

# Vegetation Management Plan

## Henley South & West Beach Dune Reserve



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**for the City of Charles Sturt**

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**Planning SA**



**Coast Park**

**Department  
for Environment  
and Heritage**





This Vegetation Management Plan is designed to be a flexible and dynamic document that should be adapted according to changes in the dune environment over time and as further information becomes available.

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Source: Department for Environment and Heritage



## 1. Reserve Identification

<b>Reserve Name:</b>	Henley South and West Beach Coastal Reserve
<b>Local Government Area:</b>	City of Charles Sturt
<b>Location:</b>	The Reserve is defined by Henley Jetty in the north and Chetwynd Street, West Beach, in the south. The eastern boundary is marked by the Esplanade, Seaview Road footpath, western property boundaries and the Henley Sailing Club. The western boundary is the high watermark. The location of the Reserve is shown in Figure 1.
<b>Size:</b>	13 ha
<b>Class of Reserve:</b>	Local Government

## 2. Purpose of the Plan

Within the City of Charles Sturt there are a number of management issues which threaten the integrity of the region's coastal native vegetation. These issues have been identified as weed and pest animal invasion, pedestrian access, stormwater discharge, erosion and fire. A coordinated approach to management is crucial to prevent further degradation and to enhance the natural biodiversity of these fragile coastal environments.

Within this context, the City of Charles Sturt has seen a need to produce a series of practical, issue specific, management plans to guide the implementation of native vegetation enhancement works within the dune system.

This plan features:

- Site and vegetation community descriptions including species lists and aerial vegetation maps;
- A weed control plan that includes a list of priority weed species, weed distribution maps and weed control methodology;
- A revegetation plan that includes a list of suitable species, numbers required and revegetation methodology;
- Direction for consultants regarding environmental management/vegetation protection during the pathway construction phase of Coast Park;
- Recommendations for addressing native vegetation management issues including fire, access and fencing, erosion, introduced fauna and stormwater outfall areas;
- Provision of background information, including history, current status and possible future sand management strategies;
- Identification of opportunities for educational activities and signage;
- A timetable for plan implementation;
- Approximate implementation budgets;
- Detailed on-ground focussed appendices to guide Council, contractors, community groups and individuals in implementing Management Plan recommendations.

The target audience for this plan includes Council staff, contractors, community groups such as Coastcare/Dunecare groups, local schools and residents who may play a role in the management of this section of coast. It is intended that this plan be the framework for a coordinated rehabilitation program for the above-mentioned groups. The plan will help optimise the success of any on-ground works within the dune system from a native vegetation perspective.

### 3. Plan Context

This plan seeks to address numerous coastal management issues identified in the Adelaide Metropolitan Coast Park Concept Plan (PPK, 2001) and the City of Charles Sturt Coastal Management Plan 2002 – 2007 (Kinhill, 1999).

#### 3.1 Coast Park

Delivered through Planning SA, the Adelaide Metropolitan Coast Park is a State Government initiative involving partnerships with other State Government agencies, local Councils and key stakeholder groups. Essentially, Coast Park is a linear park extending approximately 70 km along the Adelaide metropolitan coastline, from Sellicks Beach in the south to North Haven in the north. It will link key interest areas to provide a publicly accessible linear park along the length of the metropolitan coast in this study area. Coast Park will link with the River Torrens Linear Park, as well as other linear parks in metropolitan Adelaide.

Sections that have been completed to date (March 2005) include the coastal walking trail at Marino/Hallett Cove Conservation Parks, as well as shared-use paths (providing access for pedestrians, cyclists and people with disabilities) at:

- North and South Esplanades, Glenelg;
- the Esplanade at South Brighton and Seacliff;
- the West Beach dunes at Adelaide Shores;
- the coastal strip from Semaphore South through to Taperoo;
- the Esplanade, Christies Beach.

At the time of writing (March 2005) the development of Coast Park, including a shared-use path north and south of the River Torrens Outlet, was at design stage following public consultation and vegetation surveys conducted in 2004.

As part of the Coast Park initiative, a series of Coastal Vegetation Management Plans are being produced by the SA Urban Forest Biodiversity Program (UFBP). Planning SA has recently made funds available to the City of Charles Sturt for the production of a Vegetation Management Plan (consistent with other plans developed by UFBP) for the coastal strip between Henley Square and Chetwynd Street, West Beach. In addition, Coast Park funding is enabling the provision of technical advice and assistance to land managers to ensure the plan is implemented.

#### 3.2 Management Plans

A number of planning documents exist that provide context and direction on the management of this Reserve.



### **3.2.1 Adelaide Metropolitan Coast Park Concept Plan**

The Adelaide Metropolitan Coast Park Concept Plan (PPK, 2001) sets out a number of possible strategies and recommended actions for the Coast Park over a ten-year time frame. The plan is 'intended to guide and assist future decision making and allocation of funds for future projects' (PPK, 2001). Outlined in this document is the Coast Park vision:

'To revitalise and sustain a healthy, diverse and accessible Coast Park to be enjoyed and valued by present and future generations'.

The goals of this initiative are to:

- Maintain and enhance open space linkages ensuring free, safe and convenient access facilities are available for all ages and abilities;
- Recognise, value and reinforce the diversity of the coastline, ensuring that development takes place in appropriate locations and that social, economic and environmental values are achieved;
- Provide appropriately for traffic and parking, ensuring convenient access for people wishing to use the coast, taking into account the need for safety for pedestrians and cyclists;
- Recognise, value, protect and where possible, enhance sandy beaches, seagrass beds, remnant dunes, coastal reserves and buffers, and water quality along the coast;
- Pursue every opportunity to educate the community and decision makers on the vision for, and the special value of, the coast, and the lessons learnt about the management of our coastline.

The Concept Plan identifies pressures on the Henley South and West Beach Coastal Reserve as pedestrian access, erosion, the introduction of pest flora and fauna and subsequent pressure on remnant vegetation. The Concept Plan also outlines strategies and responses to these pressures such as controlling access to the dunes, identifying, protecting and enhancing areas of significant vegetation and undertaking a weed and feral animal control program.

### **3.2.2 City of Charles Sturt Coastal Management Plan 2002 - 2007**

The City of Charles Sturt Coastal Management Plan encompasses the Council's coastal region, stretching south from the City of Port Adelaide Enfield boundary at Bower Road to the Adelaide Shores Caravan Park north of the City of West Torrens boundary (Kinhill Pty Ltd, 1999). The Plan was developed by the Council in response to community concerns about a range of environmental and social issues within the coastal zone and a mutual desire for the sustainable use of the common coastal resources.

The key purpose of the Coastal Management Plan is to provide Council with a more accurate decision making process for the allocation of resources. It is acknowledged that the Plan operates within broader policy frameworks (i.e. the Corporate Plan and the Metropolitan Planning Strategy) and as such is not considered a strategic document.

**The aims of the Coastal Management Plan are to:**

- Identify environmental and coastal management issues in the City of Charles Sturt coastal area, for the purpose of creating a prioritised action plan for the future;
- Ensure sustainable resource usage and resource conservation taking into consideration the physical, environmental, economic, social, historical, recreational and cultural attributes of the coastal zone (Kinhill, 1999).

Through the Coastal Management Plan, Council, in consultation with an array of key stakeholder groups and individuals, identified four key management areas and associated goals. These are as follows:

**Table 1: Key Management Areas and Goals, as identified in the City of Charles Sturt Coastal Management Plan**

Key Management Areas	Goals
Access	Provision of a formal network of roads, shared-use paths, beach access paths, ramps and corresponding support facilities that allows safe access for cyclists, pedestrians, vehicles and boats, (including, where feasible, disabled and all ages access).
Activities	A diverse range of recreational and cultural activities, which are well managed, to minimise impacts on other coastal users and that protect and/or enhance the coastal and marine environments.
Conservation	Biological, social, cultural and heritage values that are identified, protected and promoted to enhance biodiversity, coastal amenity, coastal character appreciation and visitor experiences.
Coastal Processes	Pre-emptive management of natural and accelerated coastal processes.

These four key management areas were expounded and a series of detailed management aspects and strategies were identified under each of these categories. These management aspects, in no specific order, are:

- beach and water pollution/monitoring;
- capital works (timing);
- cycling (access and safety);
- general patterns of development;
- linkages between areas;
- maintenance;
- public safety;
- sand dune protection;
- sand movement and replenishment;
- stormwater runoff and pollution.

These management aspects and consequent detailed management strategies are the predominant focus of the City of Charles Sturt Coastal Management Plan.

In addition to these specific actions identified under the four key management areas, it was recommended that the Plan be reviewed on an on-going basis and that the strong communication and coordinating link between Council and those with an active interest in the coast be maintained. As a result, a major recommendation included the establishment of a Community Coastal Reference Group to provide Council with feedback and assistance in the implementation of the Plan. This group began operation in May 2003 and consists of several community representatives, elected members, council staff and a member of the Coastal Protection Branch.



The City of Charles Sturt Coastal Management Plan (Kinhill Pty Ltd, 1999) was adopted by Council in April 2002 with Council supporting its implementation through its operating project budget. External funding through NHT-Coastcare (Phase 1), Coastal Protection Branch Metropolitan Coastal Works, Coastal Protection Branch Small Participation Grants and the Urban Forest One Million Trees Program has been provided to assist in implementation (refer to Appendix 1).

### **3.2.3 Report of the Review of the Management of Adelaide Metropolitan Beaches**

Released in July 1997, this document was prepared by a Reference Group appointed by the Minister for the Environment and Natural Resources. Relating to dune management, the report notes that the Henley South and West Beach dunes are viewed, '...by some members of the community as having inherent value, as well as providing habitat and a coastal buffer'. The Reference Group made the recommendation that, '...the value of the dunes as a feature of natural or cultural significance needs to be balanced against the fact of their recent formation along an accreting coastline and the need to export limited amounts of sand from the intertidal zone as part of the regional beach management strategy endorsed by the Review' (DEH Reference Group, 1997).

In light of this, approximately 250 000m<sup>3</sup> of sand south of the Torrens Outlet will be carted from the foreshore over the next five years to provide much needed sand to beaches further south. It is estimated enough sand will remain to protect the coast in this area from a one metre sea level rise, due to global warming and two, one-in-one-hundred year storms (Tucker, 2004, pers. comm.). Refer to Figure 11 for the potential erosion area.

