



# 2019-2024: HOLDFAST BAY DUNES Biodiversity Action Plan



**ENVIRONMENT**



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## 1 INTRODUCTION

The City of Holdfast Bay has nine kilometres of coastline. Coastal dune vegetation in the City of Holdfast Bay has been substantially impacted and reduced by the high level of development and urbanisation within the Council area. However, the remaining dune systems are an important asset to the area, providing protection from tide effects, and a habitat for birds, reptiles and insects. Before extensive coastal development in the 19th and 20th centuries, the dunes were an important source of food and shelter for the traditional owners the Kaurna People<sup>1</sup>. The most significant dune systems remaining in the Holdfast Bay area are the Brighton to Seacliff dunes, and the Minda dunes at Somerton Park<sup>1</sup>. A Biodiversity Action Plan<sup>2</sup> has recently been developed and is being implemented for the Minda Dunes area. This Plan focusses on the other dune systems in the City of Holdfast Bay.

This Biodiversity Action Plan is intended to align with, and contribute to, the objectives of the Metropolitan Adelaide and Northern Coastal Action Plan (MANCAP)<sup>3</sup>. The goal of MANCAP is to understand and facilitate the conservation, protection and maintenance of the region's natural coastal resources and to establish conservation priorities for areas within the region. The MANCAP recognises the following key issues in the Holdfast Bay area:

1. Limited biodiversity in dunes
2. Weeds and nutrients are introduced to the dunes by numerous storm drains
3. Development of informal tracks in dunes damages vegetation and introduces weeds

This report focusses on activities to improve the limited biodiversity in dunes. This includes the following key actions for all dunes in the Holdfast Bay area from the MANCAP:

- Extend and intensify planting of native plant species, in tandem with removal of weed species.
- Need for ongoing dune restoration and maintenance to improve biodiversity

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

- clearly identify priority issues relating to the management of remnant vegetation and landforms within the study area; 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 Holdfast Bay dunes.

The preparation of the Action Plan has involved:

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<sup>1</sup> <https://www.holdfast.sa.gov.au/development-and-infrastructure/environment/our-coast> accessed 7/8/2019.

<sup>2</sup> Milne, T. (2018). Biodiversity Action Plan for the Minda Dunes 2018-2022. Unpublished report prepared for the City of Holdfast Bay.

<sup>3</sup> Caton B., Fotheringham D., Krahnert E., Pearson J., Royal M. and Sandercock R. 2009. Metropolitan Adelaide and Northern Coastal Action Plan. Prepared for the Adelaide and Mount Lofty Ranges NRM Board and Department for Environment and Heritage.

- 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;
- identification and prioritisation of actions necessary to improve the biodiversity values/environmental assets of the dunes; and
- identification of appropriate and cost effective monitoring

## 2 STUDY AREA

Figure 1 shows the four sections of dunes in the City of Holdfast Bay area that were considered for this report. For simplicity, these dunes were divided into the following groups:

- Holdfast Shores dunes
- Kent Street dunes
- Brighton to Seacliff dunes
- Brighton Caravan Park Dunes

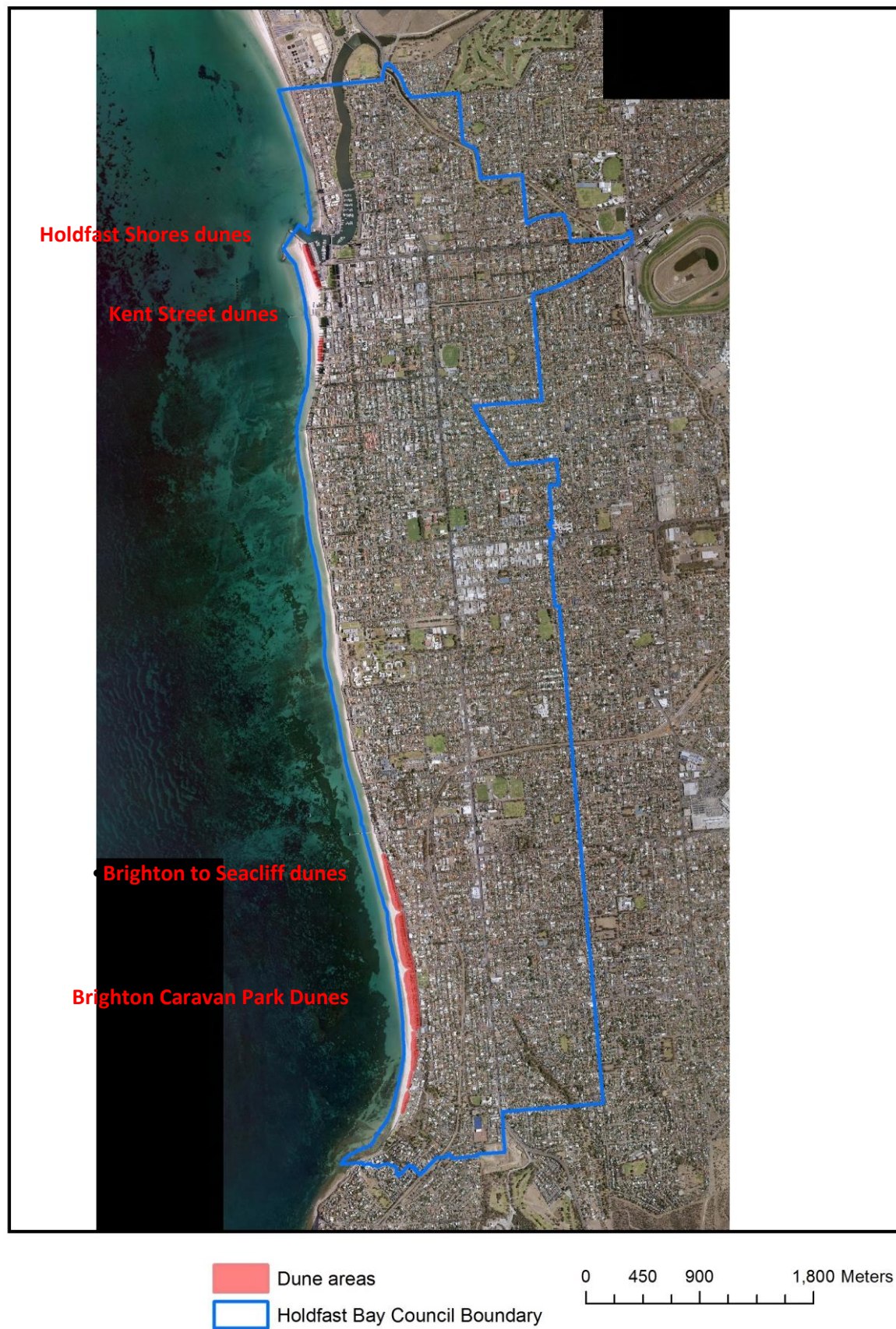


Figure 1: Location of Dunes considered in this report



## 2.1 Current land management

The dunes of the Holdfast Bay area (excluding Minda Dunes) are under the care and control of the City of Holdfast Bay in partnership with Natural Resources Adelaide and Mount Lofty Ranges, and local volunteers.

## 3 ENVIRONMENTAL ASSETS

### 3.1 Vegetation communities

The dunes that are the focus of this Plan have been substantially modified and impacted by development. As such not all structural components expected in dune systems (incipient dune, foredune, swale, secondary dune) are present in the sites. The Holdfast Shores dunes have a poorly developed incipient dune, covered with *\*Thinopyrum junceiforme*<sup>4</sup> (Sea Wheat-grass), and then an open, low dune that is an *Atriplex cinerea* (Coast Saltbush), *Olearia axillaris* (Coast Daisy-bush) open shrubland. The Kent Street dunes are really just an accumulation of sand against the sea wall that has been colonised by *\*Thinopyrum junceiforme* (Sea Wheat-grass), with one emergent *Atriplex cinerea* (Coast Saltbush).

The dunes from Brighton to Seacliff are the most well-formed, containing an incipient and foredune, a swale area, and then a slope up to the Esplanade. The incipient dune is dominated by *\*Thinopyrum junceiforme* (Sea Wheat-grass). The foredune is generally composed of a tussock grassland with a combination of the native *Spinifex hirsutus* (Rolling Spinifex), and the weedy *\*Thinopyrum junceiforme* (Sea Wheat-grass) and to a lesser extent *\*Ammophila arenaria* (Marram Grass). The back of the foredune and swale is principally a shrubland community, with *Olearia axillaris* (Coast Daisy-bush) consistently present, and *Scaevola crassifolia* (Cushion Fanflower), *Acacia longifolia ssp. sophorae* (Coastal Wattle) and *Acacia cupularis* (Cup Wattle) present to varying degrees. The slope up to the Esplanade is somewhat akin to the bottom of a secondary dune. It is currently composed of a shrubland community of *Myoporum insulare* (Common Boobialla), *Scaevola crassifolia* (Cushion Fanflower), *Acacia longifolia ssp. sophorae* (Coastal Wattle), *Olearia axillaris* (Coast Daisy-bush) with emergent *Allocasuarina verticillata* (She-oak), although in some sections (from Edward Street to Angus Neill Reserve), the planted, non-indigenous *\*Leptospermum laevigatum* (Coast Tea-tree) and planted *Melaleuca halmaturorum* (Swamp Tea-tree) form dominant stands. It is notable that Coast Beard-heath (*Leucopogon parviflorus*), which would be expected to be a co-dominant species with *Olearia axillaris* (Coast Daisy-bush) is entirely lacking in the dunes, likely as a result of past disturbance. Pre-European mapping of these dunes<sup>5</sup> shows the area was likely to have been an *Olearia axillaris* ± *Leucopogon parviflorus* shrubland. *Olearia axillaris*, *Acacia longifolia* ± *Leucopogon parviflorus* ± *Myoporum insulare* shrubland is likely to be the most prevalent plant community occurring on the white sand dunes from Brighton to Semaphore<sup>6</sup>.

<sup>4</sup> From this point forward any species marked with an asterisk (\*) is a non-indigenous species

<sup>5</sup> As accessed at [www.naturemaps.sa.gov.au](http://www.naturemaps.sa.gov.au) on 9/8/2019.

<sup>6</sup> Kraehenbuehl, D.N. (1989). Plant Communities. In: Wollaston, E.M. (ed.). The Aldinga Scrub Conservation Park. A report on its history and natural values. Nature Conservation Society of South Australia, Adelaide.

The last section of dunes at the Brighton Caravan Park is a very narrow section of accumulated sand that is a *Spinifex hirsutus* (Rolling Spinifex) hummock grassland with emergent *Scaevola crassifolia* (Cushion Fanflower) and *Acacia cupularis* (Cup Wattle).

### 3.2 Significant flora species

A search of the Naturemaps<sup>7</sup> and Atlas of Living Australia databases<sup>8</sup> revealed one record of the state Rare *Haloragis brownii* (Swamp Raspwort) in the Holdfast Shores dunes, but this is an historic record from 1885. There were no other records for State or Nationally Rated flora species within the current extent of the dune areas. Whilst no species of state or national conservation significance are found in the study area, there are 7 species considered Near Threatened, 5 species considered Rare and 1 species considered Vulnerable at a regional level (Table 1). This reflects the scarcity of dune and coastal woodland habitats in the region, and illustrates the importance of the dunes in the broader region. Appendix 1 includes a full list of species.

**Table 1: List of native plant species of conservation significance found during this study**

Species	Common Name	Conservation Status		
		AUS <sup>9</sup>	SA <sup>10</sup>	AMLR <sup>11</sup>
<i>Acacia cupularis</i>	Cup Wattle			RA
<i>Adriana quadripartita</i>	Coast Bitter-bush			RA
<i>Dianella brevicaulis</i>	Short-stem Flax-lily			NT
<i>Eucalyptus diversifolia</i> ssp. <i>diversifolia</i> *	Coastal White Mallee			RA
<i>Kunzea pomifera</i>	Muntries			RA
<i>Lepidosperma gladiatum</i>	Coast Sword-sedge			NT
<i>Leucophyta brownii</i>	Coast Cushion Bush			NT
<i>Melaleuca halmaturorum</i> *	Swamp Paper-bark			EN
<i>Myoporum insulare</i>	Common Boobialla			NT
<i>Olearia axillaris</i>	Coast Daisy-bush			NT
<i>Pelargonium australe</i>	Austral Stork's-bill			RA
<i>Pimelea serpyllifolia</i> ssp. <i>serpyllifolia</i>	Thyme Riceflower			NT
<i>Scaevola crassifolia</i>	Cushion Fanflower			VU
<i>Senecio pinnatifolius</i> var. <i>maritimus</i>	Variable Groundsel			RA
<i>Threlkeldia diffusa</i>	Coast Bonefruit			NT

Rating codes: NT = Near Threatened; R = Rare; V = Vulnerable; E=Endangered \* these species have been planted and are not considered to be a natural part of the flora of the dunes. As such they are not included in the summary in Section 3.2.

