cohorts of intermediate size/age plants, was evident for highly palatable species at approximately 0.5 rabbits ha^{-1}, and for moderately palatable species at approximately 1-2 rabbits ha^{-1}. As such, this site may be under pressure from rabbit grazing, and ongoing control is recommended.

It is recommended that the monitoring is repeated prior to any future rabbit control, to enable progress towards a target to be measured. Whilst eradication is unlikely (as rabbits will recolonise the area), a suggested target of <0.5 rabbit per hectare would be appropriate.

[63] Mutze, G., Cooke, B. and Jennings, S. (in prep.). Demonstrating relationships between density of European rabbits and damage to Australian native vegetation.

Appendix 7: Bushland Condition Monitoring Data

Note: the following are site reports extracted from the Nature Conservation Society of South Australia's Bushland Condition Monitoring database. They have not been re-formatted or modified in any way to ensure they remain compatible with future reporting from this database. Any errors reflect the original data or data entry issues.

Bushland Condition Monitoring

ASSESSMENT SITE REPORT

Site: NOR-BUCR-A-1

Region: Mount Lofty Ranges Property: Bungala Estuary

Surveyed on: 13/08/2015 by Bill New

Australian map grid reference: 255714 E 6073934 N

Permanent stake location: Bungala Estuary inside Normanville Caravan Park near entrance. Over bridge into park and approx 100m to where road forks. 30m N into scrub from side of road.

Vegetation community type: SMLRCo7.1 - Coastal Tussock Grasslands

Vegetation association: Leucopogon parviflorus, Acacia longifolia ssp. sophorae, Tall very open shrubland

Understorey: Open Rhagodia candolleana, Kunzea pomifera, Tetragonia implexicoma with scattered Scaevola crassifolia, Olearia axillaris, Dianella sp & Lepidosperma gladiatum. Dense patches & areas of Ehrharta calycina & Oxalis pes-caprae. Emergent Allocasuarinas have been planted.

Nature Conservation Society of South Australia

Contact NCSSA: T: (08) 7127 5403 F: (08) 8231 9773 E: ncssa@ncssa.asn.au

Post or visit: 260 Franklin Street, Adelaide SA 5000 www.ncssa.asn.au

Habitat Condition Indicator Values

Habitat Condition Notes

Species Diversity

There were 22 native plant species present within the 900sqm survey site and the site is therefore considered to be in EXCELLENT condition for this indicator.

Weed Abundance and Threat

There were 10 introduced plant species recorded in the survey site. The site is considered to be in VERY POOR condition for this indicator.

Structural Diversity A - Ground Cover

The estimated percentage of non-bare ground cover components is 70%

The site is considered to be in GOOD condition for this indicator.

Structural Diversity B - Plant Life Forms

There were 8 distinct layers/strata in the survey site. These were:

- Tall Shrubs > 2m
- Medium Shrubs 0.5 - 2m
- Small Shrubs < 0.5m
- Herbs
- Tall Tussocks > 0.5m
- Low Tussocks < 0.5m
- Vines, Twiners, Climbers

The site is considered to be in GOOD condition for this indicator.

Feral Animal Abundance

Signs of the following feral animal species were observed at the site:

- Rabbit
- Fox
- Other (Starlings)

The site is considered to be in VERY POOR condition for this indicator.

Total Grazing Pressure

Severe grazing damage was found in:

- Carpobrotus rossii (Native Pigface)
- Rhagodia candolleana ssp. (Sea-berry Saltbush)
- Scaevola crassifolia (Cushion Fanflower)

Heavy grazing damage was found in:

- Atriplex cinerea (Coast Saltbush)
- Carpobrotus rossii (Native Pigface)
- Isolepis nodosa (Knobby Club-rush)
- Leucophyta brownii (Coast Cushion Bush)
- Rhagodia candolleana ssp. (Sea-berry Saltbush)
- Scaevola crassifolia (Cushion Fanflower)

Light grazing damage was found in:

- Rhagodia candolleana ssp. (Sea-berry Saltbush)

The site is therefore considered to be in VERY POOR condition for this indicator.

Native Species List

Species	Common Name
Acacia longifolia ssp. sophorae	Coastal Wattle
Acacia retinodes var. (NC)	Silver Wattle
Alyxia buxifolia	Sea Box
Atriplex cinerea	Coast Saltbush
Carpobrotus rossii	Native Pigface
Dianella brevicaulis	Short-stem Flax-lily
Dianella revoluta var. revoluta	Black-anther Flax-lily
Dodonaea viscosa ssp. spatulata	Sticky Hop-bush
Isolepis nodosa	Knobby Club-rush
Kunzea pomifera	Muntries
Lepidosperma gladiatum	Coast Sword-sedge
Leucophyta brownii	Coast Cushion Bush
Leucopogon parviflorus	Coast Beard-heath
Muehlenbeckia gunnii	Coastal Climbing Lignum
Myoporum insulare	Common Boobialla
Olearia axillaris	Coast Daisy-bush
Pelargonium australe	Australian Pelargonium
Phragmites sp.	Reed
Rhagodia candolleana ssp.	Sea-berry Saltbush
Scaevola crassifolia	Cushion Fanflower
Tetragonia implexicoma	Bower Spinach
Triodia sp.	Spinifex

Conservation Rated Species (E=Endangered, V=Vulnerable, T=Threatened, R=Rare, U=Uncommon, K=Uncertain)

Species	Common Name	Region	Regional	State	National
Alyxia buxifolia	Sea Box	SL	R		
Kunzea pomifera	Muntries	SL	U		
Lepidosperma gladiatum	Coast Sword-sedge	SL	U		
Pelargonium australe	Australian Pelargonium	SL	U		
Scaevola crassifolia	Cushion Fanflower	SL	R		

Weed Abundance List

Species Name	Common Name	% Cover	Cover Rating	Threat Category
Asparagus asparagoides	Bridal Creeper	0.1	1	5
Brassica tournefortii	Wild Turnip			
Echium plantagineum	Salvation Jane			
Ehrharta calycina	Perennial Veldt Grass	10	3	3
Ehrharta longiflora	Annual Veldt Grass	1	1	2
Lagurus ovatus	Hare's Tail Grass	1	1	2
Lycium ferocissimum	African Boxthorn			
Oxalis pes-caprae	Soursob	20	3	3
Rhamnus alaternus	Blowfly Bush			
Sonchus oleraceus	Common Sow-thistle			

Red Alert Weeds

Species Name	Common Name	Quadrat	Bushland	Property
Arctotis stoechadifolia	White Arctotis	N	Y	N
Asparagus asparagoides	Bridal Creeper	Y	Y	N
Ehrharta calycina	Perennial Veldt Grass	Y	Y	N
Lycium ferocissimum	African Boxthorn	N	N	Y
Oxalis pes-caprae	Soursob	Y	Y	N

Structural Diversity A

Ground Cover Component	% Cover
Native Ground Cover	20
Weed Ground Cover	32
Leaf Litter	10
Exposed Rock	0
Moss, Lichens, Microphytic Crust	8
Bare Ground	20