Appendix 1 provides information on the international, national, state, regional and local contexts in which this plan has been written and will be implemented.

## **4. Background, History and Status of Reserve**

Prior to European settlement in 1836, Adelaide's metropolitan coastline consisted, in part, of an almost uninterrupted 30km stretch of sand dunes, running from Seacliff in the south to Outer Harbour in the north. This dune system ranged between 200 and 300 metres in width and up to 10 to 15 metres in height. Generally characterised by several parallel ridges with narrow, often wet, swales in between, the dunes were home to a diverse array of flora and fauna. Very little of these original metropolitan dunes remain, notably only at Tennyson and a small section at North Brighton. Immediately behind these dunes were a series of freshwater wetlands affected by occasional tidal incursions. These freshwater swamps and lagoons stretched from Kingston Park in the south to the Port River in the north (Kraehenbuehl, 1996). They contained very different flora and fauna communities to those represented within the dune system proper.

The area along Adelaide's coast was originally inhabited by the Kurna indigenous people. Prior to their dispossession shortly after European settlement, they were accustomed to moving seasonally between the foothills in winter and the coast during warmer months. There is very little written history of the Kurna people's presence in the Henley South or West Beach areas. They are mentioned as using the area immediately behind the dunes, now known as the Reedbeds (originally *Witoinga*, meaning 'the reedy place' (Sandercock, 2005, pers. comm.)), as camping grounds after white settlement (Gara, 2003).

Adelaide’s coastline began its history of urban development at Glenelg and Port Adelaide shortly after settlement. Other coastal developments began soon after at Largs Bay, Semaphore, Grange, Henley and Brighton, as these were seen as sites of safe anchorage (Coast Protection Board, 1993). During this early history the dunes were seen as a resource to be exploited or simply as a hindrance to progress. Early pressures on the dune system reflected the desire to provide for the basic needs of the fledgling colony. These included using the coastal vegetation as a source for grazing, firewood and timber.

Similarly, initial construction practices at the coastal townships showed little knowledge or regard for coastal processes, as for the most part the dunes were simply flattened and built over (Caton, 2004, pers. comm.). Figure 2 shows an early example of this practice at Henley Beach.

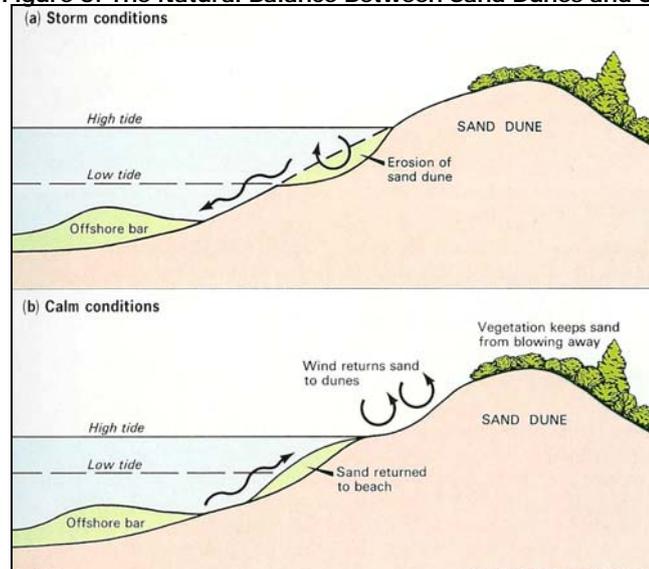
**Figure 2: Henley Beach Hotel 1891 - Looking South**



Photo courtesy of the State Library of South Australia, SLSA B - 2233

Coastal dunes act as a responsive transition zone between marine and terrestrial environments. They absorb and dissipate wave energy to provide an effective physical barrier to inland environments and are critical as a supply of erosive material in storm surge conditions. This interaction between seasonal wave energy and sand dunes can be seen simplified in Figure 3.

**Figure 3: The Natural Balance Between Sand Dunes and Sea**



Source: Dept. of Mines and Energy, 1984



A major consequence of urban development was that the store of sand in the dunes, so important to the dynamic coastal processes, began to be locked under urban houses and road systems. This isolation of sand from the coastal system, particularly from the late 1940s onwards, led to an acceleration of the natural erosion process along the metropolitan coast (CPB, 1993). Other practices such as cattle grazing and the release of pigs into the Reedbeds during the early settlement years destroyed much understorey (and presumably sand dune) vegetation. The destruction of many rush and reed communities from early settlers' fires probably allowed the first introduction of weeds within the Reedbeds and dune communities (Kraehenbuehl, 1996).

Although early development was considerable, the first Adelaide coastal townships essentially remained isolated until the coincidence of two significant events contributed to the full urbanisation of the metropolitan coastline. The first was initially of relatively local significance, but one which has had profound ramifications for the entire metropolitan coast and much of the Gulf St. Vincent. This was the channelling of the River Torrens to its present day outlet at West Beach in 1938. The second event was the *long boom*, occurring at the conclusion of World War II, with its major economic, demographic and technological changes (Forster, 1995).

The construction of the Torrens Outlet at West Beach was the culmination of many years of attempts at land reclamation and flood abatement. Prior to 1938 the River Torrens never directly reached the Gulf, even in peak winter floods. Instead, in average rainfall years, water from the Torrens ran west until its energy dissipated amongst the inland coastal dunes around present day Lockleys and Fulham (Couper-Smartt, 2003). Water then slowly filtered northward toward the Port River and southward toward the Patawalonga Creek creating a series of swamps and lagoons commonly known as the Reedbeds, named after the Common Reed, (*Phragmites australis*) which grew in abundance there. Only in times of flood would the force of the waters be sufficient for the Torrens to breach its banks and connect with both the Port River and the Patawalonga Creek. In periods of heavy rain and coinciding king high tides the Torrens would not only flood through the Reedbeds but also the entire Port Adelaide and surrounding areas (Couper-Smartt, 2003).

Early attempts at land reclamation and alleviation of the regular flood events of the Torrens took the form of creating embankments around the coastal townships. Due to their inadequacy, various drainage vents were dug in the mid-1870s (Couper-Smartt, 2003). After a particularly wet winter, the initial proposal for a channel for the river through the dunes at Henley Beach was made in 1917. However, it was not until after much debate between the local and State Governments of the time and another heavy flood in 1933 that the Torrens Outlet was finally completed in August 1938 (Couper-Smartt, 2003). Figure 4 shows the cutting through the original dune system to make way for the Torrens Outlet.

**Figure 4: Torrens Outlet Construction, 1937 – Looking South**



Photo courtesy of the State Library of South Australia, SLSA B18651/14

The opening of the Torrens Outlet had two profound effects. The first was the drainage of the Reedbeds, which depended on the Torrens' floodwaters for survival. This, in turn readied large areas of land to be reclaimed and urbanised. Initially, the land immediately to the rear of the dunes (present day Fulham and Fulham Gardens) was utilised for market gardens and dairy farms but was quickly urbanised during the late 1950s and early 1960s. The series of aerial photographs in Figures 5 to 8, which span from 1935 to the mid 1965, clearly display this transition.

**Figure 5: 1935 – Pre-outlet, Reedbeds to the rear of dunes.**



Photo courtesy of Department of Environment and Heritage

Figure 6: 1949 – Outlet Constructed, Market Gardens Present in Old Reedbed Area



Photo courtesy of Department of Environment and Heritage

Figure 7: 1953 – Original Dunes and Shacks South of Torrens Outlet



Photo courtesy of Department of Environment and Heritage

**Figure 8: 1961 – Urbanisation of Reedbeds**



Photo courtesy of Department of Environment and Heritage

The second effect the construction of the Torrens Outlet had was a massive rise in the volume of fresh water and sediment entering Gulf St. Vincent. Prior to European settlement this water and sediment never reached the sea directly but rather, was filtered and absorbed through the intricate system of wetlands that existed within the Reedbeds. This, along with increased nutrient loads from stormwater and sewage discharges, arising from a rapidly urbanising environment, placed enormous pressures upon the seagrass meadows growing along the metropolitan coast which were accustomed to a low nutrient environment. As a result, these have been retreating at an alarming rate. The almost complete channelisation of much of Adelaide's creek system throughout the 1950s to the 1970s has contributed in a similar fashion to the demise of seagrass populations along the Adelaide metropolitan coast.

Historically, seagrass meadows grew up to the low water line. Today, in most areas along the metropolitan coast, they are approximately one kilometre offshore (Caton, 2004, pers. comm.). The State of Our Environment Report, (2003) states that approximately 5000 hectares of seagrass has been lost since 1935. This equates to a loss of approximately one quarter of the original meadows growing along the metropolitan coast since 1949 (CPB, N/D). As seagrass meadows can trap at least one metre of sediment beneath them they function as a very effective buffer to nearshore wave energy. The long-term effect of their retreat has been to release the sediment layer beneath, thus lowering sea bed levels in the nearshore zone. This dramatically increases wave energy along the coast, with accelerated erosion along the adjacent beaches the consequence. The South Australian Coast Protection Board (N/D) describes this process:

*'The seabed is readily eroded by waves and currents if the stabilising seagrass cover is lost. In consequence the seabed deepens and near-shore wave energy increases. Adjacent beaches become unstable as a result.'*

The impact of these changes to the coastal and marine environment left the shoreline susceptible to major storms in the 1940s to the 1960s and led to major spending on hard protection of the coastline. Unfortunately, these artificial measures were a physical

barrier which separated sand from the beach. This isolation of sand from the beach system further diminished the role coastal dunes played in combating erosion thus effectively shortening the lifespan of the beaches, which were of such attraction in the first instance.

During the late 1960s, the State Government in conjunction with the Metropolitan Seaside Councils Committee commissioned the Adelaide University to undertake a detailed study of the processes and problems of erosion affecting Adelaide's beaches. This report titled the Beach Erosion Assessment Study – Summary Report (colloquially known as the Culver Report after its main author, Dr. Bob Culver), concluded that,

*'... there was [is] no naturally continuing replenishment source of sand. When combined with the net northerly littoral drift<sup>1</sup>, the ongoing increase in mean sea level and the development on the dune system, the long term effect is the need to artificially maintain the beaches, or eventually lose them' (CPB, 1993).'*

Considerable weight was placed upon this report and as a consequence, in 1972, the Coast Protection Board was established. The main recommendations of the report were that a beach sand replenishment program, in conjunction with other protective works, be carried out as a matter of urgency (CPB, 1993). Other recommendations were that a high priority should be placed upon monitoring and data collection to enable a more systematic and informed approach to management.