### 3.3 Native Fauna (including fauna of Conservation Significance)

#### 3.3.1 Reptiles

The Biological Database of South Australia (BDBSA) and Atlas of Living Australia (ALA) hold no reptile records for any of the dune areas. Small skink and gecko species possibly present include the Dwarf

<sup>7</sup> www.naturemaps.sa.gov.au accessed 7/8/2019

<sup>8</sup> www.ala.org.au accessed 7/8/2019

<sup>9</sup> Environment Protection and Biodiversity Conservation Act 1999

<sup>10</sup> Schedules of the National Parks and Wildlife Act 1972 accessed November 2015

<sup>11</sup> 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.

Skink (*Menetia greyii*), Four-toed Earless Skink (*Hemiergis peronii*), Bougainville's Skink (*Lerista bougainvillii*), Marbled Gecko (*Christinus marmoratus*), and the Three-toed Earless Skink (*Hemiergis decresiensis*). The larger reptile species Sleepy Lizard (*Tiliqua rugosa*), Eastern Bluetongue (*Tiliqua scincoides*), Eastern Bearded Dragon (*Pogona barbata*) and Eastern Brown Snake (*Pseudonaja textilis*) may also be present.

### 3.3.2 Birds

Bentz (2007)<sup>12</sup> conducted a bird survey in nearby Minda Dunes, and found 30 species to be present. An initial autumn survey of Minda Dunes in 2019 by Marcus Pickett noted sixteen species. The Atlas of Living Australia had 22 records<sup>13</sup> from the dune and associated beach areas that are the focus of this study. Table 2 shows these compiled data, and comments on each species. The regionally Vulnerable Silvereye (*Zosterops lateralis*) is considered likely to use the dunes as habitat. Ongoing management of the dunes should consider retention of sections of thick shrubland/low woodland in the site to ensure this species remains.

#### **Hooded Plover (*Thinornis rubricollis rubricollis*)**

A pair of the Nationally and State Vulnerable Hooded Plover (*Thinornis rubricollis rubricollis*) is known to utilise the beach at Seacliff and this pair successfully fledged a chick in the 2017-18 breeding season<sup>14</sup>, and successfully fledged two chicks across the 18/19 season<sup>15</sup>. This pair is the only pair along the City of Holdfast Bay's coast<sup>16</sup>, the most northerly pair in Gulf St Vincent, and have been nesting in the area for three seasons. The stormwater drain is integral to the survival of the chicks at that site (providing a secluded protected location to raise chicks and a spot for them to feed without having to go to the water's edge)<sup>17</sup>. Volunteers act as site guardians to assist with the protection of the chicks and educate beach users due to the high volume of beach users during the chick phase. Chick shelters have also been used at Seacliff to provide extra refuge for the chicks to hide in when threatened, as there is minimal shelter on the beach for chicks to hide from predators and recreational users<sup>18</sup>.

The Hooded Plover is a small beach-nesting bird endemic to the southern coasts of Australia. The eastern population, considered a separate subspecies, is entirely dependent on ocean beach habitats. Hooded Plovers are the most threatened of beach-nesting resident shorebirds because they are habitat specialists and in South Australia they are limited to breeding exclusively on ocean beaches, with rare exceptions. At the National Threatened Species Summit in 2015 the Hooded

<sup>12</sup> Bentz, T. (2007). Minda Dunes Bird Surveys Final 2007 Report. Unpublished report prepared for the City of Holdfast Bay.

<sup>13</sup> Note that only species considered extant in the region by "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" were included in this list.

<sup>14</sup> Mead, R. and Maguire, G. (2018). Monitoring Hooded Plover on the Fleurieu Peninsula: Distribution, breeding success and management in the 2017/18 season. Birdlife Australia.

<sup>15</sup> [http://www.birdlife.org.au/documents/bnb\\_Fleurieu\\_Peninsula\\_season\\_report\\_2018-19\\_final-sm.pdf](http://www.birdlife.org.au/documents/bnb_Fleurieu_Peninsula_season_report_2018-19_final-sm.pdf)

<sup>16</sup> Emma Stephens, pers. comm.

<sup>17</sup> Emma Stephens, pers. comm.

<sup>18</sup> [http://www.birdlife.org.au/documents/bnb\\_Fleurieu\\_Peninsula\\_season\\_report\\_2018-19\\_final-sm.pdf](http://www.birdlife.org.au/documents/bnb_Fleurieu_Peninsula_season_report_2018-19_final-sm.pdf)



Plover was listed as one of 12 bird species in Australia for action, and to improve the trajectory of conservation status, by 2020<sup>19</sup>.

According to the National Department of the Environment's Conservation Advice<sup>20</sup>, the Hooded Plover faces a number of threats, including:

- crushing or disturbance of eggs, chicks and nesting birds by human activities, particularly off-leash domestic dogs which also predate on flightless chicks;
- predation by invasive species such as foxes (*\*Vulpes vulpes*);
- predation by native scavengers such as ravens and magpies (*Corvus* spp.), currawongs (*Strepera* spp), and Silver Gulls (*Chroicocephalus novaehollandiae*), which are attracted to areas of human activity due to the availability of food and rubbish;
- indirect impacts of vehicles on prey availability;
- beach wrack harvesting;
- oil spills;
- entanglements and ingestion of marine debris;
- invasive weeds such as Sea Spurge (*\*Euphorbia paralias*), Marram Grass (*\*Ammophila arenaria*), Sea Wheatgrass (*\*Thinopyrum junceiforme*), Pyp Grass (*\*Ehrharta villosa*) and Beach Daisy (*\*Arctotheca populifolia*);
- inappropriate coastal erosion control measures such as brush matting;
- impacts of seawalls and measures to protect infrastructure against rising sea levels;
- limits to dune retreat due to residential and other buildings in the foredune, primary and secondary dunes;
- increasing frequency and severity of extreme weather events such as storms and storm surges, which flood nests and erode suitable habitat; and
- future threats from sea level rise, resulting in further narrowing of the coastal zone.

City of Holdfast Bay have the following by-laws, which come into effect on the 16<sup>th</sup> of December, 2019, to specifically address threats posed by both human and dog disturbance to Hooded Plover breeding sites:

- 1.1 Hooded Plover breeding site means any land within 100 metres of a sign on Local Government land that indicates a Hooded Plover breeding nest, eggs or chick(s) are or may be present on the land or in the vicinity.
- 1.2 A person must not allow a dog under that person's control, charge or authority to be or remain in a Hooded Plover breeding site unless the dog is under effective control by means of a leash.

### 3.3.3 Mammals

The site is considered unlikely to provide habitat for any native mammal species. Bats may fly over and feed above the site, but there is a lack of hollows or other niches that would form nesting habitat for bats.

<sup>19</sup> Letter to City of Marion from Birdlife Australia, dated 10<sup>th</sup> December 2018. *RE: Coastal Walkway, Stage 1 – Heron Way to Cormorant Drive, Hallett Cove.*

<sup>20</sup> <http://www.environment.gov.au/biodiversity/threatened/species/pubs/66726-conservation-advice.pdf>

### 3.3.4 Invertebrates

There have been no comprehensive invertebrate surveys in the dune areas. The dunes are likely to provide habitat for numerous species of invertebrates. Some specific plantings, such as *Adriana quadripartita* (Coast Bitter-bush), have been designed to provide host plants for butterflies, in this case the Bitterbush blue butterfly (*Theclinesthes albocincta*).

Table 2: Birds recorded in nearby Minda Dunes and/or on Atlas of Living Australia and Naturemaps databases.

Species	Common Name	Conservation Status			Source	Comments
		AUS <sup>21</sup>	SA <sup>22</sup>	AMLR <sup>23</sup>		
<i>Acanthiza lineata</i>	Striated Thornbill			LC	1	Possibly present.
<i>Accipiter cirrocephalus cirrocephalus</i>	Collared Sparrowhawk			LC	2,3	Possibly present.
<i>Anas superciliosa</i>	Pacific Black Duck			VU	1	Unlikely to be present.
<i>Anhinga novaehollandiae</i>	Australasian Darter			VU	1	Associated with marine rather than dune habitats.
<i>Anthochaera carunculata</i>	Red Wattlebird			LC	1,2,3	Possibly present.
<i>Anthochaera chrysoptera</i>	Little Wattlebird			LC	2	Possibly present.
<i>Cacatua sanguinea</i>	Little Corella			LC	2	Unlikely to be present.
<i>Chroicocephalus novaehollandiae</i>	Silver Gull			LC	1,2,3	Dune and marine habitats.
<i>Cincloramphus cruralis</i>	Brown Songlark			RA	2	Unlikely – usually associated with more open habitats.
<i>Corvus mellori</i>	Little Raven			LC	2	Possibly present.
<i>Cracticus torquatus</i>	Grey Butcherbird			VU	1	Unlikely to be present.
<i>Cygnus atratus</i>	Black Swan			RA	1	Associated with marine rather than dune habitats.
<i>Egretta sacra</i>	Eastern Reef Egret			CR	1	Associated with marine rather than dune habitats.
<i>Eolophus roseicapilla</i>	Galah			LC	2,3	Likely to be present.
<i>Falco cenchroides</i>	Nankeen Kestrel			LC	2	Likely to be present.
<i>Falco longipennis</i>	Australian Hobby			LC	2	Possibly present.
<i>Gavialis virens</i>	Singing Honeyeater			LC	2	Likely to be present.
<i>Glossopsitta concinna</i>	Musk Lorikeet			LC	1,2	Possibly present, although generally associated with taller overstorey.
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet			NT	2	Possibly present, although generally associated with taller overstorey.
<i>Grallina cyanoleuca</i>	Magpielark			LC	1,2,3	Likely to be present.
<i>Gymnorhina tibicen</i>	Australian Magpie			LC	2,3	Likely to be present.

<sup>21</sup> Environment Protection and Biodiversity Conservation Act 1999<sup>22</sup> Schedules of the National Parks and Wildlife Act 1972 accessed November 2015<sup>23</sup> 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			Source	Comments
		AUS <sup>21</sup>	SA <sup>22</sup>	AMLR <sup>23</sup>		
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher			EN	1	Associated with marine rather than dune habitats.
<i>Hirundo neoxena</i>	Welcome Swallow			LC	1,2,3	Likely to forage over dunes.
<i>Hydroprogne caspia</i>	Caspian Tern			VU	1	Associated with marine rather than dune habitats.
<i>Larus pacificus</i>	Pacific Gull			VU	1,3	Dune and marine habitats.
<i>Manorina melanocephala</i>	Noisy Miner			LC	1,2,3	Likely to be present.
<i>Ocyphaps lophotes</i>	Crested Pigeon			LC	1,2,3	Likely to be present.
<i>Pachycephala pectoralis</i>	Golden Whistler			LC	2	Unlikely to be present – prefers woodland habitats.
<i>Pelecanus conspicillatus</i>	Australian Pelican			RA	1,2	Associated with marine rather than dune habitats.
<i>Phalacrocorax fuscescens</i>	Black-faced Cormorant			RA	1	Associated with marine rather than dune habitats.
<i>Phalacrocorax varius</i>	Pied Cormorant			LC	1	Associated with marine rather than dune habitats.
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater			LC	1,2,3	Likely to be present.
<i>Platycercus elegans</i>	Crimson Rosella			LC	2,3	Possibly present, although generally associated with taller overstorey.
<i>Platycercus eximius</i>	Eastern Rosella			LC	2,3	Possibly present, although generally associated with taller overstorey.
<i>Ptilotula penicillata</i>	White-plumed Honeyeater			LC	2	Likely to be present.
<i>Rhipidura albiscapa</i>	Grey Fantail			LC	2	Possibly present, although prefers woodland habitats.
<i>Rhipidura leucophrys</i>	Willie Wagtail			NT	1,2,3	Likely to be present.
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet			LC	1,2,3	Possibly present, although generally associated with taller overstorey.
<i>Zosterops lateralis</i>	Silvereye			VU	2,3	Likely to be present.

Rating codes: NT = Near Threatened; R = Rare; V = Vulnerable; E=Endangered

Source: 1: Atlas of Living Australia search, 2: recorded by Bentz (2007)<sup>24</sup> in Minda Dunes, 3: recorded by Pickett (2019) in Minda Dunes in an autumn survey (unpublished data)

## 4 ENVIRONMENTAL THREATS (management issues)

Management issues that are of particular concern in terms of biodiversity conservation in the dune areas include:

- weed infestation;
- unmanaged trails;
- development of incursions into dunes;
- grazing and predation by pest animals (i.e. foxes, cats, rabbits, hares, rats, mice); and
- erosion.

### 4.1 Invasive weeds

The diversity and structure of the native vegetation are threatened by a range of introduced weed species and Table 3 lists the weeds of concern that have been recorded in the Dunes. These weeds meet one or more of the following criteria:

- Declared under the *Natural Resources Management Act*
- Threat rating under the MANCAP of 4 or more
- Red Alert weed rating of 3 or more

A full list of weeds recorded in this study is included in Appendix 1.