Structural Diversity B

Life Form	% Cover	Cover Rating
Tall Shrubs > 2m	4	1
Medium Shrubs 0.5 - 2m	4	1
Small Shrubs < 0.5m	0.2	1
Herbs	0.05	1
Mat Plants/Groundcovers	10	2
Tall Tussocks > 0.5m	0.1	1
Low Tussocks < 0.5m	0.1	1
Vines, Twiners, Climbers	1	1

Regeneration

Species	Common Name	Adults	Seedlings	Juveniles	Height Class
Acacia retinodes var. (NC)	Silver Wattle	0	0	17	1
Atriplex cinerea	Coast Saltbush	0	0	5	1
Dianella brevicaulis	Short-stem Flax-lily	0	0	38	1
Dodonaea viscosa ssp. spatulata	Sticky Hop-bush	0	0	1	1
Lepidosperma gladiatum	Coast Sword-sedge	10	0	1	2
Olearia axillaris	Coast Daisy-bush	0	0	22	1
Pelargonium australe	Australian Pelargonium	0	0	14	1
Triodia sp.	Spinifex	0	0	21	1

Tree Details

Tree	Species Name	Dist (m)	Bearing	% Dieback
1	Acacia longifolia ssp. sophorae	4.2	190	50
2	Acacia longifolia ssp. sophorae	5.3	220	45
3	Leucopogon parviflorus	4.1	288	0
4	Leucopogon parviflorus	7.3	313	45
5	Acacia longifolia ssp. sophorae	4.1	340	0
6	Myoporum insulare	10.7	308	1
7	Myoporum insulare	11.8	306	1
8	Acacia longifolia ssp. sophorae	5.5	80	0
9	Acacia longifolia ssp. sophorae	7.6	78	0
10	Leucopogon parviflorus	8	140	10

Fallen Logs and Trees: 7

Tree Habitat

Tree	Species	Common Name	GBH (cm)	Size Category	Canopy (%)	Lerp Damage (%)	Mistletoe	Hollows
1	Acacia longifolia ssp. sophorae	Coastal Wattle	1	Small	50	5	0	N
2	Acacia longifolia ssp. sophorae	Coastal Wattle	1	Small	55	5	0	N
3	Leucopogon parviflorus	Coast Beard-heath	1	Small	100	0	0	N
4	Leucopogon parviflorus	Coast Beard-heath	1	Small	55	0	0	N
5	Acacia longifolia ssp. sophorae	Coastal Wattle	1	Small	100	0	0	N
6	Myoporum insulare	Common Boobialla	1	Small	99	0	0	N
7	Myoporum insulare	Common Boobialla	1	Small	99	0	0	N
8	Acacia longifolia ssp. sophorae	Coastal Wattle	1	Small	100	0	0	N
9	Acacia longifolia ssp. sophorae	Coastal Wattle	1	Small	100	0	0	N
10	Leucopogon parviflorus	Coast Beard-heath	1	Small	90	0	0	N

Tree Density (Trees/Ha)

Tree Count	Search Radius	Tree Density
10	11.8	228.72

Feral Animals

Animal	Sign	# Signs	Comments
Rabbit	Active Warren	1	
Rabbit	Live Animal	5	
Rabbit	Dung or Dung Patch	2	
Rabbit	Soil Disturbance	15	
Fox	Dung or Dung Patch	1	
Other	Live Animal	1	30 Starlings

Grazing Pressure

Species	Common Name	Light %	Heavy %	Severe %
Atriplex cinerea	Coast Saltbush		33.3	
Carpobrotus rossii	Native Pigface		12.5	50
Isolepis nodosa	Knobby Club-rush		100	
Leucophyta brownii	Coast Cushion Bush		100	
Rhagodia candolleana ssp.	Sea-berry Saltbush	70	20	10
Scaevola crassifolia	Cushion Fanflower		66.7	33.3

Bushland Condition Monitoring

ASSESSMENT SITE REPORT

Site: NOR-NODU-A-1

Region: Mount Lofty Ranges Property: Normanville Dunes

Surveyed on: 4/04/2013 by Bill New

Australian map grid reference: 255211 E 6073322 N

Permanent stake location: Normanville Dunes. Stardroppers & yellow caps installed. Peg is in NW corner. Sighter peg 170 degs. Use waypoint and mudmap. Difficult access, walk in through Caravan Pk, walk over dunes and north along beach.

Vegetation community type: SMLRCo7.2 - Coastal Shrublands & Tall Shrublands

Vegetation association: Acacia longifolia ssp., Leucopogon parviflorus, Olearia axillaris, Very open shrubland

Understorey: Open Scaevola crassifolia, Leucophyta brownii, Isolepis nodosa and Spinifex hirsutus

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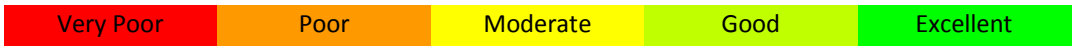
Habitat Condition Indicator Values



Species Diversity: Moderate

Weed Abundance and Threat: Poor

Structural Diversity A - Ground Cover: Poor

Structural Diversity B - Plant Life Forms: Poor

Regeneration - Trees and Woody Shrubs: Good

Feral Animal Abundance: Poor

Total Grazing Pressure: Good

Habitat Condition Notes

Species Diversity

There were 12 native plant species present within the survey site and the site is therefore considered to be in moderate condition for this indicator.

Note that this species list was made in a 900m2 area on the assessment date and does not represent a complete list for the patch of native vegetation.

Variety in plants provides a variety of habitat for other wildlife such as animals and invertebrates. (In general, an area high in plant species diversity will support a large range of fauna species that are interlinked through a huge number of interactions with each other).

This could be a result of past management of the area such as limited grazing and weed invasion.

Management of threats such as grazing pressure and weeds is likely to lead to an increase in native species diversity.

Without management of threats native species diversity is likely to decline.

Weed Abundance and Threat

There were 4 introduced plant species recorded in the survey site, the weed species with the greatest cover at the site were:

Species Name	Common Name	% Cover	Cover Rating	Threat Category
Ammophila arenaria	Marram Grass	8	3	3
Ehrharta calycina	Perennial Veldt Grass	0.5	2	3
Cakile maritima ssp. maritima	Two-horned Sea Rocket	0.01	1	1
Euphorbia paralias	Sea Spurge	0.01	1	3

The site is considered to be in poor condition for this indicator.

Note that this species list was made in a 900m2 area on the assessment date and does not represent a complete list for the patch of native vegetation.

Weeds compete with native vegetation for water, light, space and nutrients, and this competition can inhibit the survival and reproduction of native species. Weeds can also modify the suitability of a site for native fauna species.