In reference to the post WWII economic boom, Foster (1995) notes that the period between the early 1950s and early 1970s was marked by economic growth, population increase and a massive rise in automobile ownership. These, in conjunction with government housing and planning policies, fuelled a '...seemingly unstoppable chain reaction of metropolitan expansion and suburbanisation' (Foster, 1995). Prior to WWII, urban development essentially remained close to the established coastal townships, the City of Adelaide and radially along the major transport routes. During the boom period, Adelaide entered into a period of economic growth, prosperity and full employment. With economic expansion came an equally rapid growth in population. These were the baby boom years, marked by high levels of overseas migration and natural internal growth. This period was also marked by increased affluence and significant improvements in manufacturing processes, which enabled more and more people to gain access to automobile ownership. Consequently, urban development became much less dependent on public transport routes and more dependent on land availability. In close proximity to the Central Business District, the recently drained Reedbed and coastal dune areas provided the perfect location.

The drainage of the Reedbeds by channelling the Torrens River, in conjunction with the long boom, began an intricate spiral of cause and effect, both ecologically and socially along the Adelaide metropolitan coast. A series of major storms throughout the 1940s to the 1960s exposed the development errors of the past and highlighted the need for urgent and ongoing research, monitoring and practical measures to be carried out.

The original dune system between the Torrens Outlet and Glenelg North was still relatively free of urban development until the 1960s (refer to Figure 8). Rapid development on the dunes after this point left no sand dune buffer between housing and the encroachment of the sea. As a result, by the late 1960s, several of Adelaide's premier southern metropolitan beaches were devoid of sand.

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<sup>1</sup> Littoral drift is the process whereby sediment in the nearshore zone moves in a net northerly direction along the Adelaide metropolitan coast as a result of current movements and waves striking the coast at an oblique angle.

In comparison however, Figures 9 and 10, taken in 1962 and 1968 respectively, clearly show rapid sand accumulation just north of the Torrens Outlet at Henley South. Note the vertical sections of the sea wall visible in Figure 9 are well covered with sand by the time of the studies for the Culver Report (Figure 10) in 1968. Sand accumulation on the northern side of the Torrens Outlet is a result of several complex factors acting in conjunction. It is generally accepted that water entering the Gulf from the Torrens Outlet seasonally interrupts the northward littoral movement of sand along the Adelaide metropolitan coast and sufficiently reduces current and wave activity to create an accumulation of sand on the southern side of the Outlet. Consequently, a protected area of lower energy immediately north of the Outlet has formed.

Sand enters and accumulates immediately north of the Outlet through various means. Large amounts of sand moved onto the coast as a consequence of seagrass during the urbanisation of Adelaide's coastline in the 1940s to the late 1960s. In calmer summer conditions, sand continues to enter through normal littoral activity, though at a reduced rate. On rare occasions, storm activity, associated with strong north-westerly winds, moves sand into this area from a northerly direction. In the 1960s, sand began to accumulate on the northern side of the Torrens Outlet to such an extent that residents' front property fences began to be covered and house gutters filled overnight (Allen, 2005, pers. comm.).

Annual bypassing of 25 000m<sup>3</sup> sand per year by the Coastal Protection Branch, from the southern side of the Torrens Outlet to the northern side, has been the major contributor to the build up of dunes in this area in more modern times (Cox, 2005, pers. comm.).

Soon after the photograph in Figure 10 was taken, the then City of Henley and Grange began trialling sand drift fencing, in response to sand movement over local roads. This was immediately successful in capturing much free moving sand (Harvey, 2004, pers. comm.). Remnants of these initial trials can still be seen adjacent the sea wall. Due to their effectiveness, further sand drift fencing has been used in the area over the past 30 years. As a result of these factors, the sea wall visible in Figures 9 and 10 is now fronted by approximately 70 to 90 metres of dunes consisting of a fore dune, swale and hind dune.

**Figure 9: 1962 – Sea Wall, Henley South Looking North**



Photo courtesy of Dr. Merv Allen

**Figure 10: 1968 – Culver Report, Henley South Looking South**



Photo courtesy of Coastal Protection Branch

The Coastal Protection Branch estimates that since construction of the Torrens Outlet, sand has been accumulating on its southern side of at an estimated 16 000m<sup>3</sup> per year (Tucker, 2004, pers. comm.). Figures 5 to 8 clearly show this phenomenon. Over 500 000m<sup>3</sup> of sand has accumulated in this area since 1970 to form the dunes present today (Tucker, 2004, pers. comm.). These are considerably forward of the original dunes and are a modern phenomenon resulting from a highly modified coastline.

The introduced Sea Wheat-grass (*Thinophyrum junceiforme*) was first recognised in the vicinity of the Torrens Outlet in the early 1980s. Its habit of growing laterally and being highly tolerant of salinity has also contributed to the seaward progression of the dunes. It maintains a dominant position in the dunes (Sandercock, 2005, pers. comm.).

Rapid dune formation prompted establishment of the Henley and Grange Dunecare Group in 1992 (Harvey, 2004, pers. comm.). This group of dedicated volunteers have been actively involved in various projects and management of the dunes. Funded initially through Coastcare and working closely with the former City of Henley and Grange (now the City Of Charles Sturt), these activities have included fencing, nursery establishment, propagation of local native plants, revegetation projects, surveying and the production of educational pamphlets and interpretive signage. Much has been achieved in the way of revegetation, habitat creation and weed control in a once highly degraded system.

Urban development along Adelaide's coastline has led to the need to balance environmental, social and economic values with the need to provide protection to Adelaide's highly erosive coastline. In an attempt to sustainably manage the metropolitan coast, the Coast Protection Board has implemented a sand replenishment program that began in the early 1970s. In light of this, the Board has identified the area immediately south of the Torrens Outlet as a locality of sand empoundment that can provide replenishment to other areas along the coast suffering the effects of erosion. Over the next five years, approximately 250 000m<sup>3</sup> of sand will be scraped off the beach adjacent the Torrens to replenish southern beaches. The procedure will entail removal of sand from the beach in layers and allowing the dunes to retreat to a managed alignment position. The quantity of sand remaining is seen as sufficient to protect the local coast against a one metre sea level rise, due to global warming, and two, one-in-one-hundred year storms (Tucker, 2004, pers. comm.). Refer to Figure 11 for the location of this managed alignment position.

Once considered as “passive coastal fixtures – a source of nuisance sand drift – some unused land – some unsold real estate” (Culver, 1968), Adelaide’s coastal dunes, whether remnant or newly formed, have become both community treasures and critical sources of sand for infrastructure protection. This dichotomy of values will prove to be a significant challenge for community and Government in the early part of the twenty first century.

## 4.1 Physical Description

### 4.1.1 Topography/ Landform

The Henley South and West Beach Dune Reserve is characterised by a flat sandy beach, backed by vegetated low to medium sized dunes that range from approximately 10 to 125 metres in width.

The dunes and beaches are dynamic systems which are responsive to winds, waves, tides, storms and seasonal changes. Sand dunes, in particular, are only as stable as the protection they receive from erosive forces and the amount of soil and vegetation cover on them. In most locations only some hind dunes located well back from the sea could be justifiably termed stable. Environmental influences are therefore particularly severe on beaches and sand dunes and vegetation needs to be very resilient to survive.

### 4.1.2 Soils

Samples of dune sand taken from the metropolitan coast by the Coastal Protection Branch (DEH) in 1999 show the sand is predominantly low in nutrients and made up of 90% fine siliceous (quartz) sands with a small proportion of calcareous (shell) sands (10%) There is no soil structure and only shallow organic staining on the hind dunes.

### 4.1.3 Climate

The Adelaide region generally experiences a Mediterranean climate with cool wet winters and warm dry summers. The average annual rainfall for the coast is 414 mm and is less than that experienced by non-coastal areas of metropolitan Adelaide due to the effects of orographic rain, whereby rainfall declines along a gradient from the hills to the coast. Temperatures at the coast are slightly lower in summer and warmer in winter than inland areas due to the moderating effect of the ocean. This effect is due to the fact that the ocean has less temperature fluctuations than air (ID&A, 2000). Winds are predominantly from the southwest, however strong north-westerly winds are occasionally experienced predominantly during the winter months.

## 4.2 Vegetation

### 4.2.1 Indigenous Vegetation

Vegetation communities on the coast often display considerable diversity over a small area due to the gradation of environmental factors such as exposure to sun, wind, salt spray, sand blasting, sand stability, availability of water and organic content in sand. Table 2 summarises the pre-European vegetation of the Henley South and West Beach area, using information based upon botanical surveys by early botanists and naturalists active along the Adelaide metropolitan coastline in the early 20th Century.