**Table 3: List of Priority Weeds for control in Holdfast Bay Dunes**

Species	Common Name	<sup>25</sup> Declared	<sup>26</sup> WONS	<sup>27</sup> MANCAP Threat Level	<sup>28</sup> Red Alert Weed Rating
* <i>Acacia cyclops</i>	Western Coastal Wattle			7	3
* <i>Ammophila arenaria</i>	Marram Grass			2	4
* <i>Carpobrotus edulis ssp. edulis</i>	Hottentot Fig			3	3
* <i>Chondrilla juncea</i>	Skeleton Weed	Y		2	2
* <i>Euphorbia paralias</i>	Sea Spurge			5	3
* <i>Euphorbia terracina</i>	False Caper	Y		5	3
* <i>Galenia pubescens var. pubescens</i>	Coastal Galenia			5	2
* <i>Gazania linearis</i>	Gazania	Y		6	3
* <i>Leptospermum laevigatum</i>	Coast Tea-tree	Y		6	4
* <i>Oxalis pes-caprae</i>	Soursob			5	4
* <i>Pennisetum clandestinum</i>	Kikuyu			5	3

<sup>24</sup> Bentz, T. (2007). Minda Dunes Bird Surveys Final 2007 Report. Unpublished report prepared for the City of Holdfast Bay.

<sup>25</sup> Under the *Natural Resources Management Act*

<sup>26</sup> Australian Weeds Committee (2012), Weeds of National Significance. Department of Agriculture, Fisheries and Forestry, Canberra, ACT <http://www.weeds.org.au/WONS/>

<sup>27</sup> Metropolitan and Northern Coastal Action Plan, AMLR Natural Resources Management Board

<sup>28</sup> Refer to Croft, S.J., J.A. Pedler & T.I. Milne (2005 – 2008) Bushland Condition Monitoring Manual. Nature Conservation Society of SA Inc.

Species	Common Name	<sup>25</sup> Declared	<sup>26</sup> WONS	<sup>27</sup> MANCAP Threat Level	<sup>28</sup> Red Alert Weed Rating
<i>*Polygala myrtifolia</i>	Myrtle-leaf Milkwort	Y		6	4
<i>*Thinopyrum junceiforme</i>	Sea Wheat-grass			3	4
<i>*Trachyandra divaricata</i>	Dune Onion Weed	Y		7	4

## 4.2 Pest animals

Table 4 lists the introduced animal species that have been recorded, or are considered likely to be present, in the Holdfast Bay Dunes.

**Table 4: List of introduced animal species considered likely to be present, in Holdfast Bay Dunes**

Species	Common Name
<b>Mammals</b>	
<i>Felis catus</i>	Feral Cat
<i>Mus musculus</i>	House Mouse
<i>Oryctolagus cuniculus</i>	European Rabbit
<i>Rattus rattus</i>	Black Rat
<i>Vulpes vulpes</i>	Fox
<i>Canis familiaris</i>	Dog
<b>Birds</b>	
<i>Alauda arvensis</i>	Skylark
<i>Columba livia</i>	Common Rock Dove
<i>Carduelis carduelis</i>	European Goldfinch
<i>Passer domesticus</i>	House Sparrow
<i>Spilopelia chinensis</i>	Spotted Dove
<i>Sturnus vulgaris</i>	Common Starling
<i>Turdus merula</i>	Blackbird

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.

## 4.3 Recreation activities

The dunes have heavy levels of pedestrian access. Management of pedestrian traffic is essential 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; and
- disturbance/predation on native animals by domestic pets such as dogs.

The MANCAP notes that a high priority action is to "Pursue rehabilitating tracks and denuded areas with indirect forms of access control such as brush, plantings and strategic fencing." Most trails head west from the esplanade through the dune systems, and in most cases are fenced on both sides. These appear to be used by the great bulk of pedestrian traffic. However, during field inspection it was noted that there was a propensity for some walkers to walk along the top of the primary dune parallel to the shoreline.



## 4.4 Erosion

Dune systems are easily exposed to erosion, particularly if the vegetation that helps bind the soil is damaged or removed. As previously discussed, management of pedestrian access is required to help prevent ongoing issues with erosion within the dunes. Erosion is a natural process along the coastline and is evident on the toe of some sections of the Brighton to Seacliff Dunes. It is important to note that the Adelaide coast has been developed and modified to the extent that there is an overall loss of sand from the coast such that artificial management is now required to maintain a sandy coastline. In addition, the loss of seagrass has enabled the release of sediment resulting in deepening of the sea bed and greater vulnerability to erosion from intense storm events<sup>29</sup>.

## 4.5 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 3 mm/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 Southern Fleurieu Coastal Action Plan (SFCAP) and summarises the threats that may be posed by climate change in the Holdfast Bay 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<sub>2</sub> 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.

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<sup>29</sup> Tyndall, J. and Lock, C. (2010). Biodiversity Management Plan: Minda Sand Dunes. Unpublished document prepared for the City of Holdfast Bay, Adelaide.

## 5 BIODIVERSITY MANAGEMENT STRATEGIES

### 5.1 Biodiversity management objectives

The biodiversity management objectives for City of Holdfast Bay Dunes are to manage the native vegetation of the reserves in such a manner as to:

- prevent any further loss of biodiversity; and
- strengthen the long-term viability and resilience of the existing biodiversity assets.

### 5.2 Management zones

To facilitate the ongoing management of threats to biodiversity (most notably weed control and a lack of diversity and structure of native plant species), the area has been divided into management zones (Table 5, Figures 2-7). Delineation of management units or zones is based largely on the type and condition of vegetation present.

Table 5. Holdfast Bay Dunes Management Zones

Area	Management Zone	Description
Holdfast Shores dunes	1	<i>Atriplex cinerea</i> , <i>Olearia axillaris</i> open shrubland – low dune in front of Holdfast Shores development.
	2	* <i>Thinopyrum junceiforme</i> grassland – in front of management zone 1.
Kent Street dunes	3	* <i>Thinopyrum junceiforme</i> ± <i>Spinifex hirsutus</i> grassland – small area of built up sand against a seawall.
Brighton to Seacliff dunes	4	<i>Spinifex hirsutus</i> , * <i>Thinopyrum junceiforme</i> grassland – incipient dune and foredune.
	5	<i>Olearia axillaris</i> , <i>Scaevola crassifolia</i> , <i>Acacia cupularis</i> open shrubland – hind of foredune and swale.
	6	<i>Myoporum insulare</i> , <i>Scaevola crassifolia</i> , <i>Acacia longifolia</i> ssp. <i>sophorae</i> , <i>Olearia axillaris</i> closed shrubland with emergent <i>Allocasuarina verticillata</i> – secondary dune slope to esplanade.
	7	<i>Spinifex hirsutus</i> , * <i>Thinopyrum junceiforme</i> ± * <i>Ammophila arenaria</i> grassland – incipient dune and foredune.
	8	<i>Olearia axillaris</i> , <i>Scaevola crassifolia</i> , <i>Acacia longifolia</i> ssp. <i>sophorae</i> open shrubland – hind of foredune and swale.
	9	* <i>Leptospermum laevigatum</i> , <i>Melaleuca halmaturorum</i> , <i>Myoporum insulare</i> , <i>Acacia longifolia</i> ssp. <i>sophorae</i> tall shrubland – secondary dune slope to esplanade.
	10	<i>Spinifex hirsutus</i> , * <i>Thinopyrum junceiforme</i> ± * <i>Ammophila arenaria</i> grassland – incipient dune and foredune.
	11	<i>Olearia axillaris</i> , <i>Scaevola crassifolia</i> , <i>Acacia cupularis</i> , <i>A. longifolia</i> ssp. <i>sophorae</i> open shrubland – hind of foredune and swale.
	12	<i>Acacia cupularis</i> , <i>Olearia axillaris</i> very open shrubland – drainage line and slope to esplanade.
	13	<i>Olearia axillaris</i> , <i>Scaevola crassifolia</i> , <i>Acacia cupularis</i> , <i>A. longifolia</i> ssp. <i>sophorae</i> open shrubland – revegetated area near new boardwalk.
Brighton Caravan Park Dunes	14	* <i>Cakile maritima</i> herbland
	15	<i>Spinifex hirsutus</i> hummock grassland with emergent <i>Scaevola crassifolia</i> , <i>Acacia cupularis</i>

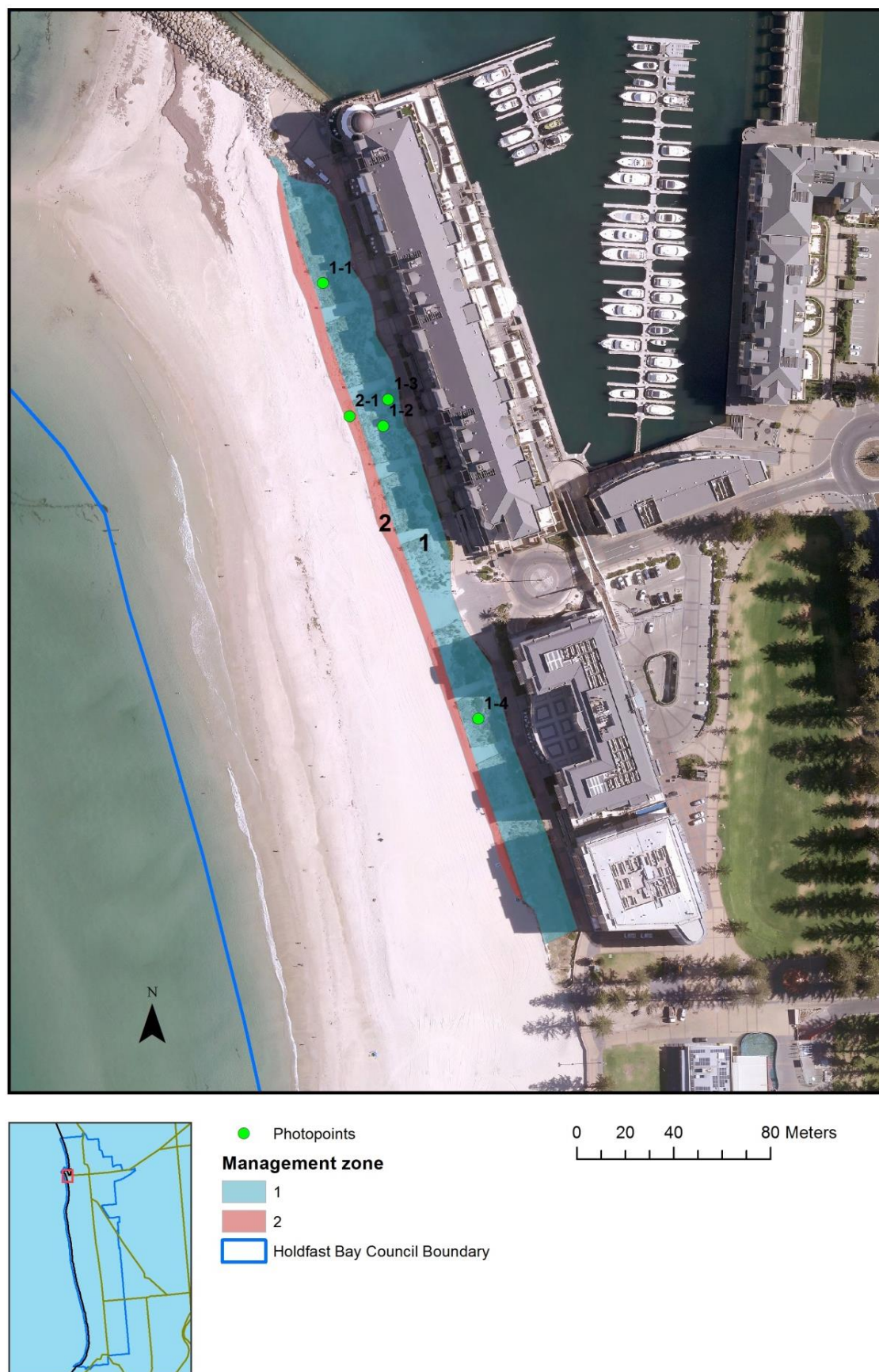


Figure 2: Management Units delineated for Holdfast Shores dunes. Management units are based largely on the type and condition of vegetation present.