A threat rating has been given to weed species in the region and is based on their invasiveness, their ability to out compete native plants and the difficulty of controlling them. Weeds that represent the highest threat are rated as 5, with a rating of 1 indicating weeds of lowest threat. The weeds with moderate to high threat rating (3-5) recorded **at the site** include:

Marram Grass (Ammophila arenaria)

Perennial Veldt Grass (Ehrharta calycina)

Additional weeds with moderate to high threat rating (3-5) recorded **in the bushland remnant** include:

Marram Grass (Ammophila arenaria)

Perennial Veldt Grass (Ehrharta calycina)

African Boxthorn (Lycium ferocissimum)

These weeds should be considered as high priorities for control.

Weed invasion can be a result of the disturbance history of the site (grazing, clearance, soil disturbance), the context of the bushland remnant within the landscape (proximity to weed infestation, size and perimeter to area ratio) and lack of active weed management.

Management of high threat weeds is a priority and is likely to improve the condition of the bushland for this and other indicators. All or some of the following may actions may be necessary to control these high threat weeds:

1. Control the most threatening weeds first, working from the best (ie least weed infested) areas of the bush towards the worst areas with the most weeds.

2. For highly invasive weeds, such as Boneseed, Blackberry, Broom, Gorse and Bridal Creeper, attempt to control small infestations wherever they occur immediately, including in areas outside the bushland.

3. Monitor bushland edges for new weed invasions and control as soon as possible.

4. Allow for prolonged observation of areas where previous outbreaks have occurred and perform regular follow-up control.

For all weed species, reduce disturbance and seed transport wherever and however possible by a variety of means:

use minimal disturbance weed control methods where practicable

ensure fencing is adequate to exclude domestic stock- control pest animals

keep vehicles and people on approved tracks

ensure vehicles and equipment are free of weed seeds

A useful, readily available starting reference is:

Robertson, M. (2005). Stop Bushland Weeds. A Guide to Successful Weeding in South Australia's Bushland 2nd Edition. The Nature Conservation Society of SA Inc., Adelaide.

Without weed management the bushland condition is likely to decline for this and other indicators.

Structural Diversity A - Ground Cover

The estimated percentage of ground cover components is 28%

The site is considered to be in poor condition for this indicator.

Increased percentage of bare ground can result in increased risk of erosion, evaporation and weed invasion. Limited bare ground and healthy ground cover components protect and promote soil health and retention, which forms a critical basis for wildlife habitat.

This is likely to be a result of past grazing practices, weed invasion and disturbance (eg clearance, soil disturbance).

Management of threats such as grazing pressure and disturbance may lead to a decrease in the percentage cover of bare ground.

Without management of threats the percentage cover of bare ground may increase and may lead to increased weed invasion, erosion risk and evaporation.

Structural Diversity B - Plant Life Forms

There were 6 distinct layers/strata in the survey site. Structural layers with the greatest cover were:

Medium Shrubs 0.5 - 2m

Small Shrubs < 0.5m

Mat Plants/Groundcovers

Low Grasses < 0.5m

Tall Tussocks > 0.5m

Low Tussocks < 0.5m

The site is considered to be in poor condition for this indicator.

A greater number of structural layers (and a greater overall cover of native species) provides better quality habitat for a diversity of wildlife. For example, in a study of 330 different farm sites, in those where understorey shrubs were present, there was a 31 percent increase in diversity of woodland-dependent birds.

This may be a result of past management of the area, for example: limited grazing and weed invasion.

Management of threats such as grazing pressure and weeds may lead to improvement in diversity of plant life forms.

Without management of threats the diversity of plant life forms is likely to decline.

Regeneration - Trees and Woody Shrubs

At this site there were 4 tree/shrub species with juvenile plants or seedlings present.

The site is considered to be in good condition for this indicator.

Regeneration varies in extent and rate between communities, species and climatic zones. It may be continual or episodic (requiring a particular disturbance or weather event such as fire or exceptionally wet conditions). In all vegetation communities, regeneration of plants should be sufficient, and occur often enough, to replace adult plants that die through natural processes. A lack or absence of regeneration indicates that bushland is stressed or disturbed and in the long term it can lead to loss of species and structural diversity.

This may be a result of past management of the area, for example: limited grazing and weed invasion.

Management of threats such as grazing pressure and weeds may lead to improvement in regeneration if other conditions (eg climate and seasonal conditions) are favourable.

Without management of threats such as grazing and weed invasion, adequate regeneration is unlikely to occur.

Feral Animal Abundance

Signs of the following feral animal species were observed at the site:

Fox

The site is considered to be in poor condition for this indicator.

Feral animals have the potential to cause declines in native plant and animal populations. They may contribute to the destruction of vegetation, loss of native animals, loss of soil stability, spread of weed species and fence line damage.

Total Grazing Pressure

This indicator assesses the impact of mammals grazing on the understory.

The site is considered to be in good condition for this indicator.

Grazing pressure can limit survival and reproduction in some plant species and reduce the cover of plants in the shrub and ground layers. As palatability and susceptibility to grazing depends on the type of plant and its life stage, grazing may also alter the group of plant species that occurs at the site.

Grazing pressure may be due to stock, native herbivores, introduced herbivores or a combination of these and may be seasonal, irregular or constant.

Management of grazing pressure may lead to improvement in this and other bushland condition indicators, particularly species diversity, structural diversity and weed abundance and threat.

In most cases prolonged/chronic heavy grazing pressure will result in a decline in this and other bushland condition indicators, particularly in species diversity, structural diversity and weed abundance and threat.

Native Species List

Species	Common Name
Acacia longifolia ssp. sophorae	Coastal Wattle
Carpobrotus rossii	Native Pigface
Dianella brevicaulis	Short-stem Flax-lily
Isolepis nodosa	Knobby Club-rush
Leucophyta brownii	Coast Cushion Bush
Leucopogon parviflorus	Coast Beard-heath
Myoporum insulare	Common Boobialla
Olearia axillaris	Coast Daisy-bush
Rhagodia candolleana ssp.	Sea-berry Saltbush
Scaevola crassifolia	Cushion Fanflower
Spinifex hirsutus	Rolling Spinifex
Threlkeldia diffusa	Coast Bonefruit

Conservation Rated Species

Species	Common Name	Region	Regional Status	State	National
Scaevola crassifolia	Cushion Fanflower	SL	R		

REGIONAL CONSERVATION STATUS	
X	Extinct/Presumed extinct: not located despite thorough searching of all known and likely habitats; known to have been eliminated by the loss of localised population(s); or not recorded for more than 50 years from an area where substantial habitat modification has occurred.
E	Endangered: rare and in danger of becoming extinct in the wild.
V	Vulnerable: rare and at risk from potential threats or long term threats that could cause the species to become endangered in the future.
T	Threatened: likely to be either Endangered or Vulnerable but insufficient data available for more precise assessment.
R	Rare: has a low overall frequency of occurrence (may be locally common with a very restricted distribution or may be scattered sparsely over a wider area). Not currently exposed to significant or widespread threats, but warrants monitoring and protective measures to prevent

	reduction of population sizes.
U	Uncommon: less common species of interest but not rare enough to warrant special protective measures.
K	Uncertain: likely to be either Threatened or Rare but insufficient data available for a more precise assessment
Q	Not yet assessed: but flagged to be of possible significance
SOUTH AUSTRALIAN CONSERVATION STATUS	
E	Endangered: Taxa that are likely to become extinct in South Australia unless the circumstances and factors threatening their abundance, survival or evolutionary development cease to operate.
V	Vulnerable: Taxa that are likely to move into the 'Endangered' category unless the circumstances and factors threatening their abundance, survival or evolutionary development cease to operate.
R	Rare: Taxa that occur in small populations in South Australia, that are not present 'Endangered' or 'Vulnerable' but are at some risk due to their low numbers.
AUSTRALIAN CONSERVATION STATUS	
E	Endangered: Species is not critically endangered, but is facing a *very high* risk of extinction in the wild in the near future.
V	Vulnerable: Species is not critically endangered or endangered, but is facing a *high risk* of extinction in the wild in the medium-term future.