**Table 2: Indigenous Vegetation of the Henley South and West Beach Coastal Dunes**

Scientific name	Common Name	Botanist/Collector
<i>Acacia cupularis</i>	Cup Wattle	Davis, Cleland, Ising
<i>Acacia longifolia</i> var. <i>sophorae</i>	Coastal Wattle	Cleland, Davis, Ising
<i>Acrotriche patula</i>	Prickly Ground-berry	Davis.
<i>Adriana klotzschii</i>	Coast Bitter-bush	Cleland, Ising.
<i>Allocasuarina verticillata</i> *	Drooping Sheoak	Davis.
<i>Alyxia buxifolia</i>	Sea Box	Cleland, Davis
<i>Atriplex cinerea</i>	Coast Saltbush	Cleland.
<i>Atriplex paludosa</i>	Marsh Saltbush	Cleland.
<i>Banksia marginata</i> *	Silver Banksia	Davis.
<i>Brachycome ciliaris</i>	Variable Daisy	Cleland.
<i>Callitris preissii</i> *	Southern Cypress Pine	Davis.
<i>Carpobrotus rossii</i>	Native Pigface	Cleland, Ising.
<i>Chrysocephalum apiculatum</i> var. <i>apiculatum</i>	Common Everlasting	Davis.
<i>Baumea juncea</i>	Bare Twig Rush	Cleland.
<i>Clematis microphylla</i>	Old Man's Beard	Cleland, Ising.
<i>Crassula sieberiana</i>	Austral Crassula	Cleland.
<i>Austrodanthonia</i> sp.	Wallaby Grass	Cleland.
<i>Daucus glochidiatus</i>	Native Carrot	Cleland.
<i>Dianella revoluta</i> (probably <i>D. brevicaulis</i> )	Short-stem Flax-lily	Cleland, Ising.
<i>Disphyma crassifolium</i> ssp. <i>clavellatum</i>	Round-leaf Pigface	Field Naturalists' Section of the Royal Society.
<i>Enchylaena tomentosa</i>	Ruby Salt-bush	Cleland.
<i>Exocarpos cupressiformis</i> *	Native Cherry	Davis.
<i>Grevillea ilicifolia</i> var. <i>ilicifolia</i>	Holly-leaved Grevillea	Cleland, Ising.
<i>Helichrysum leucopsideum</i>	Satin Everlasting	Cleland, Davis.
<i>Isolepis nodosa</i>	Knobby Club-rush	Cleland.
<i>Kennedia prostrata</i>	Running Postman	Cleland, Ising.
<i>Kunzea pomifera</i>	Muntries	Cleland, Ising.
<i>Lepidosperma gladiatum</i>	Coast Sword-sedge	Cleland, Ising.
<i>Leucophyta brownii</i>	Coast Cushion Bush	Cleland.
<i>Leucopogon parviflorus</i>	Coast Beard-heath	Davis, Cleland, Ising.
<i>Lomandra leucocephala</i> ssp. <i>robusta</i>	Woolly Mat-rush	Cleland.
<i>Lotus australis</i>	Australian Trefoil	Cleland, Ising.
<i>Melaleuca lanceolata</i> ssp. <i>lanceolata</i>	Dryland Tea-tree	Cleland.
<i>Muehlenbeckia gunnii</i>	Coastal Climbing Lignum	Cleland.
<i>Myoporum insulare</i>	Common Boobialla	Cleland, Davis, Ising.
<i>Nitraria billardierei</i>	Nitre Bush	Cleland.
<i>Olearia axillaris</i>	Coast Daisy-bush	Cleland, Ising.
<i>Pelargonium australe</i>	Australian Pelargonium	Cleland, Ising.
<i>Pimelea serpyllifolia</i> ssp. <i>serpyllifolia</i>	Thyme Riceflower	Cleland, Ising.
<i>Scaevola crassifolia</i>	Cushion Fanflower	Cleland, Ising.
<i>Senecio lautus</i>	Variable Groundsel	Cleland, Ising.
<i>Sonchus megalocarpus</i>	Coast Sow-thistle	Cleland.
<i>Spinifex sericeus</i>	Rolling Spinifex	Cleland, Ising.
<i>Stenopetalum lineare</i>	Narrow Thread-petal	Cleland.
<i>Austrostipa</i> spp.	Spear Grass	Cleland.
<i>Tetragonia implexicoma</i>	Bower Spinach	Cleland, Ising.
<i>Threlkeldia diffusa</i>	Coast Bonefruit	Cleland.
<i>Wahlenbergia gracilis</i>	Sprawling Bluebell	Cleland, Ising.

\*These species noted by Davis are likely to have occupied the very sheltered rear-most dunes.

Due to the highly modified nature of the dune system and the predominance of introduced species, current vegetation in the Reserve differs considerably from those in Table 2. Little remnant vegetation and no distinct vegetation communities exist. This can be attributed to the dunes' relatively recent formation and a history of poor management. Therefore for the purpose of this plan, the Reserve has been divided into the following vegetation communities that will act as a guide for future rehabilitation works:

- *Spinifex sericeus/ Atriplex cinerea/ Isolepis nodosa* Tussock Grassland
- *Olearia axillaris/ Rhagodia candolleana/ Isolepis nodosa/ Carpobrotus rossii/ Senecio laetus* Swales
- *Olearia axillaris/ Acacia longifolia var. sophorae/ Rhagodia candolleana/ Nitraria billardierei/ Myoporum insulare* Low Shrubland
- *Olearia axillaris/ Scaevola crassifolia/ Dianella brevicaulis/ Isolepis nodosa* Landscape–Low Shrubland
- *Isolepis nodosa/ Sporobolus virginicus/ Distichlis distichophylla/ Threlkeldia diffusa/ Carpobrotus rossii* Stormwater Outlets

Areas of good quality revegetation works have taken place within the Reserve. Encouragingly, many of these have successfully regenerated and are providing valuable habitat. Notably these are north of the Torrens Outlet between Lexington Street and Ozone Street in the rear swale and south of the Torrens Outlet between Mellor Street and the Henley Sailing Club in the rear swale.

The Henley and Grange Dunecare Group has planted a variety of indigenous plants, including a stretch of *Acacia nematophylla* (Coast Wallowa), *Acacia cupularis* (Cup Wattle), *Acacia longifolia var. sophorae* (Coastal Wattle), *Olearia axillaris* (Coast Daisy-bush) and *Myoporum insulare* (Common Boobiella) on the landward side of the hind dune, which has been highly successful. The group has also planted *Spinifex sericeus* (Rolling Spinifex) on the foredune, which in places, is very well established and out competing the introduced *Thinophyrum junceiforme* (Sea Wheat-grass). The removal of approximately 250 000m<sup>3</sup> of trapped sand immediately south of the Torrens Outlet by the Coastal Protection Branch over the next five years will necessitate the loss of some of these plantings (see Figure 11 for the anticipated managed alignment position).

#### 4.2.2 Plant Species Richness

The vegetation survey conducted for this Management Plan recorded a total of 26 indigenous and 70 introduced plant species in the Henley South and West Beach Coastal Reserve. The high number of introduced species reflects the degraded nature of the Reserve and can be attributed to:

- the recent formation of the dune system;
- a history of unrestrained pedestrian access through the dune system, creating erosion corridors and contributing to weed incursions;
- the highly invasive and pioneering nature of many of the introduced species and the resultant lack of remnant indigenous plant communities;
- the adjacent urbanised environment providing a source of garden weed incursions, for example through illegal planting within the dunes;
- the presence of several stormwater outlets throughout the dunes providing abnormal moisture and nutrient regimes within the local vicinity of the Torrens Outlet.

It is also important to note that the survey was carried out at the end of spring 2004. It is therefore likely that several species, particularly some weeds, which are active during winter and early spring, have not been recorded. Refer to Appendix 2 for a plant species list for the Reserve.



### 4.2.3 Significant Flora

Of the 26 indigenous species identified within the Reserve, eight plant species are of conservation significance. As noted earlier, the majority of these species have been re-introduced to the Reserve through revegetation works since the dunes began forming in the early 1970's. Following, is a summary of the status of these plants:

Scientific Name	Common Name	Conservation Status
<i>Acacia cupularis</i>	Cup Wattle	'rare' (R) within the Southern Lofty Region
<i>Acacia nematophylla</i>	Coast Wallowa	'uncertain' (K), thought to be extinct (X) on Adelaide coast (Sandercock, 2005, pers. comm.).
<i>Adriana klotzschii</i>	Coast Bitter-bush	'uncommon' (U)
<i>Lepidosperma gladiatum</i>	Coast Sword-sedge	'uncommon' (U)
<i>Myoporum parvifolium</i>	Creeping Boobiella	'rare' (R) in South Australia 'vulnerable' (V) within the Southern Lofty Region
<i>Pelargonium australe</i>	Native Storks Bill	'uncommon' (U)
<i>Scaevola crassifolia</i>	Cushion Fanflower	'rare' (R) within the Southern Lofty Region

### 4.2.4 Significant Plant Communities

The Reserve does not contain any plant communities that are considered to be Rare or Threatened at the national and state levels. There is no official regional class for plant communities, however it is expected that coastal plant communities would feature given their fragmented distribution (Turner in Petherick, 2004, pers. comm.).

### 4.2.5 Condition

The Reserve has been divided into five Vegetation Management Zones. These have been classified based upon the vegetation communities discussed in section 4.2.1, the areas they occupy in the dunes, environmental conditions and human modifications. All Management Zones consist of highly degraded vegetation that is dominated by alien plant species with some native plants present. Figure 11 shows the possible future location of these Management Zones. It is important to note these zones are guidelines only and will change depending on natural recession and accretion of the coast and the extent of dune recession from the Coast Protection Board's beach replenishment program. The following is a summary of the condition and status of each of the Management Zones.

#### Zone 1 - Coastal Foredune (*Spinifex sericeus/ Atriplex cinerea/ Isolepis nodosa* Tussock Grassland)

The coastal foredune stretches along the Reserve's western boundary and features a foredune of low to medium height. As part of the Coast Protection Board's beach replenishment program, approximately 250 000m<sup>3</sup> of sand will be removed from a portion of beach immediately south of the Torrens Outlet over the next five years. It is anticipated that the existing foredune in this area will retreat. Exactly how the dunes will respond is unclear, although a narrower, steeper foredune landward of the managed alignment position (see Figure 11) is likely to form (Tucker, 2005, pers. comm.).

This zone is a managed alignment of dune and is considered primarily as a buffer for protection of foreshore development and maintenance of a sandy beach, which could be affected or lost during severe storms.

Due to differing foredune formations and the consequent varied management issues, Management Zone 1 has been divided into three sub-zones (refer to section 8.2.1 for details).

Poor path and step identification has allowed informal pedestrian access into a particularly steep and fragile section of the dune system causing a small blowout<sup>1</sup> in front of residential properties in the area immediately south of the Torrens Outlet.

Vegetation found in this zone must be able to withstand harsh conditions that include strong winds, salt spray, sand abrasion and burial, undermining and inundation, dry infertile sand and intense sun exposure.

#### Zone 2 - Interdune Swale (*Olearia axillaris*/ *Rhagodia candolleana*/ *Isolepis nodosa*/ *Carpobrotus rossii*/ *Senecio lautus* Swales)

Most of the Reserve comprises a foredune, single swale (low-lying area) and a hind dune. The central area either side of the Torrens Outlet is broader (up to 125m) and contains two low-lying areas located between the foredune and hind dune and the eastern boundary. As with Management Zone 1, this area will be affected by dune recession. It is likely, at the widest point near the Torrens Outlet, that the dune system will consist of a single swale located between the new foredune and the eastern boundary of the Reserve. The anticipated future location of Management Zone 2 is illustrated in Figure 11. It is important to note the role of the dunes as a buffer and that this area is also considered to be vulnerable to storms.