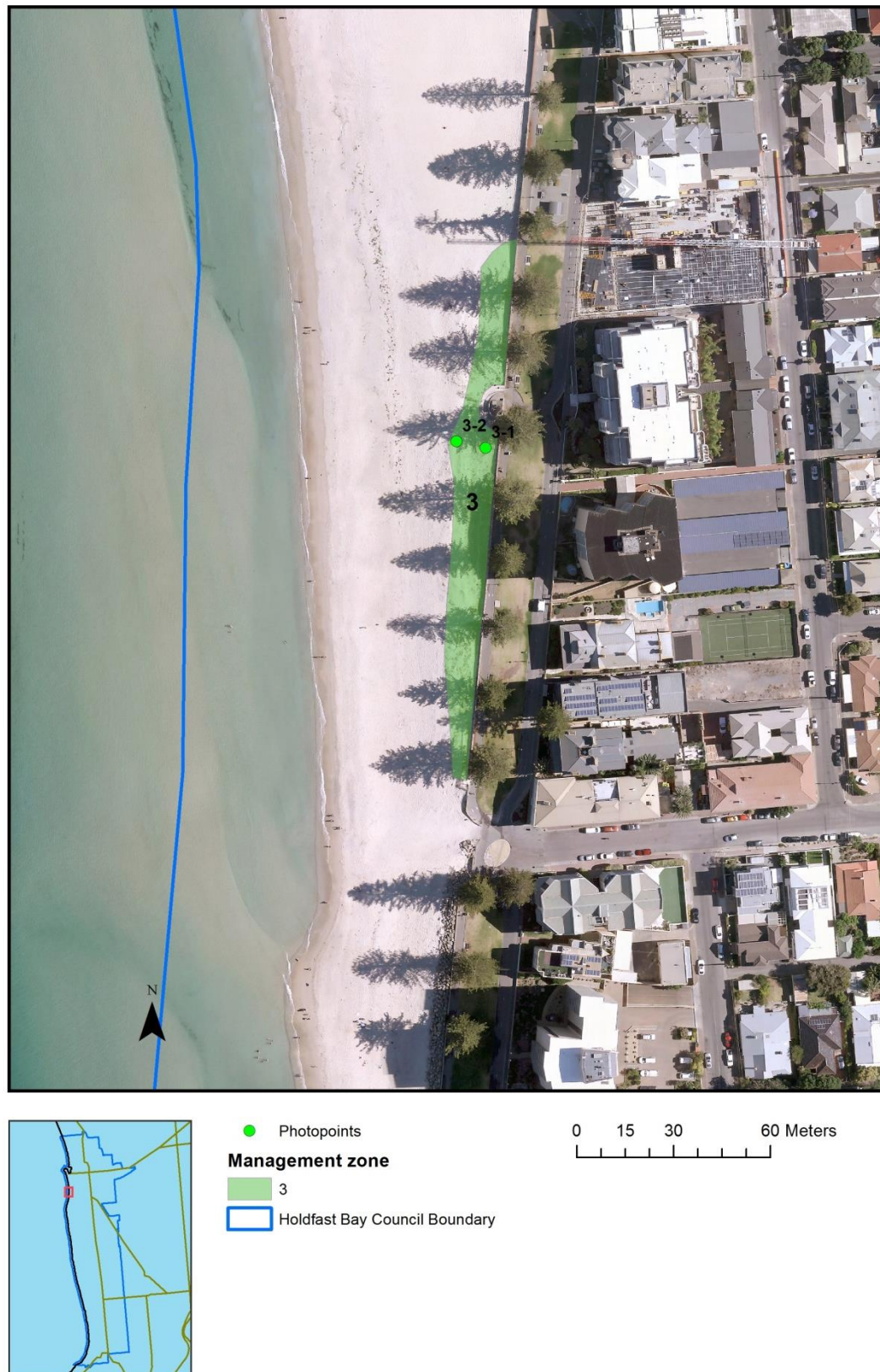


Figure 3: Management Units delineated for Kent Street dunes. Management units are based largely on the type and condition of vegetation present.





Figure 4: Management Units 4-6 delineated for Brighton to Seacliff Dunes. Management units are based largely on the type and condition of vegetation present.



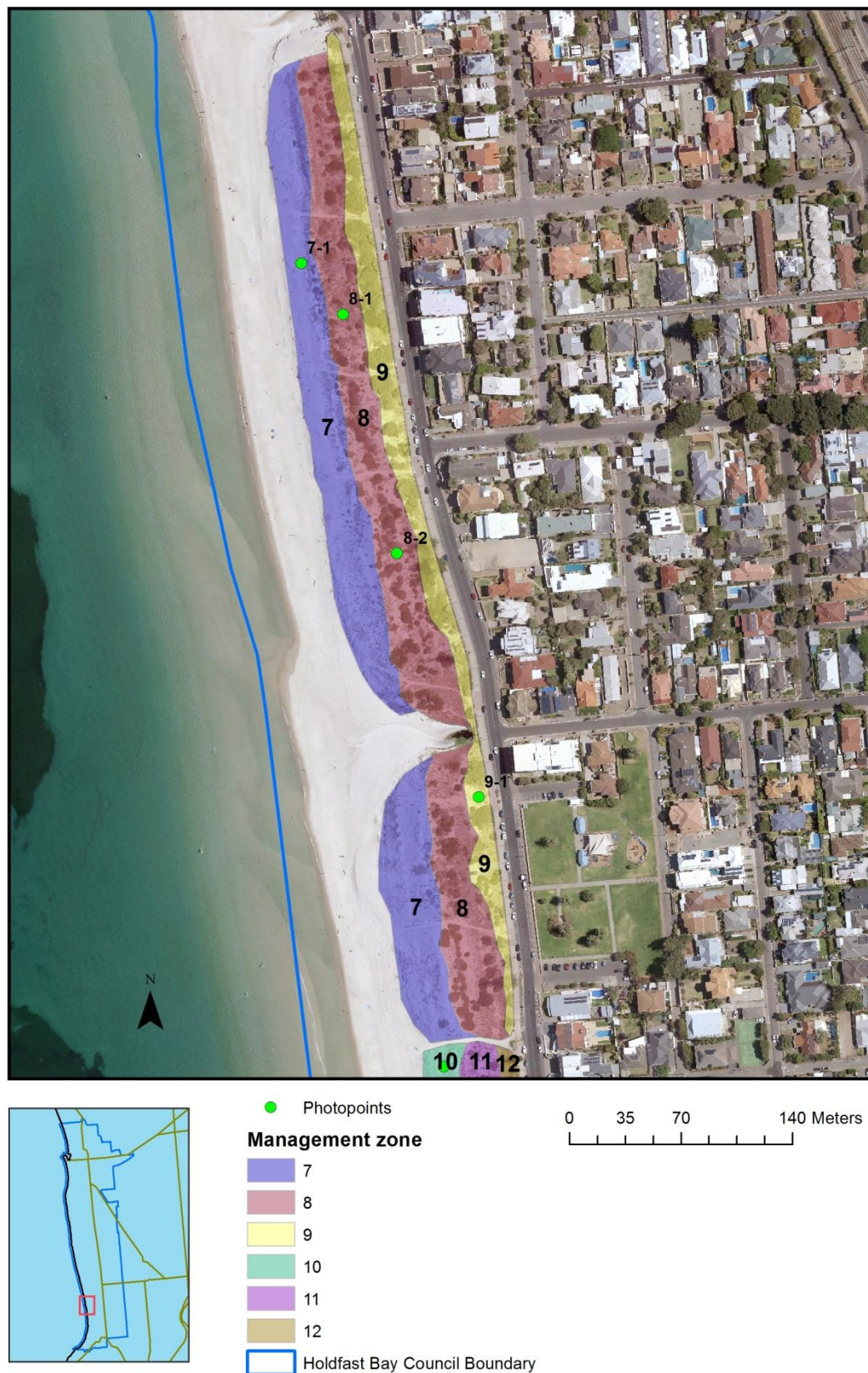


Figure 5: Management Units 7-9 delineated Brighton to Seacliff Dunes. . Management units are based largely on the type and condition of vegetation present.





Figure 6: Management Units 10-13 delineated for Brighton to Seacliff Dunes. Management units are based largely on the type and condition of vegetation present.





Figure 7: Management Units 14,15 delineated for Brighton Caravan Park dunes. Management units are based largely on the type and condition of vegetation present.



### 5.3 Description and key threats for each management zone

#### Management Zone 1 - Holdfast Shores dunes

**Management Zone Vegetation Association:** *Atriplex cinerea*, *Olearia axillaris* open shrubland

**Indicative photograph:**



Figure 8: Photopoint 1-1 of Management Unit 1 taken at 272662, 6126786 (Zone 54 WGS 84) facing SSE.

#### **Description of this Management Zone:**

This Management Zone is a low relief dune in front of the Holdfast Shores development. It is an open shrubland of *Atriplex cinerea* (Coast Saltbush), *Olearia axillaris* (Coast Daisy-bush). Sea Wheat Grass (*\*Thinopyrum junceiforme*) was prominent in this area in a June 2018 assessment, but has been sprayed and was far less prominent in the August 2019 assessment. *\*Gazania linearis* and *\*Euphorbia* spp. also appear to have been controlled. At the leeward side of this unit there are extensive plantings of Rosemary (*\*Rosmarinus officinalis*), but they do not appear to be spreading and are a low priority for control. There has been revegetation with a variety of species and lifeforms, including herbs, mat plants, sedges, low shrubs and medium shrubs.

#### **Key Management Issues for this Zone:**

- grassy and herbaceous weeds
- Lack of coastal grasses, native herbs and creepers

## Management Zone 2 - Holdfast Shores dunes

**Management Zone Vegetation Association:** *\*Thinopyrum junceiforme* grassland

**Indicative photograph:**



Figure 9: Photopoint 2-1 of Management Unit 2 taken at 272673, 6126731 (Zone 54 WGS 84) facing SSE.

**Description of this Management Zone:** This Management Zone is a poorly developed incipient dune, covered with *\*Thinopyrum junceiforme* (Sea Wheat-grass). It is likely to be significantly exposed to storm surge events.

**Key Management Issues for this Zone:**

- lack of rolling Spinifex (*Spinifex hirsutus*)



### Management Zone 3 - Kent Street dunes

**Management Zone Vegetation Association:** \**Thinopyrum junceiforme* ± *Spinifex hirsutus* grassland

**Indicative photograph:**



Figure 10: Photopoint 3-1 of Management Unit 3 taken at 272775, 6126037 (Zone 54 WGS 84) facing S.

**Description of this Management Zone:**

This Management Zone is an accumulation of sand against the sea wall that has been colonised by \**Thinopyrum junceiforme* (Sea Wheat-grass), with one emergent *Atriplex cinerea* (Coast Saltbush). There are very scattered *Spinifex sericeus* (Coastal Spinifex).

**Key Management Issues for this Zone:**

- Herbaceous weeds *Euphorbia paralias* and *Reichardia tingitana*
- Lack of diversity and density of native species and lifeforms

## Management Zone 4 - Brighton to Seacliff dunes

**Management Zone Vegetation Association:** *Spinifex hirsutus*, \**Thinopyrum junceiforme* grassland

**Indicative photograph:**



Figure 11: Photopoint 4-1 of Management Unit 4 taken at 273287, 6121924 (Zone 54 WGS 84) facing SE.

### Description of this Management Zone:

This Management Zone is a foredune area and is a tussock grassland of the native *Spinifex hirsutus* (Rolling Spinifex), and the weedy \**Thinopyrum junceiforme* (Sea Wheat-grass). There is scattered \**Cakile maritima* ssp. *maritima* (Two-horned Sea Rocket), but pleasingly no major infestations with \**Ammophila arenaria* (Marram Grass). There is a lack of medium and low shrubs, whereas in other analogous systems shrubs are generally sparse on the seaward side of the dunes, but are more prominent towards the crest and leeward side.

### Key Management Issues for this Zone:

- Lack of low and medium coastal shrubs, sedges and mat plants (Native Pigface)



## Management Zone 5 - Brighton to Seacliff dunes

**Management Zone Vegetation Association:** *Olearia axillaris*, *Scaevola crassifolia*, *Acacia cupularis* open shrubland

**Indicative photograph:**



Figure 12: Photopoint 5-1 of Management Unit 5 taken at 273321, 6121821 (Zone 54 WGS 84) facing SE.

### Description of this Management Zone:

This Management Zone is the swale behind the foredune and is quite narrow at its northern end. It is principally a shrubland community, with *Olearia axillaris* (Coast Daisy-bush), *Scaevola crassifolia* (Cushion Fanflower), *Acacia longifolia ssp. sophorae* (Coastal Wattle) and *Acacia cupularis* (Cup Wattle) the dominant species. Medium shrub density is slightly low at the northern end and could use some supplementary planting, but is sufficient at the southern end. There is a moderate diversity of species and lifeforms, with groundcover/mat plants (*Carpobrotus rossii*), sedges (*Ficinia nodosa*, *Dianella brevicaulis*), low shrubs (*Rhagodia candolleana ssp. candolleana*, *Leucophyta brownii*) and medium shrubs all present, but there is a paucity of coastal grasses, native herbs and creepers. *Olearia axillaris*, the Coast Daisy Bush, whilst present, is also considered to be at lower density than in other analogous dune systems along the coast, and *Leucopogon parviflorus* (Coast Beard-heath) is entirely lacking.