The Australian conservation status is based on the current (as at December 2000) listing of species under the Environment Protection and Biodiversity Conservation Act 1999. The Act should be consulted directly where certainty is required.

The South Australian conservation status is based on Schedules of the National Parks and Wildlife Act 1972 (SA) as amended in 2000. Where certainty is required, the schedules should be consulted directly to determine official designations under the NPWS Act.

Weed Abundance List

Species Name	Common Name	% Cover	Cover Rating	Threat Category
Ammophila arenaria	Marram Grass	8	3	3
Cakile maritima ssp. maritima	Two-horned Sea Rocket	0.01	1	1
Ehrharta calycina	Perennial Veldt Grass	0.5	2	3
Euphorbia paralias	Sea Spurge	0.01	1	3

Red Alert Weeds

Species Name	Common Name	Site	Bushland	Property
Ammophila arenaria	Marram Grass	Y	Y	N
Ehrharta calycina	Perennial Veldt Grass	Y	Y	N
Lycium ferocissimum	African Boxthorn	N	Y	N

Structural Diversity A

Ground Cover Component	% Cover
Native Ground Cover	15
Weed Ground Cover	3
Leaf Litter	10
Exposed Rock	0
Moss, Lichens, Microphytic Crust	0.01
Bare Ground	72

Structural Diversity B

Life Form	% Cover	Cover Rating
Medium Shrubs 0.5 - 2m	5	2
Small Shrubs < 0.5m	3	1
Mat Plants/Groundcovers	0.5	1
Low Grasses < 0.5m	3	1
Tall Tussocks > 0.5m	0.5	1
Low Tussocks < 0.5m	0.2	1

Regeneration

Species Name	Est # Adults	Seedlings	Juveniles	Height Classes
Acacia longifolia ssp. sophorae	20	0	3	2
Leucopogon parviflorus	0	0	1	1
Myoporum insulare	1	0	3	2
Rhagodia candolleana ssp.	2	0	4	2

Tree Details

Tree	Species	Dist (m)	Bearing
1	Acacia longifolia ssp.	10.3	80
2	Olearia axillaris	6.1	115
3	Acacia longifolia ssp.	8.8	115
4	Acacia longifolia ssp.	7.5	125
5	Acacia longifolia ssp.	7.6	140
6	Acacia longifolia ssp.	10	150
7	Olearia axillaris	7	145
8	Olearia axillaris	7.5	165
9	Olearia axillaris	9.4	185
10	Acacia longifolia ssp.	7.4	300

Tree Habitat

Tree	Species	Common Name	GBH (cm)*	Size Category	Canopy Left (%)	Lerp Damage (%)	Mistletoe	Hollows
1	Acacia longifolia ssp.	Sallow Wattle	1	Small	98	0	0	N
2	Olearia axillaris	Coast Daisy-bush	1	Small	95	0	0	N
3	Acacia longifolia ssp.	Sallow Wattle	1	Small	95	0	0	N
4	Acacia longifolia ssp.	Sallow Wattle	1	Small	98	0	0	N
5	Acacia longifolia ssp.	Sallow Wattle	1	Small	97	0	0	N
6	Acacia longifolia ssp.	Sallow Wattle	1	Small	98	0	0	N
7	Olearia axillaris	Coast Daisy-bush	1	Small	70	0	0	N
8	Olearia axillaris	Coast Daisy-bush	1	Small	98	0	0	N
9	Olearia axillaris	Coast Daisy-bush	1	Small	95	0	0	N
10	Acacia longifolia ssp.	Sallow Wattle	1	Small	97	0	0	N

*Nominal 1 given as GBH

Tree Density (Trees/Ha)

TreeCount	SearchRadius	TreeDensity
10	10.3	300.19

Feral Animals

Animal	Sign	# Signs
Fox	Dung or Dung Patch	4

Bushland Condition Monitoring

ASSESSMENT SITE REPORT

Site: NOR-YANK-A-1

Region: Mount Lofty Ranges Property: Normanville Dunes

Surveyed on: 30/07/2014 by Ben McCallum

Australian map grid reference: 255523 E 6073656 N

Permanent stake location: WP#277. Quadrat oriented NSEW. Permanent stake in NE corner. Photopoint stake 10 m at 225 degrees.

Vegetation community type: SMLRCo7.31 - Non-eucalypt Coastal Low Woodlands

Vegetation association: Allocasuarina verticillata, Low open woodland

Understorey: Open Leucopogon & Acacia longifolia ssp sophorae with Rhagodia candolleana & Tetragonia implexicoma. Ground layer dominated by Oxalis pes-caprae, Ehrharta sp & Lepidosperma.

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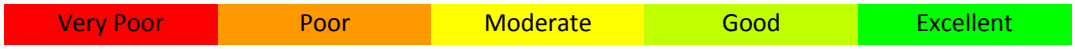
Habitat Condition Indicator Values



Species Diversity: Moderate

Weed Abundance and Threat: Very Poor

Structural Diversity A - Ground Cover: Excellent

Structural Diversity B - Plant Life Forms: Moderate

Regeneration - Trees and Woody Shrubs: Very Poor

Tree Health - Dieback: Good

Feral Animal Abundance: Good

Total Grazing Pressure: Very Poor

Regeneration - Trees: Very Poor

Tree Habitat Score: Excellent

Habitat Condition Notes

Species Diversity

There were 14 native plant species present within the survey site and the site is therefore considered to be in moderate condition for this indicator.

Note that this species list was made in a 900m2 area on the assessment date and does not represent a complete list for the patch of native vegetation.

Variety in plants provides a variety of habitat for other wildlife such as animals and invertebrates. (In general, an area high in plant species diversity will support a large range of fauna species that are interlinked through a huge number of interactions with each other).

This could be a result of past management of the area such as limited grazing and weed invasion.

Management of threats such as grazing pressure and weeds is likely to lead to an increase in native species diversity.

Without management of threats native species diversity is likely to decline.

Weed Abundance and Threat

There were 13 introduced plant species recorded in the survey site, the weed species with the greatest cover at the site were:

Species Name	Common Name	% Cover	Cover Rating	Threat Category
Asparagus asparagoides	Bridal Creeper	0.2		5
Ehrharta calycina	Perennial Veldt Grass	6	3	3
Ehrharta longiflora	Annual Veldt Grass	15	3	2
Lolium perenne	Perennial Ryegrass	0.5		1
Oxalis pes-caprae	Soursob	60	5	3

The site is considered to be in very poor condition for this indicator.