Swales are slightly more protected from the harsh conditions experienced on the foredune due to their low-lying nature. These conditions enable the establishment of plants that favour more protected environments, including the dominant species listed in the vegetation community description for Management Zone 2 listed above. At times they may also be subject to inundation by the sea and stormwater from adjacent outlets.

#### Zone 3 - Hind Dune (*Olearia axillaris*/ *Acacia longifolia* var. *sophorae*/ *Rhagodia candolleana*/ *Nitraria billardierei*/ *Myoporum insulare* Low Shrubland)

Hind dunes are more protected from extreme coastal conditions than the foredune and are more stable. These conditions allow a more diverse array of shrubs and other plants to become established. It is unknown how this zone will be affected by the retreat of the dune system; the dune may remain in its current state, or alternatively it may become part of a new foredune. This will be dependent on numerous factors such as the volume of sand removed from the beach, the volume of sand stored in the dunes and the extent of the recession and any impacts from future storm events.

#### Zone 4 - Landscape (*Olearia axillaris*/ *Scaevola crassifolia*/ *Dianella brevicaulis*/ *Isolepis nodosa* Landscape - Low Shrubland)

This area comprises the hind dune between the Torrens Outlet and the Henley Sailing Club. It is possibly the most highly degraded zone within the Reserve and will be the focus of the construction of the Coast Park shared-use pathway. This Management Zone

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<sup>1</sup> Blowouts are hollows in sand dunes that develop where vegetation cover is destroyed or removed, exposing the dune to excavation by wind action. They occur naturally when part of the foredune is cut away during storm activity, leaving an unvegetated cliff of loose sand (Bird, 1984). They are most often initiated by human activity that damages vegetation, such as informal access paths that are worn over the dunes, creation of vehicular tracks and burning of coastal vegetation, or poorly aligned formal access paths that create wind tunnels.



will not be affected by sand removal as part of the Coast Protection Board's beach replenishment strategy.

Indigenous vegetation featured in this Management Zone will provide screening between the Coast Park shared-use path and adjacent residential housing at the Torrens Outlet, and will include numerous attractive, locally native flowering plants.

#### Zone 5 - Stormwater Outlets (*Isolepis nodosa*/ *Sporobolus virginicus*/ *Distichlis distichophylla*/ *Threlkeldia diffusa*/ *Carpobrotus rossii* Outlets)

This zone consists of ten stormwater outlets and immediately adjacent areas that are located along the Reserve's eastern boundary. These areas are characteristically damp and often inundated with nutrient-rich water, providing conditions that favour the growth of introduced species. Many of the weed species present in this Management Zone have been introduced via the stormwater system, with dominant species including *Pennisetum clandestinum* (Kikuyu), *Cynodon* sp. (Couch), *Plantago* sp. (Plantain) and *Foeniculum vulgare* (Fennel). A limited number of indigenous plants exist in this zone.

### 4.3 Fauna

#### 4.3.1 Native Fauna

The population of indigenous fauna in the Reserve is likely to be low given the lack of native vegetation present. This is further exacerbated by the multitude of access paths that dissect the dunes and the presence of introduced fauna.

Minimal indigenous fauna was sighted during the vegetation survey conducted for this Management Plan. A Sleepy Lizard (*Tiliqua rugosa*) was sighted; however other reptiles such as the Eastern Brown Snake (*Pseudonaja textilis*), Common Death Adder (*Acanthophis antarcticus*), Eastern Blue Tongue (*Tiliqua scincoides*) and various skinks and geckos are also likely to be present. Bird species were not recorded. No native mammals are thought to exist in the Reserve due to its small size, degraded nature and presence of introduced predators, such as cats, foxes and domestic dogs.

Whilst not present in the Henley South and West Beach Dune Reserve, a population of Bitter-bush Blue Butterfly (*Theclinesthes albocincta*) exists at Torrens Island (Grund in Petherick, 2003, pers. comm.). Butterfly species have specific food requirements and the loss of particular plant species can lead to the disappearance of a species (Sandercock in Petherick, 2004, pers. comm.). The Bitter-bush Blue Butterfly relies on the native plant *Adriana klotzschii* (Coast Bitter-bush) as a caterpillar food plant; however urban sprawl has seen the butterfly's distribution reduced to only a few isolated populations. Butterfly Conservation South Australia (BCSA) received a grant in 2003 to propagate *Adriana klotzschii* for planting in the hind dune areas from Outer Harbor to Normanville with the aim of creating a coastal corridor for the butterfly. It is recommended that this plant continue to be included in revegetation works to assist in the creation of this corridor and to aid the Reserve's restoration and rehabilitation. *Adriana klotzschii* originally occurred within the City of Charles Sturt dunes.

Extensive fauna studies, including assessments of bird, reptile, mammal and butterfly populations have been conducted in the Taperoo and Largs North dune systems. These surveys provide an insight into the type of indigenous fauna that can potentially inhabit dune systems containing appropriate habitats (refer to Playfair, 1999).

### 4.3.2 Introduced Fauna

As with indigenous fauna, the Reserve does not provide an ideal habitat for introduced animals. Common starlings (*Sturnus vulgaris*) and House sparrows (*Passer domesticus*) are present and it is common to see rabbits (*Oryctolagus cuniculus*) and foxes (*Vulpes vulpes*) in the area. The City of Charles Sturt carries out an annual fox control program and will also be incorporating rabbit control for this area in the future. It is highly likely that domestic cats (*Felis catus*) from nearby houses forage in the dunes. Domestic dogs (*Canis familiaris*) were sighted on numerous occasions in the dunes whilst on walks with their owners.

## 5. Adjoining Land Uses and Vegetation

This 3.2km section of coastal reserve is part of the City of Charles Sturt coastline. To the north is Henley Square, which is comprised of dining and café facilities. To the east, are the Esplanade, Seaview Road, Henley Surf Life Saving Club, Henley Sailing Club, West Beach Surf Life Saving Club, a large grassed reserve and two large car parks. To the west is Gulf St Vincent. At the southern extremity of the Reserve is the West Beach Dune Reserve and Adelaide Shores Caravan Park. Substantial weed control and revegetation works are being carried out within the West Beach Dune Reserve by Adelaide Shores and the Urban Forest Million Trees Program as part of the Coast Park initiative. This presents good opportunities for linkages and the creation of a coastal biodiversity corridor.

## 6. Reserve Values

The Henley South and West Beach Dune Reserve is an integral part of a continuous strip of dunes that stretch along the central Adelaide metropolitan coastline. Several environmental and community groups take an active interest in the area's conservation and there is a strong sense of community ownership present in the region. In the context of the overall Metropolitan Adelaide Coast Protection Strategy, the dune system's prime purpose is to provide protection for road and housing infrastructure and the maintenance of sandy beaches through buffering storm events and the impact of sea level rise from climate change.

### 6.1 Conservation Value

The area is of importance as:

- A coastal dune system along a highly modified metropolitan coastline;
- It provides habitat and food resources for local birds, reptiles and insects in an urban area;
- It is part of a significant corridor for indigenous fauna along the coastal strip between the Port Adelaide Enfield and West Beach dunes and potentially further along the coast;
- It contains some indigenous plant species of local and regional significance;
- It has potential to reinstate pre-European plant and animal communities.

### 6.2 Educational Value

The Reserve is of educational importance as it can illustrate:

- Examples of vegetation historically native to the Adelaide coastline;



- Examples of vegetation used by the Kurna indigenous people for food, medicinal and craft purposes;
- How vegetation (species, communities, dune succession) has changed with European settlement;
- How coastal processes have been affected by European settlement and how the Adelaide coastline is managed as a result;
- The impacts of weed invasion.

### 6.3 Aesthetic Value

The Reserve is an aesthetically appealing backdrop to the beach, featuring a number of attractive flowering indigenous plants, particularly in the winter and spring months. It also forms a buffer between human development i.e. houses, roads, parks and footpaths, as well as being the transitional foreshore area delineating the marine environment and development.

### 6.4 Scientific Value

The Reserve provides an example of coastal and ecological processes occurring along a metropolitan coastline.

### 6.5 Open Space Value

The beach adjacent the Henley South and West Beach Dune Reserve is popular for swimming, sunbathing, walking, jogging, fishing, kite flying and various other recreational activities. The Reserve is also of recreational value as a picturesque place to visit, with the dunes used as a sheltered area near which to relax.

## 7 Reserve Management Objectives

The following aims and objectives for the Henley South and West Beach Dune Reserve seek to provide a technically sound and practical basis for management of this important area. These aims and objectives are consistent with other coastal management plans for the Adelaide metropolitan coast and broader regional plans such as the City of Charles Sturt Coastal Management Plan (Kinhill Pty. Ltd, 1999) and the Adelaide Metropolitan Coast Park Concept Plan (PPK, 2001).

#### **The aims of this Management Plan are to:**

- Protect and restore native vegetation, particularly those species of conservation significance;
- Increase the area of native vegetation within the Reserve;
- Protect existing native fauna and provide habitat and conditions that encourage their return (i.e. creation of habitat corridors);
- Contribute to the management of the potential and actual impact of fire on the Reserve in accordance with other management objectives;
- Encourage and support community participation in dune management and foster an appreciation of Reserve values within the wider community;
- Develop and implement strategic actions for vegetation management and rehabilitation within the Reserve for dune, school and other community groups.

**The objectives of this Management Plan are to ensure that:**

- The extent of weed invasion is reduced and native vegetation increased;
- Populations of feral animals are controlled;
- The Reserve is used appropriately;
- The number of access paths are minimised and those present are designed to reduce informal pedestrian access and are correctly aligned to prevent erosion (i.e. blowouts);
- Reserve boundaries are managed consistently with other management objectives and a cooperative approach involving adjacent land managers is continued;
- An adaptive management approach is adopted, whereby management directions are regularly reviewed and adapted according to changes in the dune environment over time and as further information becomes available.

## 8. Native Vegetation Management Issues

### 8.1 Whole Reserve Management Issues

#### 8.1.1 Weeds

Weeds are the primary threat to biodiversity within the Reserve. Cooperative Research Centre (CRC) for Australian Weed Management (2003) states that, 'weeds are one of the most serious threats facing Australia's primary production and biodiversity, costing the economy an estimated \$4 billion per year. The cost to the environment is also high, with weeds second only to land clearing as a cause of biodiversity loss'.