### Key Management Issues for this Zone:

- Lack of coastal grasses, native herbs and creepers
- Lack of *Leucopogon parviflorus* and low density of *Olearia axillaris*

## Management Zone 6 - Brighton to Seacliff dunes

**Management Zone Vegetation Association:** *Myoporum insulare*, *Scaevola crassifolia*, *Acacia longifolia* ssp. *sophorae*, *Olearia axillaris* closed shrubland with emergent *Allocasuarina verticillata*

**Indicative photograph:**



Figure 13: Photopoint 6-1 of Management Unit 6 taken at 273325, 6121820 (Zone 54 WGS 84) facing SE.

**Description of this Management Zone:**

This Management Zone is located on the incline up to the Esplanade, and is a relatively dense, tall shrubland of *Myoporum insulare* (Common Boobialla), with *Scaevola crassifolia* (Cushion Fanflower), *Acacia longifolia* ssp. *sophorae* (Coastal Wattle) and *Olearia axillaris* (Coast Daisy-bush) present as co-dominants or sub-dominants. There are very scattered *Ammophila arenaria* (Marram Grass), although generally there are few high threat weeds in this Management Zone.

**Key Management Issues for this Zone:**

- *Ammophila arenaria* (Marram Grass)



## Management Zone 7 - Brighton to Seacliff dunes

**Management Zone Vegetation Association:** *Spinifex hirsutus*, \**Thinopyrum junceiforme* ±  
\**Ammophila arenaria* grassland

**Indicative photograph:**



Figure 14: Photopoint 7-1 of Management Unit 7 taken at 273393, 6121420 (Zone 54 WGS 84) facing SSE.

**Description of this Management Zone:**

This Management Zone is a foredune area and is a tussock grassland of the native *Spinifex hirsutus* (Rolling Spinifex), and the weedy \**Thinopyrum junceiforme* (Sea Wheat-grass). There is scattered Two-horned Sea Rocket (\**Cakile maritima* ssp. *maritima* and \**Ammophila arenaria* (Marram Grass). There are scattered sedges (*Ficinia nodosa*) and very scattered low and medium shrubs (*Acacia cupularis*, *Acacia longifolia* ssp. *sophorae*, *Leucophyta brownii*, *Olearia axillaris*) and Native Pigface (*Carpobrotus rossii*) forms cover of 1-5%. Low and medium shrub density is below what would be expected in an unmodified system.

**Key Management Issues for this Zone:**

- *Ammophila arenaria* (Marram Grass)
- Lack of low and medium coastal shrubs, sedges and mat plants (Native Pigface)



## Management Zone 8 - Brighton to Seacliff dunes

**Management Zone Vegetation Association:** *Olearia axillaris*, *Scaevola crassifolia*, *Acacia longifolia* ssp. *sophorae* open shrubland

**Indicative photograph:**



Figure 15: Photopoint 8-1 of Management Unit 8 taken at 273419, 6121388 (Zone 54 WGS 84) facing SSE.

### Description of this Management Zone:

This Management Zone is the swale behind the foredune. It is principally a shrubland community, with *Olearia axillaris* (Coast Daisy-bush), *Scaevola crassifolia* (Cushion Fanflower) and *Acacia longifolia* ssp. *sophorae* (Coastal Wattle). It has areas with significant invasion by grassy and herbaceous weeds (with Soursob (\**Oxalis pes-caprae*) prominent), possibly as a result of past ground disturbance and may also indicate addition of nutrients. There are also patches of \**Ammophila arenaria* (Marram Grass), many of which appear to have been sprayed. There is a moderate diversity of species and lifeforms, with groundcover/mat plants (*Carpobrotus rossii*), sedges (*Ficinia nodosa*, *Dianella brevicaulis*), low shrubs (*Rhagodia candolleana* ssp. *candolleana*, *Leucophyta brownii*) and medium shrubs all present, but there is a paucity of coastal grasses, native herbs and creepers. *Olearia axillaris*, the Coast Daisy Bush, whilst present, is also considered to be at lower density than in other analogous dune systems along the coast, and *Leucopogon parviflorus* (Coast Beard-heath) is entirely lacking.

### Key Management Issues for this Zone:

- \**Ammophila arenaria* (Marram Grass)
- Grassy and herbaceous weeds

- Lack of coastal grasses, native herbs and creepers
- Lack of *Leucopogon parviflorus* and low density of *Olearia axillaris*

### Management Zone 9 - Brighton to Seacliff dunes

**Management Zone Vegetation Association:** \**Leptospermum laevigatum*, *Melaleuca halmaturorum*, *Myoporum insulare*, *Acacia longifolia ssp. sophorae* tall shrubland

#### Indicative photograph:



Figure 16: Photopoint 9-1 of Management Unit 9 taken at 273504, 6121085 (Zone 54 WGS 84) facing SSE.

#### Description of this Management Zone:

This Management Zone is located on the incline up to the Esplanade, and is distinguished from Management Zone 6 due to the presence of \**Leptospermum laevigatum* (Coastal Tea-tree) and *Melaleuca halmaturorum* (Swamp Paperbark) as co-dominants in the overstorey, along with *Myoporum insulare* (Common Boobialla) and *Acacia longifolia ssp. sophorae* (Coastal Wattle). \**Leptospermum laevigatum* is recognised as a significant weed in coastal ecosystems (see Section 4.1).

#### Key Management Issues for this Zone:

- \**Leptospermum laevigatum* (Coastal Tea-tree)
- Lack of diversity and density of native plant species
- Need to ensure Coastal Tea-tree removal does not cause unwanted sand movement



## Management Zone 10 - Brighton to Seacliff dunes

**Management Zone Vegetation Association:** *Spinifex hirsutus*, \**Thinopyrum junceiforme* ±  
\**Ammophila arenaria* grassland

**Indicative photograph:**



Figure 17: Photopoint 10-1 of Management Unit 10 taken at 273482, 6120916 (Zone 54 WGS 84) facing SSE.

**Description of this Management Zone:**

This Management Zone is a foredune area and is a tussock grassland of the native *Spinifex hirsutus* (Rolling Spinifex), and the weedy \**Thinopyrum junceiforme* (Sea Wheat-grass). There is scattered Two-horned Sea Rocket (\**Cakile maritima* ssp. *Maritima*) and \**Ammophila arenaria* (Marram Grass). There are scattered sedges (*Ficinia nodosa*) and Native Pigface (*Carpobrotus rossii*) and very scattered medium shrubs (*Olearia axillaris*, *Scaevola crassifolia*, *Atriplex cinerea*). Low and medium shrub density is below what would be expected in an unmodified system.

**Key Management Issues for this Zone:**

- \**Ammophila arenaria* (Marram Grass)
- Lack of low and medium coastal shrubs, sedges and mat plants (Native Pigface)

## Management Zone 11 - Brighton to Seacliff dunes

**Management Zone Vegetation Association:** *Olearia axillaris*, *Scaevola crassifolia*, *Acacia cupularis*, *A. longifolia ssp. sophorae* open shrubland

**Indicative photograph:**



Figure 18: Photopoint 11-1 of Management Unit 11 taken at 273514, 6120895 (Zone 54 WGS 84) facing S.

### Description of this Management Zone:

This Management Zone is the leeward side of the foredune/swale. It is principally a shrubland community, with *Olearia axillaris* (Coast Daisy-bush), *Scaevola crassifolia* (Cushion Fanflower) and *Acacia longifolia ssp. sophorae* (Coastal Wattle) and *Acacia cupularis* (Cup Wattle) dominant species. This area is distinguished from Management Zone 8 in generally having lower invasion by introduced annual grasses and herbs, but *\*Ammophila arenaria* (Marram Grass) is much more prominent, estimated to be about 5% cover overall. There is a moderate diversity of medium and small shrub species, but there is a paucity of coastal grasses, native herbs, sedges, low shrubs and creepers. *Olearia axillaris*, the Coast Daisy Bush, whilst present, is also considered to be at lower density than in other analogous dune systems along the coast, and *Leucopogon parviflorus* (Coast Beard-heath) is entirely lacking.

### Key Management Issues for this Zone:

- *\*Ammophila arenaria* (Marram Grass)
- Lack of herbs, sedges, low shrubs, coastal grasses and creepers
- Lack of *Leucopogon parviflorus* and low density of *Olearia axillaris*



## Management Zone 12 - Brighton to Seacliff dunes

**Management Zone Vegetation Association:** *Acacia cupularis*, *Olearia axillaris* very open shrubland

**Indicative photograph:**



Figure 19: Photopoint 12-1 of Management Unit 12 taken at 273521, 6120896 (Zone 54 WGS 84) facing SSE.

**Description of this Management Zone:**

This Management Zone is the banks and depression on the seaward side of the Esplanade. Numerous stormwater drains enter this area, and the additional nutrients and water are likely the cause of significant invasion by grassy and herbaceous weeds, especially Soursob (\**Oxalis pes-caprae*). There are scattered shrubs along this section, with *Olearia axillaris* (Coast Daisy-bush), and *Acacia cupularis* (Cup Wattle) most common.

**Key Management Issues for this Zone:**

- Management of grassy and herbaceous weeds
- Lack of diversity and density of native plant species
- Ongoing issues with stormwater



### Management Zone 13 - Brighton to Seacliff dunes

**Management Zone Vegetation Association:** *Olearia axillaris*, *Scaevola crassifolia*, *Acacia cupularis*, *A. longifolia* ssp. *sophorae* open shrubland

**Indicative photograph:**



Figure 20: Photopoint 13-1 of Management Unit 13 taken at 273517, 6120529 (Zone 54 WGS 84) facing S.

**Description of this Management Zone:**

This area appears to have been the focus of recent good quality revegetation works. There is an appropriate density and diversity of most lifeforms, although supplementary plantings could focus on the addition of coastal grasses and creepers.

**Key Management Issues for this Zone:**

- Lack of coastal grasses and creepers

## Management Zone 14 - Brighton Caravan Park Dunes

**Management Zone Vegetation Association:** *\*Cakile maritima* herbland

**Indicative photograph:**



Figure 21: Photopoint 14-1 of Management Unit 14 taken at 273487, 6120284 (Zone 54 WGS 84) facing S.

### **Description of this Management Zone:**

This Management Zone is a small section of sand accumulating against a rock wall near the Brighton/Seacliff Yacht Club. It is virtually devoid of native species, with *\*Cakile maritima* (Two-horned Sea Rocket) the dominant weed species, and scattered *\*Ammophila arenaria* (Marram Grass).

### **Key Management Issues for this Zone:**

- Lack of native species
- Exposure to storm surge events
- *\*Ammophila arenaria* (Marram Grass)



## Management Zone 15 - Brighton Caravan Park Dunes

**Management Zone Vegetation Association:** *Spinifex hirsutus* hummock grassland with emergent *Scaevola crassifolia*, *Acacia cupularis*

**Indicative photograph:**



Figure 22: Photopoint 15-1 of Management Unit 15 taken at 273445, 6120092 (Zone 54 WGS 84) facing S.

**Description of this Management Zone:**

This Management Zone is a narrow strip of low relief sand in front of the Brighton Caravan Park. The seaward half is principally a Rolling Spinifex (*Spinifex hirsutus*) tussock grassland on sand, but the leeward half to the walking trail is dominated by Soursob (*Oxalis pes-caprae*) with emergent low and medium coastal shrub species, including *Scaevola crassifolia* (Cushion Fanflower) and *Acacia cupularis* (Cup Wattle). There is one open bare area (shown as photopoint 15-2 in Appendix 2) where recent clearance has occurred and this should be revegetated as a priority.

**Key Management Issues for this Zone:**

- *Ammophila arenaria* (Marram Grass)
- Grassy and herbaceous weeds
- Lack of herbs, coastal grasses and creepers
- Lack of low and medium shrubs in foredune



## 5.4 Revegetation

As discussed in Section 5.3, there are many sections of the Holdfast Bay dunes that are considered to be missing key structural elements and species. Tables 6 and 7 provide detail of species that may be suitable for revegetation, divided into primary dune, swale and hind dune elements.