Note that this species list was made in a 900m2 area on the assessment date and does not represent a complete list for the patch of native vegetation.

Weeds compete with native vegetation for water, light, space and nutrients, and this competition can inhibit the survival and reproduction of native species. Weeds can also modify the suitability of a site for native fauna species.

A threat rating has been given to weed species in the region and is based on their invasiveness, their ability to out compete native plants and the difficulty of controlling them. Weeds that represent the highest threat are rated as 5, with a rating of 1 indicating weeds of lowest threat. The weeds with moderate to high threat rating (3-5) recorded **at the site** include:

Bridal Creeper (Asparagus asparagoides)

Olive (Olea europaea ssp.)

Soursob (Oxalis pes-caprae)

Weeds with moderate to high threat rating (3-5) recorded **in the bushland remnant** include:

Bridal Creeper (Asparagus asparagoides)

Olive (Olea europaea ssp.)

Soursob (Oxalis pes-caprae)

African Daisy (Senecio pterophorus)

These weeds should be considered as high priorities for control.

Weed invasion can be a result of the disturbance history of the site (grazing, clearance, soil disturbance), the context of the bushland remnant within the landscape (proximity to weed infestation, size and perimeter to area ratio) and lack of active weed management.

Management of high threat weeds is a priority and is likely to improve the condition of the bushland for this and other indicators. All or some of the following may actions may be necessary to control these high threat weeds:

1. Control the most threatening weeds first, working from the best (ie least weed infested) areas of the bush towards the worst areas with the most weeds.

2. For highly invasive weeds, such as Boneseed, Blackberry, Broom, Gorse and Bridal Creeper, attempt to control small infestations wherever they occur immediately, including in areas outside the bushland.

3. Monitor bushland edges for new weed invasions and control as soon as possible.

4. Allow for prolonged observation of areas where previous outbreaks have occurred and perform regular follow-up control.

For all weed species, reduce disturbance and seed transport wherever and however possible by a variety of means:

use minimal disturbance weed control methods where practicable

ensure fencing is adequate to exclude domestic stock- control pest animals

keep vehicles and people on approved tracks

ensure vehicles and equipment are free of weed seeds

A useful, readily available starting reference is:

Robertson, M. (2005). Stop Bushland Weeds. A Guide to Successful Weeding in South Australia's Bushland 2nd Edition. The Nature Conservation Society of SA Inc., Adelaide.

Without weed management the bushland condition is likely to decline for this and other indicators.

Structural Diversity A - Ground Cover

The estimated percentage of ground cover components is 117%

The site is considered to be in excellent condition for this indicator.

Increased percentage of bare ground can result in increased risk of erosion, evaporation and weed invasion. Limited bare ground and healthy ground cover components protect and promote soil health and retention, which forms a critical basis for wildlife habitat.

This may be a result of past management of the area, for example: limited grazing, weed invasion, soil disturbance and vegetation clearance.

Management of threats such as grazing pressure and disturbance may lead to a decrease in the percentage cover of bare ground.

Without management of threats the percentage cover of bare ground may increase and may lead to increased weed invasion, erosion risk and evaporation.

Structural Diversity B - Plant Life Forms

There were 8 distinct layers/strata in the survey site. Structural layers with the greatest cover were:

Medium Trees 5 - 15m

Medium Shrubs 0.5 - 2m

Mat Plants/Groundcovers

Tall Tussocks > 0.5m

The site is considered to be in moderate condition for this indicator.

A greater number of structural layers (and a greater overall cover of native species) provides better quality habitat for a diversity of wildlife. For example, in a study of 330 different farm sites, in those where understorey shrubs were present, there was a 31 percent increase in diversity of woodland-dependent birds.

This may be a result of past management of the area, for example: limited grazing and weed invasion.

Management of threats such as grazing pressure and weeds may lead to improvement in diversity of plant life forms.

Without management of threats the diversity of plant life forms is likely to decline.

Regeneration - Trees and Woody Shrubs

At this site there were 0 tree/shrub species with juvenile plants or seedlings present.

The site is considered to be in very poor condition for this indicator.

Regeneration varies in extent and rate between communities, species and climatic zones. It may be continual or episodic (requiring a particular disturbance or weather event such as fire or exceptionally wet conditions). In all vegetation communities, regeneration of plants should be sufficient, and occur often enough, to replace adult plants that die through natural processes. A lack or absence of regeneration indicates that bushland is stressed or disturbed and in the long term it can lead to loss of species and structural diversity.

This is likely to be a result of past grazing practices, weed invasion and disturbance (eg clearance, soil disturbance).

Management of threats such as grazing pressure and weeds may lead to improvement in regeneration if other conditions (eg climate and seasonal conditions) are favourable.

Without management of threats such as grazing and weed invasion, adequate regeneration is unlikely to occur.

Tree Health - Dieback

The health of the 10 adult trees closest to the star dropper was assessed. The following trees were found:

10 Allocasuarina verticillata with average remaining canopy of 88%

The site is therefore considered to be in good condition for this indicator.

Even in healthy communities plants can be subject to stress, however in a healthy community this stress will be within a range where plants can cope and recover. In communities suffering unnatural disturbances the stress levels on plants may be higher than is normal, and as a result, plants are considerably weakened, become unhealthy and may even die.

Dieback in plants can be caused by a large number of factors.

Management of threats such as weed invasion and grazing pressure may lead to improvement in tree canopy health.

Without management of threats such as grazing and weed invasion, tree canopy health may decline.

Feral Animal Abundance

No signs of feral animal species were observed at the site.

The site is considered to be in good condition for this indicator.

Feral animals have the potential to cause declines in native plant and animal populations. They may contribute to the destruction of vegetation, loss of native animals, loss of soil stability, spread of weed species and fence line damage.

Total Grazing Pressure

This indicator assesses the impact of mammals grazing on the understorey.

Severe grazing damage was found in:

Acacia sp. (Wattle)

Heavy grazing damage was found in:

Acacia sp. (Wattle)

Light grazing damage was found in:

Spinifex hirsutus (Rolling Spinifex)

The site is therefore considered to be in very poor condition for this indicator.

Grazing pressure can limit survival and reproduction in some plant species and reduce the cover of plants in the shrub and ground layers. As palatability and susceptibility to grazing depends on the type of plant and its life stage, grazing may also alter the group of plant species that occurs at the site.

Grazing pressure may be due to stock, native herbivores, introduced herbivores or a combination of these and may be seasonal, irregular or constant.

Management of grazing pressure may lead to improvement in this and other bushland condition indicators, particularly species diversity, structural diversity and weed abundance and threat.

In most cases prolonged/chronic heavy grazing pressure will result in a decline in this and other bushland condition indicators, particularly in species diversity, structural diversity and weed abundance and threat.