Weeds are plants that are not naturally present in an area and include plants introduced from overseas and Australian plants inappropriate to the local environment (South Australian Coast Protection Board, 2003). They threaten biodiversity through competition for resources such as sunlight, nutrients, space and water, readily establishing and displacing native vegetation communities. They also reduce the amount of native habitat, food, nesting material and shelter available for indigenous fauna.

Weeds are considered a serious threat along Australia's coast. They can increase soil nutrient levels and change vegetation cover, causing disruptions to sand movement processes essential to dune formation, as well as alter dune shape and form, resulting in significant alterations to the coastal landscape (South Australian Coast Protection Board, 2003).

Some weeds have been introduced inadvertently through previous revegetation programs, such as *Casuarina glauca* (Swamp Sheoak). Several of these currently provide sand stability and habitat, which needs to be taken into consideration when determining appropriate management.

As detailed in Appendix 2, a total of 70 introduced plant species were recorded within the Henley South and West Beach dunes as of November 2004. These species occur throughout the dune system, although their density is highest along the eastern Reserve boundary where garden encroachments are a major problem. Succulent species are particularly prevalent adjacent to houses immediately south of the Torrens Outlet. The construction of a Shared-use path will provide an ideal opportunity to address these garden escapes and other priority weeds throughout the Reserve.

The distribution of weed populations was collected during survey work using Global Positioning System (GPS) units. Geographic Information System (GIS) was then utilised to display the data in map form at a scale of 1:5000.

A priority weeds list for the Reserve has been developed using these weed distribution maps in conjunction with the Weed Risk Assessment (WRA) and Weed Assessment Scoresheet (WAS) developed by the Animal and Plant Control Commission of South Australia (see Table 3). The guide is available at:

<http://www.pir.sa.gov.au/pages/susres/animalplant/wraguide.pdf>

The WAS is a score sheet divided into three main criteria to prioritise weed species:

- *Invasiveness* (rate of weed spread – faster spreading weeds are higher priority);
- *Impacts* (economic, environmental and social effects of the weed);
- *Potential distribution* (indicates the total area the weed could spread to).

Scores for each of these criteria are multiplied (each ranging between 0 and 10), to give a weed importance score out of 1000.

A priority weeds workshop involving coastal and weed experts was convened by the SA Urban Forest Biodiversity Program to determine weed risk scores using the weed distribution maps and the Weed Risk Assessment and Scoresheet. The weed risk (very high, high, medium, low or negligible) of each of the species scored was then determined according to the WRA guidelines. The results are illustrated in Table 3. Priority weed distribution maps of species in this table are available in Figures 12-16.

It is important to note that the vegetation survey for this Management Plan was conducted in the late spring, early summer (2004) and therefore may not include some weed species that may be present during winter and early spring. The list also does not include *Reichardia tingitana* (False Sow Thistle), *Cakile maritima* (Sea Rocket), *Thinopyrum junceiforme* (Sea Wheat Grass) and several other grasses that are naturalised in the Reserve. In addition, it is important to note that some weed species are in low abundance and therefore easily eradicated. These weeds should receive attention before those that have already become widespread (refer to pages 25-32 and the weed control recommendations in each Management Zone for these low abundance species).

Construction of the Coast Park Shared-use pathway, particularly between the Ozone Street car park and the Henley Sailing Club, will provide a good opportunity for action on much of the priority weed and revegetation issues within this section of the Reserve. Garden escapes near the Torrens Outlet are a particular problem at present. It is recommended that the full and immediate eradication of all weed species occur concurrently with the path construction within this zone. Stabilisation material will be needed in some areas to reduce erosion, followed by thorough revegetation using local native species.

**Table 3: Priority Weeds List for Henley South and West Beach Dune Reserve**

Priority	Scientific Name	Common Name	Weed Importance Score	Weed Risk
1	<i>Trachyandra divaricata</i>	Dune Onion Weed	386.0	Very High
2	<i>Arctotis stoechadifolia</i>	White Arctotis	227.4	Very High
3	<i>Leptospermum laevigatum</i>	Coast Tea-tree	224.6	Very High
4	<i>Argyranthemum frutescens</i>	Marguerite Daisy	210.5	Very High
5	<i>Succulent spp./ Cacti spp.</i>	Succulent & Cacti	202.1	High
6	<i>Mesembryanthemum crystallinum</i>	Common Ice Plant	185.3	High
7	<i>Gazania sp.</i>	Gazania sp	179.6	High
8	<i>Lycium ferocissimum</i>	African Boxthorn	151.6	High
9	<i>Euphorbia paralias</i>	Sea Spurge	147.4	High
10	<i>Carpobrotus edulis</i>	Hottentot Fig	103.2	High
11	<i>Euphorbia terracina</i>	False Caper	89.8	High
12	<i>Acacia cyclops</i>	Western Coastal Wattle	56.1	Medium
13	<i>Galenia pubescens</i>	Coastal Galenia	50.5	Medium
14	<i>Pennisetum setaceum</i>	Fountain Grass	44.9	Medium
15	<i>Oenothera stricta</i>	Evening Primrose	42.1	Medium
16	<i>Drosanthemum candens</i>	Rodondo Creeper	35.1	Medium
17	<i>Tetragonia decumbens</i>	Sea Spinach	28.1	Low
18	<i>Cynara cardunculus</i>	Artichoke Thistle	28.1	Low
19	<i>Cynodon sp.</i>	Couch	28.1	Low
20	<i>Rhamnus alaternus</i>	Buckthorn	25.3	Low
21	<i>Osteospermum fruticosum</i>	Seascape Daisy	16.8	Low
22	<i>Pennisetum clandestinum</i>	Kikuyu	9.8	Low
23	<i>Tamarix aphylla</i>	Tamarisk	9.5	Low
24	<i>Ammophila arenaria</i>	Marram Grass	8.4	Low
25	<i>Coprosma repens</i>	Mirror Bush	6.3	Low
26	<i>Arundo donax</i>	Bamboo	5.6	Low
27	<i>Ricinus communis</i>	Castor Oil Plant	4.2	Low
28	<i>Casuarina glauca</i>	Swamp Sheoak	2.8	Negligible

Refer to pages 25-32 for details.

The following describes the priority weed species listed in Table 3. Appendices 3-6 should be consulted for detailed information on species descriptions and distribution, management recommendations and control techniques.

#### *Trachyandra divaricata* (Dune Onion Weed)

*Trachyandra divaricata* is the highest priority weed for the Henley South and West Beach Dune Reserve. As Table 3 illustrates, the weed risk of *Trachyandra divaricata* is 'very high' and the plant's weed impact score is more than 1.5 times greater than that of priority weed number two, *Arctotis stoechadifolia* (White Arctotis). *Trachyandra divaricata* is highly invasive, has significant environmental, economic and social impacts, and has the potential to infest the foredune through to the hind dune. It has been observed in both degraded and high quality vegetation (Petherick, 2004).

*Trachyandra divaricata* is a tufted perennial herb to knee high with flat, shiny and hairless leaves. It flowers predominantly in winter to late spring although has been observed flowering after episodes of summer rain. The flower stems are branched and sprawling, detaching at maturity to blow as "tumbleweeds", dispersing seeds. Heyligers (1998) estimates that mature plants produce approximately 200 capsules per inflorescence per season, each containing roughly 12 seeds. This equates to up to 50,000 seeds per flowering season. It is toxic to livestock.

The plant originates from South Africa where it is a coastal dune plant. It was introduced to Western Australia in the 1920s most likely through contaminated ballast water. Within

50 years it had infested a 300-kilometre stretch of the Western Australian coast between Perth and Karridale (Heyligers, 1998). It is also present in coastal areas of New South Wales where it is believed to have been introduced to revegetation sites through contaminated tubestock from Western Australia (Heyligers, 1998).

*Trachyandra divaricata* was first recorded along the Adelaide metropolitan coast in the mid to late 1990s in the Taperoo Dune Reserve, which forms part of the Port Adelaide dune system on Adelaide's northern metropolitan coastline. Until recently it was known to be present in only two dune systems - serious infestations are present in the Port Adelaide dunes while a relatively small population exists in the Port Noarlunga dunes on Adelaide's southern metropolitan coast. Outlying specimens have recently been seen at Tennyson and Brighton dunes on the central metropolitan coast (Sandercock in Petherick, 2004, comm.).

Seven individual plants were discovered during the vegetation survey conducted for the Henley South and West Beach Dune Reserve. While these plants were removed, it is highly likely a considerable stock of seed exists within the immediate vicinity. To minimise the likelihood of infestation, it is recommended the recorded locations (refer to Figure 14) be closely monitored and germinating seedlings be controlled for at least four years. Henceforth, due to the likelihood of germination and potential re-infestation, this plan will consider *Trachyandra divaricata* as existing as mature plants within the dune system.

Henley South and West Beach Dune Reserve contains the most southerly distribution of *Trachyandra divaricata* in the Charles Sturt coastline, with the most southerly plant recorded approximately 175 metres south of the Torrens Outlet (refer to the distribution map shown in Figure 14). To prevent spread further south into the City of Charles Sturt, West Beach dunes and the rest of the Adelaide metropolitan coast, monitoring and control of these sites will be essential.

It is recommended that annual site assessments be undertaken using the Nature Conservation Society's *Bushland Condition Monitoring Manual Southern Mount Lofty Ranges Coastal Version* (Croft et al, 2004) to assess the success of this control strategy and record changes in the plants' distribution. The community groups active along the City of Charles Sturt coastline will be able to play a vital role in monitoring and controlling *Trachyandra divaricata* and reporting any new outbreaks.

#### *Arctotis stoechadifolia* (White Arctotis)

*Arctotis stoechadifolia* is a rampant perennial groundcover. It significantly alters vegetation in the coastal environment through smothering, shading and competition for resources. This causes a reduction in biodiversity as indigenous plants can be replaced with dense monocultures of this weed.

There are four infestations of *Arctotis stoechadifolia* within the dune Reserve. They occupy a position to the rear of the swale or in the hind dune in sheltered, disturbed sites. The most northerly infestation is north of the Torrens Outlet at the base of the sea wall. The remaining three are within close proximity to one another between the Torrens Outlet and the Henley Sailing Club adjacent to the houses. These infestations should be removed and the area revegetated as part of the Coast Park path construction. The infestation north of the Torrens Outlet should be removed as a matter of priority and replaced with indigenous plants.