**Table 6: Revegetation species, grouped by lifeform type, for different Holdfast Dune habitats**

SPECIES	COMMONNAME	LIFEFORM	DIAMETER MATURE PLANTS (m)	Primary Dune	Swale	Hind dune
<i>Muehlenbeckia gunnii</i>	Coastal Climbing Lignum	CR	1-2		Y	Y
<i>Myoporum parvifolium</i>	Creeping Boobialla	CR	0.5-1		Y	Y
<i>Chrysocephalum apiculatum</i>	Common Everlasting	FO	0.2-0.5		Y	Y
<i>Helichrysum leucopsidium</i>	Satin Everlasting	FO	0.2-0.5		Y	Y
<i>Lotus australis</i>	Austral Trefoil	FO	0.1-0.2		Y	Y
<i>Pelargonium australe</i>	Austral Stork's-bill	FO	0.2-0.5		Y	Y
<i>Senecio pinnatifolius</i> var. <i>maritimus</i>	Variable Groundsel	FO	0.1-0.2		Y	Y
<i>Carpobrotus rossii</i>	Native Pigface	GC	0.5-1	Y	Y	Y
<i>Disphyma crassifolium</i> ssp. <i>clavellatum</i>	Round-leaf Pigface	GC	0.5-1		Y	Y
<i>Kennedia prostrata</i>	Scarlet Runner	GC	0.5-1		Y	Y
<i>Kunzea pomifera</i>	Muntries	GC	1-2		Y	Y
<i>Tetragonia implexicoma</i>	Bower Spinach	GC	1-2		Y	Y
<i>Spinifex hirsutus</i>	Rolling Spinifex	TUG	0.2-0.5	Y	Y	Y
<i>Austrostipa flavescens</i>	Coast Spear-grass	TG	0.1-0.2		Y	Y
<i>Poa poiformis</i> var. <i>poiformis</i>	Coast Tussock-grass	TG	0.1-0.2		Y	Y
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush	LS	0.5-1		Y	Y
<i>Lomandra leucocephala</i> ssp. <i>robusta</i>	Woolly Mat-rush	LSE	0.2-0.5		Y	Y
<i>Dianella brevicaulis</i>	Short-stem Flax-lily	TSE	0.5-1		Y	Y
<i>Ficinia nodosa</i>	Knobby Club-rush	TSE	0.1-0.2	Y	Y	Y
<i>Lepidosperma gladiatum</i>	Coast Sword-sedge	TSE	0.5-1		Y	Y
<i>Leucophyta brownii</i>	Coast Cushion Bush	LS	0.2-0.5	Y	Y	Y
<i>Pimelea serpyllifolia</i> ssp. <i>serpyllifolia</i>	Thyme Riceflower	LS	0.2-0.5		Y	Y
<i>Threlkeldia diffusa</i>	Coast Bonefruit	LS	0.5-1		Y	Y
<i>Atriplex cinerea</i>	Coast Saltbush	MS	1-2	Y	Y	Y
<i>Rhagodia candolleana</i> ssp. <i>candolleana</i>	Sea-berry Saltbush	MS	0.5-1		Y	Y
<i>Scaevola crassifolia</i>	Cushion Fanflower	MS	2-4		Y	Y
<i>Acacia cupularis</i>	Cup Wattle	TS	2-3		Y	Y
<i>Acacia longifolia</i> ssp. <i>sophorae</i>	Coastal Wattle	TS	3-5		Y	Y
<i>Adriana quadripartita</i>	Coast Bitter-bush	TS	1-2		Y	Y
<i>Leucopogon parviflorus</i>	Coast Beard-heath	TS	2-3		Y	Y
<i>Myoporum insulare</i>	Common Boobialla	TS	3-5		Y	Y
<i>Olearia axillaris</i>	Coast Daisy-bush	TS	2-3	Y	Y	Y
<i>Acacia pycnantha</i>	Golden Wattle	TR	2-4			Y
<i>Allocasuarina verticillata</i>	Drooping Sheoak	TR	2-4			Y

### Key to Codes: Lifeform

CR	Creepers	LSE	Low sedge <60cm	LS	Low shrub <0.6m
GC	Groundcover	TSE	Tall sedge >60cm	MS	Medium shrub 0.6-1.2m
FO	Forb	LG	Low grass <60cm	TS	Tall shrub > 1.2m
TUG	Tussock Grass	TG	Tall grass > 60cm	TR	Tree

**Table 7: Target densities (projective foliage cover) of lifeforms for different dune habitat types.**

LIFEFORM	Primary Dune	Swale
Creeper		Plentiful around 1%
Groundcover	5-10%	5-10%
Forb		1-5%
Sedges	5-10%	5-10%
Tussock grasses	26-50%	5-10%
Grasses		1-5%
Low shrubs	11-20%	11-20%
Medium shrubs		
Tall shrubs		21-40%
Trees		

**Table 8: Target densities (plants per hectare) of lifeforms for different dune habitat types.**

LIFEFORM	Primary Dune	Swale
Creeper		100
Groundcover	500	800
Forb		1000
Sedges	1000	1000
Tussock grasses ( <i>Spinifex hirsutus</i> )	2000	1000
Grasses		1000
Low shrubs	300	1500
Medium shrubs		
Tall shrubs	300	900

## 5.5 Staged Removal of Coastal Tea-tree (*Leptospermum laevigatum*)

*Leptospermum laevigatum* (Coastal Tea-tree) has been flagged as a key weed species, and is prominent in Management Zone 9. Figure 23 shows the current distribution of Coastal Tea-tree. However, removal of this species needs to consider the values it currently provides with regard to both prevention of wind erosion, and habitat values for bird species. It is recommended that a staged removal of this species is undertaken.

Where there is adjoining remnant or planted native shrubland vegetation on the seaward side, and the Tea-tree is generally scattered amongst other species, it is recommended that removal is undertaken in Year 1 of this plan (Figure 23). It is recommended that the native species *Scaevola crassifolia* is planted in its place, as this species is robust, relatively low and forms dense stands.

Where the Tea-tree is dominant, forms a dense stand, or lacks adjoining vegetation to buffer wind impacts, it is recommended that staged removal is undertaken. Removal of part of stands on the seaward side, and revegetation with coastal dune shrubs (*Olearia axillaris*, *Scaevola crassifolia*, *Myoporum insulare* (in lower lying areas) in adjoining areas is recommended for year 1 of this plan

(see Figure 23). Removal of remaining stands will require monitoring success and growth of revegetation, but may be possible from year 3 onwards.

It is also noted that there are other plantings in Management Zone 9 that would be considered non-indigenous to dune habitat, with *Melaleuca halmaturorum* (Swamp Paperbark) the most prolific. This species was not observed to be spreading in the dunes, and is providing good habitat values for fauna, especially birds, as well as binding the sand to prevent erosion. It is recommended that at this stage this species is left *in situ* for the duration of this Biodiversity Action Plan, but that after 5 years the viability of removing this species and replacing with local dune species is re-evaluated.

## 5.6 Revegetation by management zone

Table 9 provides an indicative list of revegetation for each management zone. Note that the number of plants proposed of each species is based upon both the type of landform (foredune, swale etc.), along with an assessment of which species or lifeforms may currently be deficient in number or cover when compared to benchmarks from Tables 7 and 8. Appendix 4 provides current cover by lifeform for each management zone.



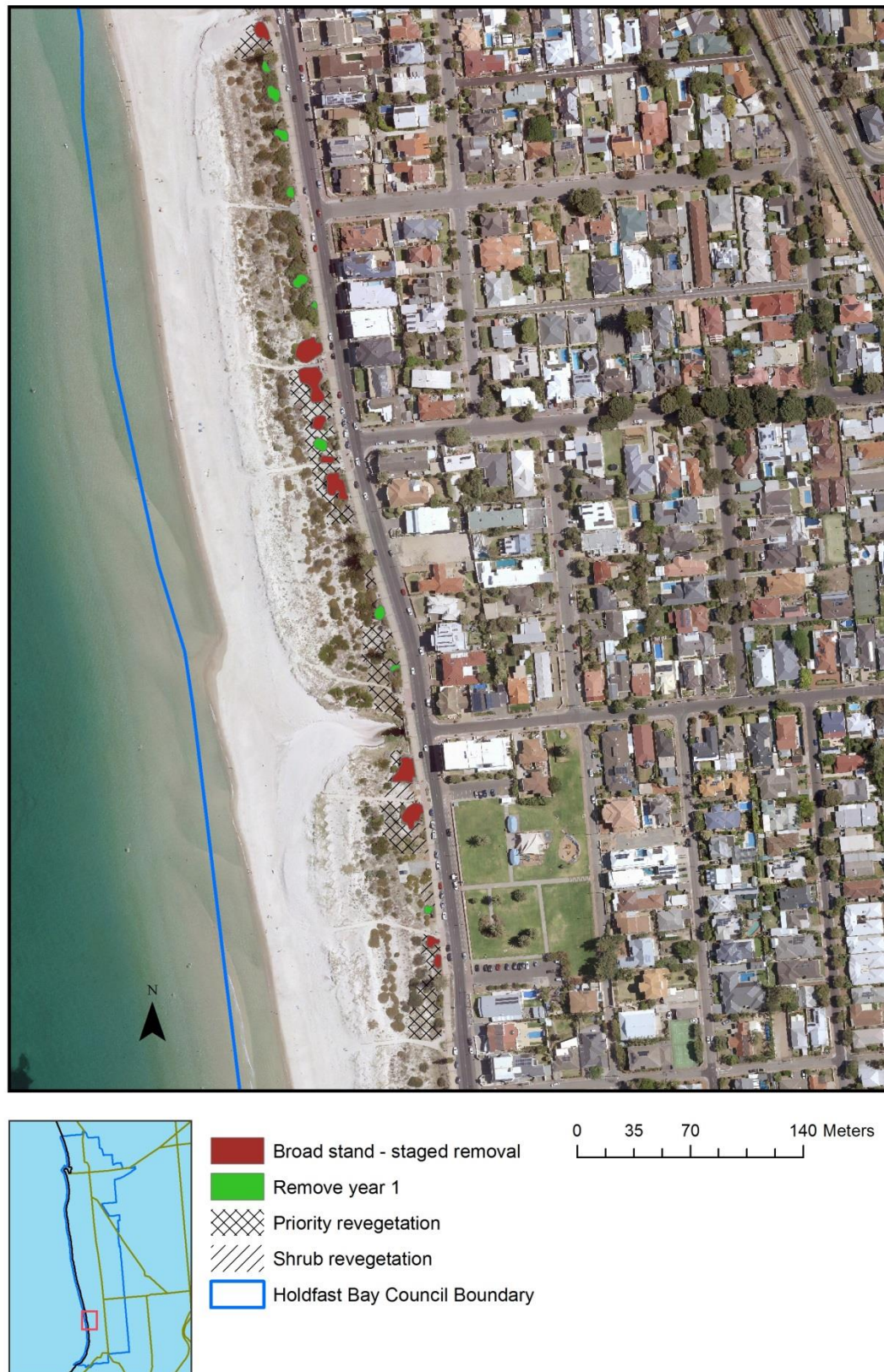


Figure 23: Proposed management actions associated with Coastal Tea-tree removal from Management Zone 9.

Table 9: Revegetation requirements by management zone.

Species	Common Name	Lifeform	1	2	3	4	5	6	7	8	8/9 priority	9	10	11	12	13	14	15
<i>Muehlenbeckia gunnii</i>	Coastal Climbing Lignum	CR	25				15			75	25			30	20	10		15
<i>Myoporum parvifolium</i>	Creeping Boobialla		25				15			75	25			30	20	10		15
<i>Chrysocephalum apiculatum</i>	Common Everlasting	FO					40			150	50			100		25		
<i>Helichrysum leucopsidium</i>	Satin Everlasting						40			150	50			100		25		
<i>Lotus australis</i>	Austral Trefoil						40			200	50			100		25		
<i>Pelargonium australe</i>	Austral Stork's-bill		150				100			300	100			200	100	25		50
<i>Senecio pinnatifolius</i> var. <i>maritimus</i>	Variable Groundsel		125				75			300	100			150	100	25		50
<i>Carpobrotus rossii</i>	Native Pigface	GC			100	250	30		200	150	50		400	100	100		50	20
<i>Disphyma crassifolium</i> ssp. <i>clavellatum</i>	Round-leaf Pigface		50				15			75	25			50	50	20		20
<i>Kennedia prostrata</i>	Scarlet Runner						30			120	30			50	50	10		10
<i>Kunzea pomifera</i>	Muntries		100				60			225	75			150	100	10		30
<i>Tetragonia implexicoma</i>	Bower Spinach		50				30			120	30			50	50	20		20
<i>Spinifex hirsutus</i>	Rolling Spinifex	LG	100	300	300		100		200	150	50		500	500			100	25
<i>Austrostipa flavescens</i>	Coast Spear-grass	TG	250				150			550	200			300	200	50		50
<i>Poa poiformis</i> var. <i>poiformis</i>	Coast Tussock-grass		250				150			550	200			300	200	50		50
<i>Lomandra leucocephala</i> ssp. <i>robusta</i>	Woolly Mat-rush	LSE					60			200	50			100		25		
<i>Dianella brevicaulis</i>	Short-stem Flax-lily	TSE	100				60			75	25			100	100			20
<i>Ficinia nodosa</i>	Knobby Club-rush		100		150	200	50		1000	150	50		800	300	200		50	50
<i>Lepidosperma gladiatum</i>	Coast Sword-sedge						30			120	30			50	200	15		
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush	LS	100				30			75	25			100	100	20		10
<i>Leucophyta brownii</i>	Coast Cushion Bush		125		50	150	50		400	75	25		250	150	100	20	20	30
<i>Pimelea serpyllifolia</i> ssp. <i>serpyllifolia</i>	Thyme Riceflower		50				40			75	25			50	50	15		15
<i>Threlkeldia diffusa</i>	Coast Bonefruit		100				30			75	25			100	100	20		20
<i>Atriplex cinerea</i>	Coast Saltbush	MS			10	25			50		50		50		50		10	5
<i>Rhagodia candolleana</i> ssp. <i>candolleana</i>	Sea-berry Saltbush		100				30			75	25			100	100	20		15