Tree Habitat Score

The tree habitat indicator is based on the presence of tree hollows, large sized trees and the health of the tree canopy. In all mature communities where trees are naturally present these factors provide important habitat for native animals.

9 of the 10 trees measured are considered to be 'habitat' trees.

The site is therefore considered to be in excellent condition for this indicator.

This may be a result of past management of the area, for example: no vegetation clearance in the recent past and/or weed and grazing pressure management.

Native Species List

Species	Common Name
Acacia longifolia ssp. sophorae	Coastal Wattle
Allocasuarina verticillata	Drooping Sheoak
Baumea juncea	Bare Twig-rush
Bursaria spinosa ssp. spinosa	Sweet Bursaria
Callitris gracilis	Southern Cypress Pine
Crassula sp.	Crassula/Stonecrop
Isolepis nodosa	Knobby Club-rush
Kunzea pomifera	Muntries
Lepidosperma gladiatum	Coast Sword-sedge
Leucopogon parviflorus	Coast Beard-heath
Olearia axillaris	Coast Daisy-bush
Rhagodia candolleana ssp.	Sea-berry Saltbush
Spinifex hirsutus	Rolling Spinifex
Tetragonia implexicoma	Bower Spinach

Conservation Rated Species

Species	Common Name	Region	Regional	State	National
Callitris gracilis	Southern Cypress Pine	SL	U		
Kunzea pomifera	Muntries	SL	U		
Lepidosperma gladiatum	Coast Sword-sedge	SL	U		

REGIONAL CONSERVATION STATUS	
X	Extinct/Presumed extinct: not located despite thorough searching of all known and likely habitats; known to have been eliminated by the loss of localised population(s); or not recorded for more than 50 years from an area where substantial habitat modification has occurred.
E	Endangered: rare and in danger of becoming extinct in the wild.
V	Vulnerable: rare and at risk from potential threats or long term threats that could cause the species to become endangered in the future.
T	Threatened: likely to be either Endangered or Vulnerable but insufficient data available for more precise assessment.
R	Rare: has a low overall frequency of occurrence (may be locally common with a very restricted distribution or may be scattered sparsely over a wider area). Not currently exposed to significant or widespread threats, but warrants monitoring and protective measures to prevent reduction of population sizes.
U	Uncommon: less common species of interest but not rare enough to warrant special protective measures.
K	Uncertain: likely to be either Threatened or Rare but insufficient data available for a more precise assessment
Q	Not yet assessed: but flagged to be of possible significance
SOUTH AUSTRALIAN CONSERVATION STATUS	
E	Endangered: Taxa that are likely to become extinct in South Australia unless the circumstances and factors threatening their abundance, survival or evolutionary development cease to operate.
V	Vulnerable: Taxa that are likely to move into the 'Endangered' category unless the circumstances and factors threatening their abundance, survival or evolutionary development cease to operate.
R	Rare: Taxa that occur in small populations in South Australia, that are not present 'Endangered' or 'Vulnerable' but are at some risk due to their low numbers.
AUSTRALIAN CONSERVATION STATUS	
E	Endangered: Species is not critically endangered, but is facing a *very high* risk of extinction in the wild in the near future.
V	Vulnerable: Species is not critically endangered or endangered, but is facing a *high risk* of extinction in the wild in the medium-term future.

The Australian conservation status is based on the current (as at December 2000) listing of species under the Environment Protection and Biodiversity Conservation Act 1999. The Act should be consulted directly where certainty is required.

The South Australian conservation status is based on Schedules of the National Parks and Wildlife Act 1972 (SA) as amended in 2000. Where certainty is required, the schedules should be consulted directly to determine official designations under the NPWS Act.

Weed Abundance List

Species Name	Common Name	% Cover	Cover Rating	Threat Category
Arctotheca calendula	Cape Weed			
Asparagus asparagoides	Bridal Creeper	0.2		5
Cerastium glomeratum	Common Mouse-ear Chickweed			
Crassula sp.	Crassula/Stonecrop			
Ehrharta calycina	Perennial Veldt Grass	6	3	3
Ehrharta longiflora	Annual Veldt Grass	15	3	2
Ficus sp.	Fig			
Hypochaeris glabra	Smooth Cat's Ear			
Lolium perenne	Perennial Ryegrass	0.5		1
Oenothera stricta ssp. stricta	Common Evening Primrose			
Olea europaea ssp.	Olive			
Oxalis pes-caprae	Soursob	60	5	3
Solanum nigrum	Black Nightshade			

Red Alert Weeds

Species Name	Common Name	Site	Bushland	Property
Asparagus asparagoides	Bridal Creeper	Y	Y	N
Olea europaea ssp.	Olive	Y	Y	N
Oxalis pes-caprae	Soursob	Y	Y	N
Senecio pterophorus	African Daisy	N	Y	N

Structural Diversity A

Ground Cover Component	% Cover
Native Ground Cover	15
Weed Ground Cover	80
Leaf Litter	15
Bare Ground	0.5
Exposed Rock	0
Moss, Lichens, Microphytic Crust	7

Structural Diversity B

Life Form	% Cover	Cover Rating
Medium Trees 5 - 15m	8	2
Tall Shrubs > 2m	1	1
Medium Shrubs 0.5 - 2m	5	2
Small Shrubs < 0.5m	0.5	1
Herbs	0.001	1
Mat Plants/Groundcovers	7	2
Tall Tussocks > 0.5m	5	2
Low Tussocks < 0.5m	0.001	1

Tree Details

Tree	Species	Dist (m)	Bearing
1	Allocasuarina verticillata	11.5	255
2	Allocasuarina verticillata	15	213
3	Allocasuarina verticillata	22	190
4	Allocasuarina verticillata	21	50
5	Allocasuarina verticillata	21.5	223
6	Allocasuarina verticillata	19	268
7	Allocasuarina verticillata	24	201
8	Allocasuarina verticillata	20.4	85
9	Allocasuarina verticillata	22.9	95
10	Allocasuarina verticillata	23.1	83

Tree Habitat

Tree	Species	Common Name	GBH (cm)*	Size Category	Canopy Left (%)	Lerp Damage (%)	Mistletoe	Hollows
1	Allocasuarina verticillata	Drooping Sheoak	1	Small	90	0	0	N
2	Allocasuarina verticillata	Drooping Sheoak	1	Small	90	0	0	N
3	Allocasuarina verticillata	Drooping Sheoak	1	Small	100	0	0	N
4	Allocasuarina verticillata	Drooping Sheoak	1	Small	100	0	0	N
5	Allocasuarina verticillata	Drooping Sheoak	1	Small	85	0	0	N
6	Allocasuarina verticillata	Drooping Sheoak	1	Small	100	0	0	N
7	Allocasuarina verticillata	Drooping Sheoak	1	Small	95	0	0	N
8	Allocasuarina verticillata	Drooping Sheoak	1	Small	90	0	0	N
9	Allocasuarina verticillata	Drooping Sheoak	1	Small	97	0	0	N
10	Allocasuarina verticillata	Drooping Sheoak	1	Small	30	0	0	N

* Nominal 1 given as GBH as measurement not recorded

Tree Density (Trees/Ha)

Count	Search Radius	Density
10	24	55.29

Grazing Pressure

Species	Common Name	Light %	Heavy %	Severe %
Acacia sp.	Wattle		66.6	33.3
Spinifex hirsutus	Rolling Spinifex	100		

Bushland Condition Monitoring

ASSESSMENT SITE REPORT

Site: NOR-YANK-A-2

Region: Mount Lofty Ranges Property: Normanville Sand Dunes

Surveyed on: 19/05/2015 by Sonia Croft

Australian map grid reference: 256248 E 6075156 N

Permanent stake location: Normanville Sand Dunes. From carpark at SW end of Shakeshaft Dr, 80m W to edge of dunes, S approx 200m along dune edge. W 95m onto dune ridge.