### *Leptospermum laevigatum* (Coast Tea-tree)

*Leptospermum laevigatum* is an Australian native that was introduced from the eastern states into South Australia as a garden ornamental. It invades disturbed areas and coastal heaths and forests, significantly altering the environment by forming dense thickets that out-compete indigenous plants through shading and competition for resources.

A large number of plants currently exist within the Reserve. The most northerly occurrences are immediately south of Gilmore Road. The majority are distributed south of the Torrens Outlet. The latter are of very high priority to remove as they have the potential to infest a significant area within the dune system. Removal will need to be staged and revegetation works undertaken due to the fact the plants are currently providing habitat and sand stability.

### *Argyranthemum frutescens* (Marguerite Daisy)

*Argyranthemum frutescens* is a garden escape which aggressively competes with less vigorous native vegetation through shading and competition for resources. It is most often found in disturbed areas or in places of low biodiversity.

Eleven plants were identified within the dune Reserve and because of their low numbers should be a priority for removal. These plants are located in the swale south of Lexington Street.

### *Succulent / Cacti* spp.

Numerous species of cacti and succulent plants were recorded in the dune Reserve, and have been classified under a single category. Plants in this grouping include *Opuntia* sp. (Prickly Pear) and *Agave americana* (Century Plant). Many are garden escapes that can be observed in nearby residential gardens, some of which have been deliberately planted into the hind dune area and are spreading further into the Reserve. All plants should be removed as a priority to prevent further establishment. Some plants, for example, *Agave americana* also harbour introduced animals such as rabbits, making it difficult to control feral animal populations.

As with several other priority weeds the removal of these particularly problematic garden incursions should be undertaken in conjunction with the construction of the shared-use path.

### *Mesembryanthemum crystallinum* (Common Ice Plant)

*Mesembryanthemum crystallinum* is often found in degraded areas in a variety of loamy and well-drained soils. It has a severe allelopathic effect on other plants and can form mats that smother existing native vegetation and suppress seedling growth.

Minimal *Mesembryanthemum crystallinum* is present in the Reserve and it is important that this remains the case. Plants appear in the most disturbed areas of the dune system, predominantly at the base of the sea wall between South Street and Henley Beach Road, immediately either side of the Torrens Outlet and south near the West Beach Surf Life Saving Club. All plants should be eradicated and the site monitored for any new outbreaks.

### *Gazania* sp. (Gazania)

*Gazania* sp. is a garden escape that often spreads from public and private gardens, or is deliberately planted or dumped in garden refuse in the dunes. *Gazania* readily colonizes sandy areas and compete with and suppress indigenous species such as *Carpobrotus rossii* (Native Pig-face). It is thought *Gazania* sp. has some allelopathic properties due to the fact patches of this plant are usually devoid of other species (Sandercock, 2004, pers. comm.).

*Gazania* sp. has become naturalised throughout much of the dune Reserve and its complete removal will be subject to long term management strategies. Removal should be carried out in the immediate planting area prior to revegetation. Control of this weed, particularly immediately south of the Torrens Outlet to Burbridge Road, would provide a considerable infestation free zone for native rehabilitation.

### *Lycium ferocissimum* (African Boxthorn)

*Lycium ferocissimum* tolerates harsh coastal conditions and can inhabit the foredune, swale and hind dune areas. It is an aggressive weed that shades and crowds out native vegetation. It often occurs under trees and shrubs where birds roost. When left unchecked it will form impenetrable thickets. Large thickets also provide habitat for introduced animals such as rabbits and foxes. Refer to Appendix 3 for information on native species that may be confused with this woody weed.

Historically, *Lycium ferocissimum* occurred throughout the Reserve, however systematic control of this species by Council has reduced populations to only four or five small individual plants. These occur between the Torrens Outlet and the Henley Sailing Club. It is important to eradicate these plants before they re-establish and become difficult to remove. Control of these particularly aggressive plants should occur in conjunction with the construction of the Coast Park shared-use path.

### *Euphorbia paralias* (Sea Spurge)

*Euphorbia paralias* colonises eroded areas and those of relatively high salt content, from the incipient to the hind dunes. It can withstand a variety of conditions including sand accretion, full sun, drought, high salinity, inundation, undermining and strong winds. The plant can form monocultures that out-compete indigenous plants for space and resources.

Several large infestations are present in the swale within the Reserve and are competing with indigenous vegetation such as *Isolepis nodosa* (Knobby Club-rush), *Spinifex sericeus* (Rolling Spinifex) and *Senecio lautus* (Variable Groundsel). These infestations should be subject to staged removal and replaced with indigenous vegetation.

### *Carpobrotus edulis* (Hottentot Fig)

*Carpobrotus edulis* occupies the same niche as the local native, *Carpobrotus rossii* (Native Pig-face) and can inhabit the foredune to the more sheltered hind dune. It will tolerate drought and is frost resistant. While in flower it is easy to discern from *Carpobrotus rossii* by its yellow 'petals' as opposed to the native's pink petals with a white base. The difficulty of identifying between the two species while not in flower may result in lower than actual numbers in the survey data. It is thought *Carpobrotus edulis* readily hybridises with the local species and as such, is considered a serious threat to the integrity of local populations of *Carpobrotus rossii* and genetic biodiversity in general.

Within the Henley South and West Beach Dune Reserve it appears to prefer the more protected areas of the swale and hind dune. Plants should be identified and marked during the flowering season of spring and summer. Removal should then be undertaken in late autumn and through the winter months with appropriate local native species planted in their place.

#### *Euphorbia terracina* (False Caper)

*Euphorbia terracina* became naturalised in the coastal sand dunes near Adelaide during early settlement. It inhabits well-drained sandy soils and is commonly found in degraded areas. It is found mostly around the Torrens Outlet from Ozone Street, towards Burbridge Road. There is little present at the southern and northern ends of the Reserve where the dune system is narrower and only a foredune is present. It will become naturalised in the Reserve if not controlled and should therefore be contained to prevent this occurrence. It is recommended that the opportunity be taken at the time of the construction of the Coast Park shared-use path to eradicate infestations near the Torrens Outlet.

#### *Acacia cyclops* (Western Coastal Wattle)

*Acacia cyclops* is an Australian native that is weedy along the Adelaide metropolitan coastline. It originates from the western coast of South Australia. It can form dense thickets that suppress indigenous vegetation through shading and competition for resources.

All recorded specimens of *Acacia cyclops* occur between the second and third walkway south of the Torrens Outlet, near the Henley Sailing Club. As these plants are medium to large in size and currently providing valuable habitat and sand stability it is recommended their removal be staged, coinciding with the construction of the Coast Park Shared-use pathway. Any juvenile specimens should be removed immediately.

#### *Galenia pubescens* (Coastal Galenia)

*Galenia pubescens* inhabits degraded areas, forming dense mats that out-compete native groundcovers and smother established vegetation. The weed is present throughout the Reserve, particularly along edges of the eastern boundary and access paths. Smaller infestations and plants that are smothering native vegetation should be removed immediately while larger infestations must be contained and controlled to prevent further spread.

#### *Pennisetum setaceum* (Fountain Grass)

Native to East Africa and the Middle East, *Pennisetum setaceum* is a common landscaping grass that can form dense infestations which interfere with the regeneration and survival of native species. Its capacity to regenerate well after fire can further enhance its ability to out-compete more sensitive local species.

This species is predominantly distributed north of the Torrens Outlet both on and at the base of the sea wall. These occurrences are most likely the result of garden escapes. Given their easy access, relatively low numbers and potential for further spread it is advisable to remove these as a matter of high priority.



### *Oenothera stricta* (Evening Primrose)

A garden escape introduced from South America, *Oenothera stricta* is found in disturbed sandy soils throughout Australia. It is distributed throughout the Reserve with populations greatest immediately either side of the Torrens Outlet. It is recommended that the weed be removed from the Reserve in conjunction with the construction of the Coast Park shared-use path.

### *Drosanthemum candens* (Rodondo Creeper)

*Drosanthemum candens* is a popular coastal groundcover/rockery plant due to its hardy nature and bright pink flowers. It is particularly fond of disturbed sites and can form a smothering mat if not controlled. Native species may be displaced and regeneration thwarted in areas where this garden escape exists.

As with several other priority weeds the removal of these particularly problematic garden incursions should coincide with the construction of the Coast Park shared-use path.

### *Tetragonia decumbens* (Sea Spinach)

*Tetragonia decumbens* is a South African coastal dune plant present in the temperate coastal areas of Australia. It is commonly dispersed by offshore currents as its fruits are buoyant and remain viable after two years afloat. In the Henley South and West Beach Dune Reserve, scattered plants are present in the semi-stable environment of the hind dune and rear swale, although the plant is known to occupy the front of the foredune and unstable dunes. *Tetragonia decumbens* should be removed from the Reserve and replaced with appropriate native plants such as the native *Tetragonia implexicoma* (Bower Spinach).

### *Cynara cardunculus* (Artichoke Thistle)

Once established, *Cynara cardunculus* dominates vegetation within an area by outcompeting other species for available light, moisture and nutrients. Normally, this weed occurs near waterways and is capable of forming impenetrable monocultures. A single mature plant exists adjacent to the southern end of the Henley Sailing Club car park and should be eradicated as a high priority.

### *Cynodon* sp. (Couch)

*Cynodon* sp. is a commonly used lawn grass in Australia. It is often deliberately planted in public and private gardens, and frequently spreads from dumped lawn clippings. It is extremely invasive and is known to invade native bushland where it spreads from the outskirts, smothering and out-competing native plants.

*Cynodon* sp. is generally present along the Reserve's eastern boundary and into the rear swales. It is highly likely to have spread from lawned areas immediately to the east of the Reserve with sprinkler run-off from these areas aiding its growth. Larger sized infestations should be controlled and contained to ensure that they do not continue to spread into the dunes. Smaller patches should be removed immediately before they become more established. Replace with appropriate indigenous plants (see recommendations for individual Management Zones in Section 8.2).

### *Rhamnus alaternus* (Buckthorn)

Well adapted to Mediterranean climates, *Rhamnus alaternus* rapidly forms dense thickets that shade out native species and alter the vegetation community structure. It reduces biodiversity through habitat degradation and altering the natural community composition.

Several mature individuals exist within the dune system, however the main population is situated north of the Torrens Outlet. They occur either at the base of the sea wall or adjacent to pedestrian access paths. It is important these plants are removed as a matter of priority as they are presently in low numbers and therefore relatively easy to control.