Species	Common Name	Lifeform	1	2	3	4	5	6	7	8	8/9 priority	9	10	11	12	13	14	15
<i>Scaevola crassifolia</i>	Cushion Fanflower										100	150			50			
<i>Acacia cupularis</i>	Cup Wattle	TS									50				25			
<i>Acacia longifolia ssp. sophorae</i>	Coastal Wattle										50				50			
<i>Adriana quadripartita</i>	Coast Bitter-bush						30			100				50	50			
<i>Leucopogon parviflorus</i>	Coast Beard-heath		100				100			150	100			150	100	50		40
<i>Myoporum insulare</i>	Common Boobialla										25							
<i>Olearia axillaris</i>	Coast Daisy-bush		100		40	125	100		350	150	100		200	100	200	20	10	40
<i>Allocasuarina verticillata</i>	Drooping Sheoak	TR										10			10			
Total			2000	300	650	750	1500	0	2200	4510	1815	180	2200	3560	2475	510	240	600

**Key to Codes: Lifeform**

CR	Creeper	LSE	Low sedge <60cm	LS	Low shrub <0.6m
GC	Groundcover	TSE	Tall sedge >60cm	MS	Medium shrub 0.6-1.2m
FO	Forb	LG	Low grass <60cm	TS	Tall shrub > 1.2m
TUG	Tussock Grass	TG	Tall grass > 60cm	TR	Tree



## 6 MONITORING

### 6.1 Photopoints

Simple, repeatable photo points can be used as a mechanism to provide a visual illustration of changes over time. Photopoints have been established and the GPS coordinates are included in Table 9, with actual photopoint images provided in Section 5.3 and Appendix 2. A brief description of photopoint methodology is included in Appendix 3.

**Table 10. Photopoint locations established in City of Holdfast Bay Dunes 2019.**

Management Zone	Photopoint number	Easting	Northing	Direction
1: <i>Atriplex cinerea</i> , <i>Olearia axillaris</i> open shrubland	1-1	272662	6126786	SSE
1: <i>Atriplex cinerea</i> , <i>Olearia axillaris</i> open shrubland	1-2	272687	6126727	SSE
1: <i>Atriplex cinerea</i> , <i>Olearia axillaris</i> open shrubland	1-3	272689	6126738	SSE
1: <i>Atriplex cinerea</i> , <i>Olearia axillaris</i> open shrubland	1-4	272726	6126606	SSE
2: <i>*Thinopyrum junceiforme</i> grassland	2-1	272673	6126731	SSE
3: <i>*Thinopyrum junceiforme</i> ± <i>Spinifex hirsutus</i> grassland	3-1	272775	6126037	S
3: <i>*Thinopyrum junceiforme</i> ± <i>Spinifex hirsutus</i> grassland	3-2	272766	6126039	S
4: <i>Spinifex hirsutus</i> , <i>*Thinopyrum junceiforme</i> grassland	4-1	273287	6121924	SE
5: <i>Olearia axillaris</i> , <i>Scaevola crassifolia</i> , <i>Acacia cupularis</i> open shrubland	5-1	273321	6121821	SE
6: <i>Myoporum insulare</i> , <i>Scaevola crassifolia</i> , <i>Acacia longifolia</i> ssp. <i>sophorae</i> , <i>Olearia axillaris</i> closed shrubland with emergent <i>Allocasuarina verticillata</i>	6-1	273325	6121820	SE
7: <i>Spinifex hirsutus</i> , <i>*Thinopyrum junceiforme</i> ± <i>*Ammophila arenaria</i> grassland	7-1	273393	6121420	SSE
8: <i>Olearia axillaris</i> , <i>Scaevola crassifolia</i> , <i>Acacia longifolia</i> ssp. <i>sophorae</i> open shrubland	8-1	273419	6121388	SSE
8: <i>Olearia axillaris</i> , <i>Scaevola crassifolia</i> , <i>Acacia longifolia</i> ssp. <i>sophorae</i> open shrubland	8-2	273453	6121238	SSE
9: <i>Leptospermum laevigatum</i> , <i>Melaleuca halmaturorum</i> , <i>Myoporum insulare</i> , <i>Acacia longifolia</i> ssp. <i>sophorae</i> tall shrubland	9-1	273504	6121085	SSE
10: <i>Spinifex hirsutus</i> , <i>*Thinopyrum junceiforme</i> ± <i>*Ammophila arenaria</i> grassland	10-1	273482	6120916	SSE
10: <i>Spinifex hirsutus</i> , <i>*Thinopyrum junceiforme</i> ± <i>*Ammophila arenaria</i> grassland	10-2	273506	6120474	S
11: <i>Olearia axillaris</i> , <i>Scaevola crassifolia</i> , <i>Acacia cupularis</i> , <i>A. longifolia</i> ssp. <i>sophorae</i> open shrubland	11-1	273514	6120895	S
11: <i>Olearia axillaris</i> , <i>Scaevola crassifolia</i> , <i>Acacia cupularis</i> , <i>A. longifolia</i> ssp. <i>sophorae</i> open shrubland	11-2	273530	6120772	S
12: <i>Acacia cupularis</i> , <i>Olearia axillaris</i> very open shrubland	12-1	273521	6120896	SSE
13: <i>Olearia axillaris</i> , <i>Scaevola crassifolia</i> , <i>Acacia cupularis</i> , <i>A. longifolia</i> ssp. <i>sophorae</i> open shrubland	13-1	273517	6120529	S
14: <i>*Cakile maritima</i> herbland	14-1	273487	6120284	S
15: <i>Spinifex hirsutus</i> hummock grassland with emergent <i>Scaevola crassifolia</i> , <i>Acacia cupularis</i>	15-1	273445	6120092	S
15: <i>Spinifex hirsutus</i> hummock grassland with emergent <i>Scaevola crassifolia</i> , <i>Acacia cupularis</i>	15-2	273450	6120112	S

### 6.2 Specific targets in Action Plan

The Biodiversity Action Plan (Section 7) provides targets based upon specific attributes gathered during field assessment, including plant species richness, diversity of lifeforms, and cover and abundance of weed species present. These targets can be used to monitor the implementation of this Biodiversity Action Plan.

## 7 BIODIVERSITY ACTION PLAN

The table below lists the biodiversity management threats/issues for Holdfast Bay dune systems, their related objectives, and further actions being proposed, as well as prioritising of these actions. Note that weeds that have been targeted for control over the next 5 years are based on the priority weeds as described in Section 4.1.

ISSUE/THREAT	5-Yr Objective / Milestone	Proposed actions - what/ where/how	Management Zone(s)	Priority*
<i>Leptospermum laevigatum</i> – Coast Tea-tree	Eradicate from dunes	<p><b>Year 1:</b> Remove all individuals shown in Figure 23. Plant <i>Scaevola crassifolia</i> (Cushion Fanflower) in its place, at density of 1 per 2m<sup>2</sup>. Plant very scattered <i>Allocasuarina verticillata</i> (Drooping She-oak) – 10 in total, to provide habitat values.</p> <p>Revegetate in priority areas (Figure 23), ensuring that medium and tall shrub lifeforms are planted in moderate densities as per Table 10.</p> <p><b>Year 3:</b> Evaluate success of revegetation and if appropriate commence removal of remaining <i>Leptospermum laevigatum</i> from the seaward side. Revegetate in its place with <i>Scaevola crassifolia</i> on slopes, and <i>Myoporum insulare</i> in lower lying areas.</p>	9	VH
<i>Ammophila arenaria</i> – Marram Grass	Eradicate from dunes	<p><b>Year 1:</b> Broad stands should be removed with concurrent revegetation with <i>Spinifex hirsutus</i> to ensure sufficient native species are present to perform sand binding function.</p> <p><b>Years 2-5:</b> Ensure follow up each year to treat any new plants or those that survive initial treatment.</p>	5,6,7,8,9,10,11,12,13,14,15	H
<i>Carpobrotus edulis ssp. edulis</i> – Hottentot Fig	Eradicate from dunes	Patrol dunes when flowering (September to December), so introduced <i>Carpobrotus edulis ssp. edulis</i> is more easily distinguished from the native <i>Carpobrotus rossii</i> . Mark and spray/grub all individuals located.	1,2,4-12	H
<i>Chondrilla juncea</i> – Skeleton Weed and <i>Trachyandra divaricata</i> – Dune Onion Weed	Eradicate from dunes	Patrol dunes and carefully grub as encountered.	7,8,9,12,13	H
<i>Galenia pubescens</i> var. <i>pubescens</i> - Coastal Galenia and <i>Gazania linearis</i> - Gazania	Eradicate from dunes	Patrol dunes and spray or grub any individuals located.	3,6,8,11,12	H
<i>Euphorbia terracina</i> , <i>Euphorbia paralias</i>	Reduce below current levels to scattered individuals <1% cover for all management zones	Spray / grub opportunistically. Highest priority is in foredune areas, where this species has been implicated in reducing habitat suitability for the nationally Endangered Hooded Plover.	4,7,10	VH H

ISSUE/THREAT	5-Yr Objective / Milestone	Proposed actions - what/ where/how	Management Zone(s)	Priority*
			1,2,3,5,8,11,13,14,15	
<i>Oxalis pes-caprae</i> - Soursob	Infestations not compromising revegetation activities.	Spot-spraying just prior to or early in flowering period. Repeat applications over a 2-5 year period may be necessary.	1,2,3,5,6,8,9,11,12,13,14,15	M
	No increase in spread or cover.	Ensure no movement of contaminated soil within or into the site.	All	VH
Invasive Acacia species, including <i>Acacia cyclops</i> and <i>Acacia saligna</i>	Eradicate from dunes.	Cut and swab all non-indigenous <i>Acacia</i> species and remove from the dune areas.	5,6,8,9,11,12,13,15	H
New weed incursions	No new weeds in dunes.	Continue ongoing vigilance by NRAMLR/Council staff for any new weed incursions into the Dunes.	All	H
Hooded Plover ( <i>Thinornis cucullatus cucullatus</i> )	Ongoing nesting and successful fledging of pair at Seacliff	Continue ongoing volunteer / Council program of signage, awareness raising, temporary fencing, chick shelters, and monitoring.  Monitor vegetation near nesting areas and specifically implement control of identified problem weed species (Sea Spurge ( <i>*Euphorbia paralias</i> ), Marram Grass ( <i>*Ammophila arenaria</i> ), Sea Wheatgrass ( <i>*Thinopyrum junceiforme</i> )) if required.	7	VH
Lack of native species – revegetation required (foredune)	Diversity of native species present >5. Density/cover of lifeforms as per Tables 7,8.	<b>Year 1:</b> Revegetate using planting densities provided in Table 9. <b>Year 3:</b> Assess revegetation and infill as required, depending on survival.	3,4,7,10,14,15	M
Lack of native species – revegetation required (swale)	Diversity of species present >25. Density/cover of lifeforms as per Tables 7,8.	<b>Year 1:</b> Revegetate using planting densities provided in Table 9. <b>Year 3:</b> Assess revegetation and infill as required, depending on survival.	5,8,11,15	M
Saturated soils and weeds from stormwater runoff, showers and taps	Native species at higher density and with higher richness counts than currently observed. Reduction in weed cover.	<b>Year 1:</b> Revegetate using planting densities provided in Table 9, with a focus on planting <i>Lepidosperma gladiatum</i> (Coastal Sword Sedge) in the lower lying areas. <b>Year 3:</b> Assess revegetation and infill as required, depending on survival. <b>Ongoing:</b> Spray out following heavy rains or as required.	9,12	M
Rabbits and foxes	No active warrens in Dunes.  Anecdotal observations that rabbit and fox density is low.	Monitor for rabbit/fox warrens and fumigate with phostoxin and fill if they appear. Implement rabbit baiting program if numbers appear to be increasing, or significant impacts on revegetation are noted.	All	H



ISSUE/THREAT	5-Yr Objective / Milestone	Proposed actions - what/ where/how	Management Zone(s)	Priority*
Lack of adaptive management	Progress and success of works undertaken is monitored on an ongoing and regular basis, and actions modified to suit. Plan reviewed on this basis at end of 5 years.	Re-assess weed cover, species richness and structural diversity in each Management Zone every 5 years.	All	M
		Repeat photopoints every 2 years	All	M

\*VH = very high, H = high, M = medium, L = low

## **Appendix 1: Plant species lists**

## Appendix 1.1: Native Plant Species Recorded in the Holdfast Bay Dunes

Note that this is not a comprehensive list (which would need survey conducted over multiple seasons), but based on a once-off assessment in August 2019.