Vegetation community type: SMLRCo7.31 - Non-eucalypt Coastal Low Woodlands

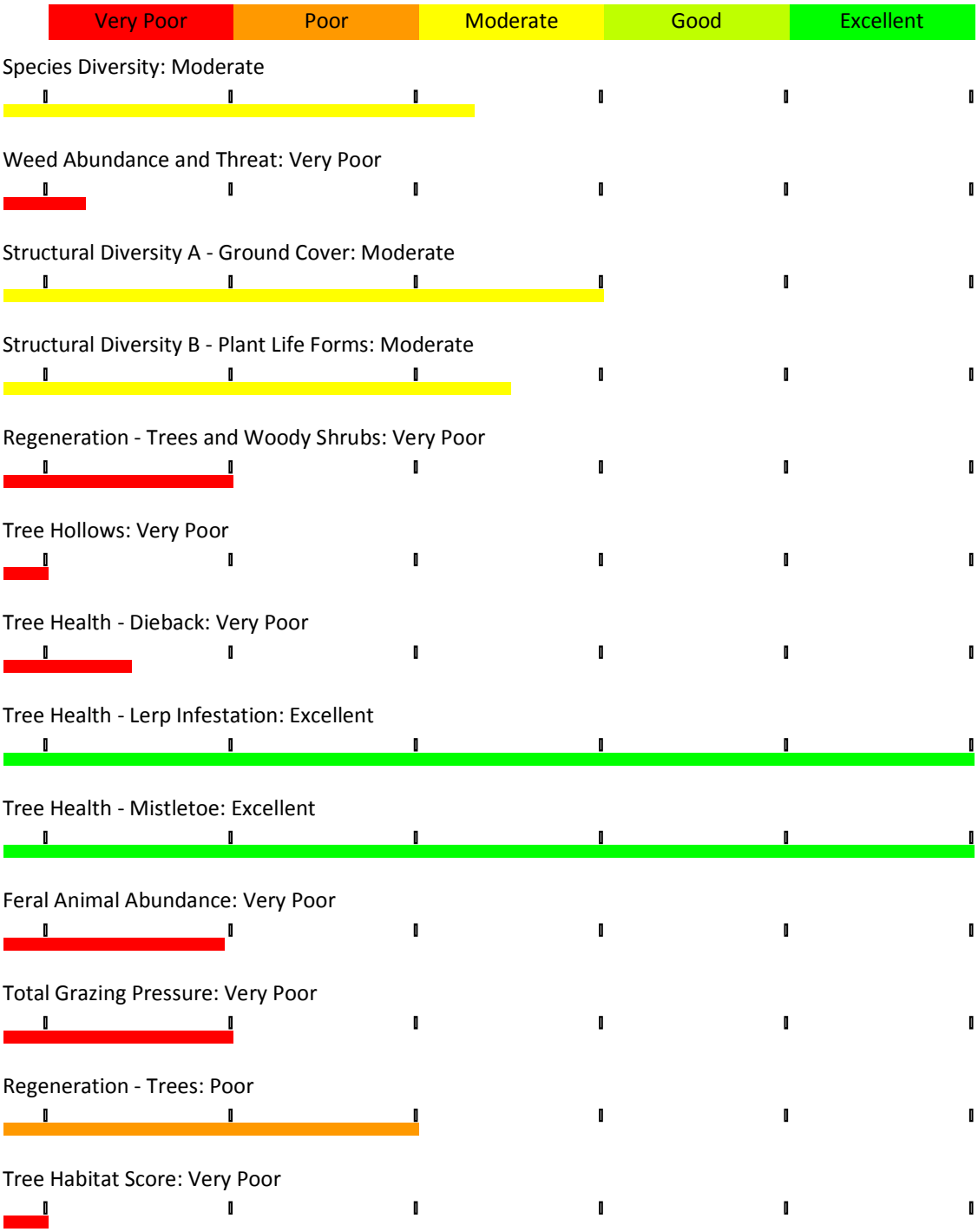
Vegetation association: Acacia retinodes var. retinodes, +/- Allocasuarina verticillata Low woodland

Understorey: Very sparse sedge & shrub layer of Rhagodia candolleana, Ficinia nodosa & Lepidosperma gladiatum. Groundcover dominated by Ehrharta calycina, Oxalis pes-caprae +/- Kunzea & bare ground. A few scattered young Allocasuarina verticillata also present.

Nature Conservation Society of South Australia

Contact NCSSA: T: (08) 7127 5403 F: (08) 8231 9773 E: ncssa@ncssa.asn.au

Habitat Condition Indicator Values



Habitat Condition Notes

Species Diversity

There were 12 native plant species present within the 900sqm survey site and the site is therefore considered to be in MODERATE condition for this indicator.

Weed Abundance and Threat

There were 10 introduced plant species recorded in the survey site. The site is considered to be in VERY POOR condition for this indicator.

Structural Diversity A - Ground Cover

The estimated percentage of non-bare ground cover components is 60%

The site is considered to be in MODERATE condition for this indicator.

Structural Diversity B - Plant Life Forms

There were 7 distinct layers/strata in the survey site. These were:

Medium Trees 5 - 15m
Small Trees < 5m
Medium Shrubs 0.5 - 2m
Small Shrubs < 0.5m
Tall Tussocks > 0.5m
Vines, Twiners, Climbers

The site is considered to be in MODERATE condition for this indicator.

Regeneration - Trees and Woody Shrubs

At this site there were 1 tree/shrub species with juvenile plants or seedlings present.

The site is considered to be in VERY POOR condition for this indicator.

Tree Hollows

The number of hollows indicates that this site provides VERY POOR habitat for hollow-using fauna. 0 of the 10 trees measured had one or more hollows.

Tree Health - Dieback

The health of the 10 adult trees closest to the star dropper was assessed. The following trees were found:

10 Coast Silver Wattle (Acacia retinodes var. uncifolia) with average dieback of 82%

The site is therefore considered to be in VERY POOR condition for this indicator.

Tree Health - Lerp Infestation

No species had lerp infestation of 5% or greater.

The site is therefore considered to be in EXCELLENT condition for this indicator.