Species	Common Name	AUS <sup>30</sup>	SA <sup>31</sup>	AMLR <sup>32</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Acacia cupularis</i>	Cup Wattle			RA	1				1	1	1	1	1		1	1	1		1
<i>Acacia longifolia</i> ssp. <i>sophorae</i>	Coastal Wattle			LC	1				1	1	1	1	1		1	1	1		
<i>Acacia pycnantha</i>	Golden Wattle			LC									1						
<i>Adriana quadripartita</i>	Coast Bitter-bush			RA								1							
<i>Allocasuarina verticillata</i>	Drooping Sheoak			LC						1			1						
<i>Atriplex cinerea</i>	Coast Saltbush			LC	1		1		1	1	1	1	1						
<i>Atriplex paludosa</i> ssp.	Marsh Saltbush																		1
<i>Austrostipa flavescens</i>	Coast Spear-grass			LC								1						1	
<i>Billardiera cymosa</i> ssp. <i>cymosa</i>	Sweet Apple-berry			LC								1							
<i>Carpobrotus rossii</i>	Native Pigface			LC	1	1			1	1	1	1	1	1	1	1	1		1
<i>Clematis microphylla</i>	Small-leaved Clematis			NE					*	*		*	*		*	*			
<i>Dianella brevicaulis</i>	Short-stem Flax-lily			NT	1				1	1		1	1		1	1	1		1
<i>Disphyma crassifolium</i> ssp. <i>clavellatum</i>	Round-leaf Pigface			LC									1						
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush			LC									1						
<i>Eucalyptus diversifolia</i> ssp. <i>diversifolia</i>	Coastal White Mallee			RA									1						
<i>Ficinia nodosa</i>	Knobby Club-rush			LC	1		1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Kennedia prostrata</i>	Scarlet Runner			LC								1			1				
<i>Kunzea pomifera</i>	Muntries			RA	1				1			1			1				
<i>Lepidosperma gladiatum</i>	Coast Sword-sedge			NT								1			1				
<i>Leucophyta brownii</i>	Coast Cushion Bush			NT	1				1	1	1	1	1		1				1
<i>Melaleuca halmaturorum</i>	Swamp Paper-bark			EN						1			1						
<i>Muehlenbeckia gunnii</i>	Coastal Climbing Lignum			LC	1				1										
<i>Myoporum insulare</i>	Common Boobialla			NT	1				1	1		1	1		1				
<i>Olearia axillaris</i>	Coast Daisy-bush			NT	1			1	1	1	1	1	1	1	1	1	1		1
<i>Pelargonium australe</i>	Austral Stork's-bill			RA								1			1		1		
<i>Pimelea serpyllifolia</i> ssp. <i>serpyllifolia</i>	Thyme Riceflower			NT	1				1										

<sup>30</sup> Environment Protection and Biodiversity Conservation Act 1999

<sup>31</sup> Schedules of the National Parks and Wildlife Act 1972 accessed November 2015

<sup>32</sup> 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.



<i>Poa poiformis</i> var. <i>poiformis</i>	Coast Tussock-grass			LC	1					1		1							
<i>Rhagodia candolleana</i> ssp. <i>candolleana</i>	Sea-berry Saltbush			LC	1				1			1	1		1	1	1		1
<i>Scaevola crassifolia</i>	Cushion Fanflower			VU					1	1		1	1	1	1		1		1
<i>Senecio pinnatifolius</i> var. <i>maritimus</i>	Variable Groundsel			RA	1	1			1	1	1	1	1		1				
<i>Spinifex hirsutus</i>	Rolling Spinifex			LC	1		1	1	1	1	1	1		1	1	1	1	1	1
<i>Tetragonia implexicoma</i>	Bower Spinach			LC								1							
<i>Threlkeldia diffusa</i>	Coast Bonefruit			NT					1			1							

\* this species is known from the Dunes but was not detected at the time of survey

## Appendix 1.2: Introduced Plant Species Recorded in the Holdfast Bay Dunes

Species	Common Name	Threat Rating SMLR Coastal <sup>33</sup>	Threat rating MANCAP <sup>34</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Acacia cyclops</i> <sup>35</sup>	Western Coastal Wattle	3	7															
<i>Acacia saligna</i>	Golden Wreath Wattle	2	2						1						1			
<i>Alyssum linifolium</i>	Flax-leaf Alyssum	1										1						
<i>Ammophila arenaria</i>	Marram Grass	4	2					1a	1a	1a	2	1a		2	1a	1	1	1
<i>Araucaria heterophylla</i>	Norfolk Island Pine								1			1						
<i>Arctotheca calendula</i>	Cape Weed	2							1			1a		1a	2	1a		1a
<i>Avena spp.</i>	Oat	2	2								2	3			3	1		
<i>Brassica spp.</i>	Turnip sp.	2	3									1a						
<i>Bromus diandrus</i>	Great Brome	1	1								2	2			1a	1		
<i>Cakile maritima ssp. maritima</i>	Two-horned Sea Rocket	2	1	1	1a	1a	1a	1a	2	1a	1a	1a	2	1a	2	1a	4	1a
<i>Carpobrotus edulis ssp. edulis</i>	Hottentot Fig	3	3	*	*			*	*	*	*	*		*	*	*		*
<i>Chenopodium sp.</i>	Goosefoot	1										1						
<i>Chondrilla juncea</i>	Skeleton Weed	2	2							*	*	*			*	*		
<i>Conyza sp.</i>	Fleabane	2	1	1								2						
<i>Crassula sp.</i>	Crassula	1	1						1									
<i>Cynodon dactylon var.</i>	Couch	2	3	1		1a			1			2			2	1a	1a	1a
<i>Ehrharta longiflora</i>	Annual Veldt Grass	2			1						1a			1a				
<i>Euphorbia paralias</i>	Sea Spurge	3	5	1		2		1						1a			2	1a
<i>Euphorbia peplus</i>	Petty Spurge	2																1
<i>Euphorbia terracina</i>	False Caper	3	5												1			

<sup>33</sup> Refer to Croft, S.J., J.A. Pedler & T.I. Milne (2005) Bushland Condition Monitoring Manual – Coastal Communities of the Southern Mount Lofty Ranges. Nature Conservation Society of SA Inc.

<sup>34</sup> As per Metropolitan and Northern Coastal Action Plan, AMLR Natural Resources Management Board

<sup>35</sup> Previously known from Brighton to Seacliff Dunes, although has been extensively controlled and no live specimens were noted at the time of survey

Species	Common Name	Threat Rating SMLR Coastal <sup>33</sup>	Threat rating MANCAP <sup>34</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Fumaria spp.</i>	Fumitory	1		1								1						
<i>Galenia pubescens</i> var. <i>pubescens</i>	Coastal Galenia	2	5						1		1							
<i>Gazania linearis</i>	Gazania	3	6			2					1a			1				
<i>Graminae sp.</i>	Unidentified grass			1					1a		2					1		2
<i>Hordeum sp.</i>	Barley-grasses	1	1									1						
<i>Hypochaeris glabra</i>	Smooth Cat's Ear	1	1	2														
<i>Hypochaeris radicata</i>	Rough Cat's Ear	2	3	2	1a	1a					2							
<i>Lagurus ovatus</i>	Hare's Tail Grass	2										1a		1a				
<i>Leptospermum laevigatum</i>	Coast Tea-tree	4	6					1				4						1
<i>Medicago spp.</i>	Medic	2	1	1a					1		3	3		1a	2		1a	1a
<i>Melilotus indicus</i>	King Island Melilot	2	1						1									
<i>Osteospermum fruticosum</i>			2						1			1						
<i>Oxalis pes-caprae</i>	Soursob	4	5	2	1a	1		1	1a		2	3		1a	4	2	2	3
<i>Pennisetum clandestinum</i>	Kikuyu	3	5			1			1			1						
<i>Piptatherum miliaceum</i>	Rice Millet	2	3									1						
<i>Poa annua</i>	Winter Grass	2													1a			
<i>Polygala myrtifolia</i>	Myrtle-leaf Milkwort	4	6		1?													
<i>Reichardia tingitana</i>	False Sowthistle	2	3	1		2				1a	2					1	1a	2
<i>Rosmarinus officinalis</i>	Rosemary			1a														
<i>Sonchus oleraceus</i>	Common Sow-thistle	1	1	1		1a		1	1a			2		1a	2		1a	2
<i>Thinopyrum junceiforme</i>	Sea Wheat-grass	4	3	2	3	3	3		1	2	1a	1a	2	2	1a			
<i>Trachyandra divaricata</i>	Dune Onion Weed	4	7							*	*	*			*	*		
<i>Vicia spp.</i>	Vetch	2	1	1											1			
<i>Vulpia spp.</i>	Fescue	2	3											2	1a			

Cover categories: 1 = few individuals, <1%, 1a = plentiful, <1%, 2 = 1-5%, 3 = 5-25%, 4 = 26-50% \* this species is known from the Dunes but was not detected at the time of survey



## **Appendix 2: Additional photopoints established in the dunes**

**Management Zone 1 - Holdfast Shores dunes**

**Management Zone Vegetation Association:** *Atriplex cinerea*, *Olearia axillaris* open shrubland

**Indicative photograph:**



Figure 24: Photopoint 1-2 of Management Unit 1 taken at 272687, 6126727 (Zone 54 WGS 84) facing SSE.



Figure 25: Photopoint 1-3 of Management Unit 1 taken at 272689, 6126738 (Zone 54 WGS 84) facing SSE.





Figure 26: Photopoint 1-4 of Management Unit 1 taken at 272726, 6126606 (Zone 54 WGS 84) facing SSE.

**Management Zone 3 - Kent Street dunes**

**Management Zone Vegetation Association:** *Thinopyrum junceiforme* ± *Spinifex hirsutus* grassland

**Indicative photograph:**



Figure 27: Photopoint 3-2 of Management Unit 3 taken at 272766, 6126039 (Zone 54 WGS 84) facing S.



**Management Zone 8 - Brighton to Seacliff dunes**

**Management Zone Vegetation Association:** *Olearia axillaris*, *Scaevola crassifolia*, *Acacia longifolia* ssp. *sophorae* open shrubland

**Indicative photograph:**



Figure 28: Photopoint 8-2 of Management Unit 8 taken at 273453, 6121238 (Zone 54 WGS 84) facing SSE.



**Management Zone 10 - Brighton to Seacliff dunes**

**Management Zone Vegetation Association:** *Spinifex hirsutus*, *Thinopyrum junceiforme* ± *Ammophila arenaria* grassland

**Indicative photograph:**



Holdfast Dune  
6/8/2019 S 10  
273506 / 6120474

Figure 29: Photopoint 10-2 of Management Unit 10 taken at 273506, 6120474 (Zone 54 WGS 84) facing S.

### **Management Zone 11 - Brighton to Seacliff dunes**

**Management Zone Vegetation Association:** *Olearia axillaris*, *Scaevola crassifolia*, *Acacia cupularis*, *A. longifolia* ssp. *sophorae* open shrubland

#### **Indicative photograph:**



Figure 30: Photopoint 11-2 of Management Unit 11 taken at 273530, 6120772 (Zone 54 WGS 84) facing S.



### **Management Zone 15 - Brighton Caravan Park Dunes**

**Management Zone Vegetation Association:** *Spinifex hirsutus* hummock grassland with emergent *Scaevola crassifolia*, *Acacia cupularis*

#### **Indicative photograph:**



Figure 31: Photopoint 15-2 of Management Unit 15 taken at 273450, 6120112 (Zone 54 WGS 84) facing S.



## **Appendix 3: Establishing Photopoints**

## 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 with a survey peg
- Record details in the table below. If possible, include a photopoint board with these details on the board – this means that the photograph metadata is contained in the photograph itself.
- Take photos at regular intervals, 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 ZONE: \_\_\_\_\_

Year: \_\_\_\_\_

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



## **Appendix 4: Plant Lifeform Cover Estimates from 2019 Assessments**

Native Plant Life Forms	Management Zone Number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Trees < 5m						1									
Shrubs > 2 m	1					4		1							
Shrubs 0.5–2m	3		1	1	3	3	1	4	3	1	3	3	4		3
Shrubs < 0.5 m	2				2	1a	1	2	1a	1	1a	2	2		2
Herbs	2	1			1a	1	1	1a	1a	1	1	1a	1a		
Mat Plants	2	1		1	2		2	2	1a	1	2	1a	4		3
Grasses >0.2m															
Grasses ≤ 0.2m	1a														
‘Sedges’ > 1m															
‘Sedges’ ≤ 1m	2			2	3	1a	1a	2	1a	1	2	1a	2	1	1a
Hummock grass	2		1	4	3	1a	4	2	1a	3	2		2	1	4
Vines,scramblers	1							1							

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