Feral Animal Abundance

Signs of the following feral animal species were observed at the site:

Rabbit
White Snail

The site is considered to be in VERY POOR condition for this indicator.

Total Grazing Pressure

Heavy grazing damage was found in:

Acacia pycnantha (Golden Wattle)

Isolepis nodosa (Knobby Club-rush)

Rhagodia candolleana ssp. (Sea-berry Saltbush)

Light grazing damage was found in:

Acacia retinodes var. uncifolia (Coast Silver Wattle)

Allocasuarina verticillata (Drooping Sheoak)

Isolepis nodosa (Knobby Club-rush)

Rhagodia candolleana ssp. (Sea-berry Saltbush)

The site is therefore considered to be in VERY POOR condition for this indicator.

Tree Habitat Score

The tree habitat indicator is based on the presence of tree hollows, large sized trees and the health of the tree canopy. In all mature communities where trees are naturally present these factors provide important habitat for native animals.

0 of the 10 trees measured are considered to be 'habitat' trees.

The site is therefore considered to be in VERY POOR condition for this indicator.

Native Species List

Species	Common Name
Acacia pycnantha	Golden Wattle
Acacia retinodes var. uncifolia	Coast Silver Wattle
Allocasuarina verticillata	Drooping Sheoak
Dianella brevicaulis	Short-stem Flax-lily
Isolepis nodosa	Knobby Club-rush
Kunzea pomifera	Muntries
Lepidosperma gladiatum	Coast Sword-sedge
Leucopogon parviflorus	Coast Beard-heath
Melaleuca lanceolata	Dryland Tea-tree
Muehlenbeckia adpressa	Climbing Lignum
Pimelea serpyllifolia ssp. serpyllifolia	Thyme Riceflower
Rhagodia candolleana ssp.	Sea-berry Saltbush

Conservation Rated Species (E=Endangered, V=Vulnerable, T=Threatened, R=Rare, U=Uncommon, K=Uncertain)

Species	Common Name	Region	Regional	State	National
Acacia retinodes var. uncifolia	Coast Silver Wattle	SL	R		
Kunzea pomifera	Muntries	SL	U		
Lepidosperma gladiatum	Coast Sword-sedge	SL	U		
Melaleuca lanceolata	Dryland Tea-tree	SL	U		

Weed Abundance List

Species Name	Common Name	% Cover	Cover Rating	Threat Category
Asparagus asparagoides	Bridal Creeper	2	1	5
Brassica tournefortii	Wild Turnip			
Briza maxima	Large Quaking-grass			
Bromus sp.	Brome			
Ehrharta calycina	Perennial Veldt Grass	15	3	3
Euphorbia terracina	False Caper	2	1	3
Lycium ferocissimum	African Boxthorn	0.1	1	3
Oenothera stricta ssp. stricta	Common Evening Primrose			
Olea europaea ssp.	Olive			
Oxalis pes-caprae	Soursob	25	3	3

Red Alert Weeds

Species Name	Common Name	Quadrat	Bushland	Property
Acacia cyclops	Western Coastal Wattle	N	Y	Y
Ammophila arenaria	Marram Grass	N	Y	Y
Asparagus asparagoides	Bridal Creeper	Y	N	N
Ehrharta calycina	Perennial Veldt Grass	Y	Y	Y
Euphorbia paralias	Sea Spurge	N	Y	Y
Euphorbia terracina	False Caper	Y	Y	Y
Gazania sp.	Gazania	N	Y	Y
Lycium ferocissimum	African Boxthorn	Y	Y	Y
Olea europaea ssp.	Olive	Y	Y	Y
Oxalis pes-caprae	Soursob	Y	Y	Y

Structural Diversity A

Ground Cover Component	% Cover
Native Ground Cover	10
Weed Ground Cover	42
Leaf Litter	3
Moss, Lichens, Microphytic Crust	5
Bare Ground	40

Structural Diversity B

Life Form	% Cover	Cover Rating
Medium Trees 5 - 15m	5	2
Small Trees < 5m	5	2
Medium Shrubs 0.5 - 2m	1	1
Small Shrubs < 0.5m	0.5	1
Mat Plants/Groundcovers	8	2
Tall Tussocks > 0.5m	1	1
Vines, Twiners, Climbers	0.1	1

Regeneration

Species	Common Name	Adults	Seedlings	Juveniles	Height Class
Allocasuarina verticillata	Drooping Sheoak	2	0	5	2

Tree Details

Tree	Species Name	Dist (m)	Bearing	% Dieback
1	Acacia retinodes var. uncifolia	6.9	157	60
2	Acacia retinodes var. uncifolia	9.7	180	100
3	Acacia retinodes var. uncifolia	10	102	25
4	Acacia retinodes var. uncifolia	10.3	118	100
5	Acacia retinodes var. uncifolia	10.8	109	100
6	Acacia retinodes var. uncifolia	13.7	199	100
7	Acacia retinodes var. uncifolia	15.2	207	100
8	Acacia retinodes var. uncifolia	17.7	187	80
9	Acacia retinodes var. uncifolia	18	353	50
10	Acacia retinodes var. uncifolia	16.2	105	100

Fallen Logs and Trees: 0

Tree Habitat

Tree	Species	Common Name	GBH (cm)*	Size Category	Canopy (%)	Lerp Damage (%)	Mistletoe	Hollows
1	Acacia retinodes var. uncifolia	Coast Silver Wattle	1	Small	40	0	0	N
2	Acacia retinodes var. uncifolia	Coast Silver Wattle	1	Small	0	0	0	N
3	Acacia retinodes var. uncifolia	Coast Silver Wattle	1	Small	75	0	0	N
4	Acacia retinodes var. uncifolia	Coast Silver Wattle	1	Small	0	0	0	N
5	Acacia retinodes var. uncifolia	Coast Silver Wattle	1	Small	0	0	0	N
6	Acacia retinodes var. uncifolia	Coast Silver Wattle	1	Small	0	0	0	N
7	Acacia retinodes var. uncifolia	Coast Silver Wattle	1	Small	0	0	0	N
8	Acacia retinodes var. uncifolia	Coast Silver Wattle	1	Small	20	0	0	N
9	Acacia retinodes var. uncifolia	Coast Silver Wattle	1	Small	50	0	0	N
10	Acacia retinodes var. uncifolia	Coast Silver Wattle	1	Small	0	0	0	N

* GBH not recorded so given a nominal 1.

Tree Density (Trees/Ha)

Tree Count	Search Radius	Tree Density
10	18	98.29

Feral Animals

Animal	Sign	# Signs
Rabbit	Dung or Dung Patch	3
White snails	Live & dead animals	2

Grazing Pressure

Species	Common Name	Light %	Heavy %	Severe %
Acacia pycnantha	Golden Wattle		100	
Acacia retinodes var. uncifolia	Coast Silver Wattle	100		
Allocasuarina verticillata	Drooping Sheoak	71.4		
Isolepis nodosa	Knobby Club-rush	20	20	
Rhagodia candolleana ssp.	Sea-berry Saltbush	75	25	