### *Osteospermum fruticosum* (Seascape Daisy)

*Osteospermum fruticosum* is a garden groundcover that often spreads from public and private gardens, or is deliberately introduced through plantings and dumped garden debris. *Osteospermum fruticosum* readily colonises sandy areas where it competes with and suppresses indigenous species such as *Carpobrotus rossii* (Native Pig-face). Numerous plants are present in the Reserve and these should be a high priority for removal.

### *Pennisetum clandestinum* (Kikuyu)

*Pennisetum clandestinum* is a common lawn grass that spreads into native vegetation from nearby gardens, contaminated soil and dumped garden waste. It can form dense mats that smother and exclude indigenous plant species.

It is present in stormwater outlet areas and depressions along the eastern boundary of the Reserve that are wet and rich in nutrients. *Pennisetum clandestinum* will continue to be a problem in these wet sections of the dunes and should be removed and replaced with appropriate indigenous plants such as *Isolepis nodosa* (Knobby Club-rush), *Distichlis distichophylla* (Emu Grass) and *Sporobolus virginicus* (Salt Couch).

### *Tamarix aphylla* (Tamarisk)

*Tamarix aphylla* is native to Northern Africa, Europe, the Mediterranean, the Middle East and Asia. It was originally introduced into Australia as a shade tree and windbreak. A *Weed of National Significance* (WONS), it is well suited to a variety of coastal conditions, including high salinity, low nutrient and high pH levels. Over time it can form large colonies which decrease light penetration and increase local salinity levels thus reducing the capacity for local species to establish.

Two large planted trees exist between Lexington Street and Ozone Street alongside a pedestrian access path. Another large colony exists at the southern end of the Henley Sailing Club car park. As this patch provides one of the few significant shade and high stratum habitat sites along the Charles Sturt coastline it is recommended these particular trees remain. It is highly advisable to monitor for new seedling growth and limit the further spread of this colony. Removal of the two individuals north of the Torrens Outlet should be staged and replaced with appropriate indigenous species.

### *Ammophila arenaria* (Marram Grass)

*Ammophila arenaria* was introduced into Australia for stabilisation of coastal sand dunes. The plant is generally considered to be of benefit in sand dune stabilisation although it is no longer recommended for revegetation projects. It is known to form dense hummocks that alter dune shape, resulting in steeper dunes, which are more susceptible to erosion



by wave action (Blood, 2001). It can also out-compete indigenous flora such as *Spinifex sericeus* (Rolling Spinifex) and inhibits the establishment of other species as its long flexible leaves continually sweep sand around the plant's edge.

Several large colonies exist throughout the Reserve, mainly on and to the rear of the hind dune. These exist almost certainly as a result of past plantings to establish dunes in the 1970s. Long term removal strategies will need to be implemented for its complete removal. Where future revegetation works occur, *Ammophila arenaria* plants in the immediate area should be removed.

#### *Coprosma repens* (Mirror Bush)

*Coprosma repens* is a garden escape that is often planted in coastal gardens due to its high salt tolerance. For this reason it is a common weed in coastal areas and can occupy sand dunes and coastal cliffs. It reduces natural diversity through shading and suppression of native species.

Six plants were recorded within the Reserve – five at the northern end near South Street and one near Mellor Street adjacent to a pedestrian access path. Due to their invasive nature these plants should be eradicated immediately.

#### *Arundo Donax* (Giant Reed)

Despite being called a "reed", *Arundo Donax* is actually a perennial grass that can grow to 6m tall. It grows in a variety of environments, often along watercourses and in degraded areas. Characteristics such as rapid growth and vegetative reproduction allow *Arundo donax* to readily invade new areas. Once established, it out-competes and suppresses native vegetation. It presents a fire hazard due to its highly flammable nature.

Two clumps are present within the Reserve. These should be removed and monitored for regeneration.

#### *Ricinus communis* (Castor Oil Plant)

*Ricinus communis* has naturalised in all Australian states with the exception of Tasmania and can be found along creek banks, degraded city areas and along the coast. The seeds are highly toxic and are a common cause of child poisonings. A single plant was present nearby a stormwater drain south of the Torrens Outlet.

Due to the highly toxic nature of this plant it is recommended that it be removed as a matter of priority. As with several other priority weeds, the construction of Coast Park path will provide an opportunity to remove this toxic weed.

#### *Casuarina glauca* (Swamp Sheoak)

*Casuarina glauca* originated from coastal eastern Australia. It was utilised as a hardy windbreak and stock shelter suited to a wide range of conditions. It was possibly introduced as an inappropriate revegetation plant. Highly competitive outside of their natural environment they compete for nutrients and displace local native species.

Three medium-sized plants within close proximity to one another were observed near Mellor Street. These plants may have been deliberately planted when Australian natives were commonly used in conservation projects. They should be removed and replaced with appropriate indigenous species.

### 8.1.2 Fire

Naturally occurring fires are not regarded as being common events in the coastal dune environment due to the relatively low fuels loads present, the higher humidity experienced at the coast and the fact that most coastal plants are not highly volatile. Extreme conditions are required for fire to take hold (Sandercock in Petherick, 2004, pers. comm.). The majority of dune vegetation species are able to reproduce in the absence of fire. Seeds of species normally associated with the need for fire to germinate, such as *Acacia* spp. are likely to have dormancy broken through seed coat abrasion from sand.

All natural environments have a fire regime that indigenous plant and animal species have adapted to. The fire regime of a location is made up of three factors (NSW Department of Land and Water Conservation, 2001):

1. Frequency (how often a fire occurs);
2. Intensity and duration (how hot and how long the fire burns);
3. Timing (what time of the year/ season).

Variation of these factors will result in changes to the flora and fauna of that area. A fire frequency that is too high will change vegetation composition and structure with the loss of some species (NSW Department of Land and Water Conservation, 2001). Fires in the dune environment can also lead to dune instability (such as the development of blowouts – refer to page 19) and increased susceptibility to weed invasion.

The Henley South and West Beach Dune Reserve is considered to be a low-fire risk area given the low fuel load present in the dunes. This risk is likely to remain low with the decrease in Reserve size from the dune recession associated with the Coast Protection Board's foreshore protection strategy occurring over over the next five years. In the case of fire, vehicular access could occur along either the Esplanade or Seaview Road.

### 8.1.3 Access and Fencing

Coastal dune vegetation is especially vulnerable to damage from pedestrian and vehicular traffic. Fences are therefore used in coastal environments to protect naturally vegetated sand dunes and revegetation works from uncontrolled traffic, as well as assisting in the formation of sand dunes (NSW Department of Land and Water Conservation, 2001). Access paths enable pedestrian and vehicular traffic to gain access to beaches in a manner that preserves adjacent dunes and vegetation (Telfer, 2001). Carefully designed access ways can also ensure people with disabilities are able to experience the beach and dune environments.

As the aerial imagery in Figure 11 illustrates, the Reserve is heavily dissected with 17 east-west aligned access paths. This high number of paths is detrimental to biodiversity conservation as it fragments areas of native vegetation, increases susceptibility to degradation by pedestrian traffic, enables weeds to invade more readily and significantly reduces habitat for native fauna. This issue is further exacerbated by the presence of several informal north-south orientated paths that run through the dune system.

Figure 17 shows the haphazard and highly erosive nature paths can take as a result of inadequate fencing and education. Various public education programs by Council and community groups in combination with the use of strained wire fencing since the 1970s appears to be relatively successful in controlling pedestrian access throughout the Reserve. At the time of the photograph some 19 informal paths over a 200m section of the coast were evident. Today, in the same area these have been consolidated into two formal paths.

The only exception to the success of reducing pedestrian access is at the southern end of the Reserve. At this point the dune is above the wall height and people have climbed onto the dune for a better vantage point.

The eastern boundary of the Henley South and West Beach Dune Reserve is defined by a variety of structures. A sea wall is present to the north of the Torrens Outlet, whilst immediately south there is a 300m section of residential development with dune frontage. Further south again, for several hundred metres, there is a low stone wall with regular openings for formal beach access.

**Figure 17 - Uncontrolled Beach Access, West Beach, 1976**



Photo courtesy of Coastal Protection Branch

It is also apparent that it may be difficult for beach users to identify the location of access paths when leaving the beach. It is therefore suggested that the beach end of access paths be marked, possibly with treated pine posts or signage. The above recommendations should be addressed as part of the Coast Park project.

North of the Torrens Outlet between Lexington Road and South Street, and on the western boundary of the Reserve, the City of Charles Sturt has constructed a series of sand drift fences to aid in the construction of an artificial dune to protect residential infrastructure. These fences work by reducing wind speed, which in turn causes drifting sand to accumulate in the vicinity of the fence (NSW Department of Land and Water Conservation, 2001). At present it is estimated approximately 16,000m<sup>3</sup> of sand accumulates south of the Torrens Outlet per year, with over 500,000m<sup>3</sup> accumulating since 1970 (Tucker, 2004, pers. comm.). The Coast Protection Board, as part of its management of Adelaide's metropolitan coast currently transports approximately 25,000m<sup>3</sup> of sand per year to the Henley South area between Lexington Road and South Street. It is expected this will continue into the future (Tucker, 2004, pers. comm.). Sand drift fencing will therefore continue to play an integral role in Council's management of the dune system and should continue to be utilised as an effective management technique.

The sand dunes within the City of Charles Sturt consist of indigenous vegetation that is of poor to good condition. Plans are currently underway to develop a Coast Park Shared-use path between the Ozone Street car park and the Henley Sailing Club. At the time of writing (March 2005) the proposed path alignment and design was under review by the design team following public consultation. Details of this process and outcomes can be viewed in the *Coast Park from Ozone Street Car Park to Henley Sailing Club – Concept Design Report* (Howard et al., 2004).

The precise path location (within Management Zone 4) and construction techniques within the boundaries of the preferred 'Dune Edge Option' were still being finalised following costings based upon detailed topographic and vegetation surveys.

No paths currently exist that facilitate disabled access; however the construction of the Coast Park shared-use pathway will allow for north-south access once completed. The ramp at the Henley Sailing Club is adequate for disabled access to the beach.

Currently, several owners of property between the Torrens Outlet and the Henley Sailing Club have illegally extended gardens into the dune environment. This has created an atmosphere of implied ownership by private residents upon public land. Negative effects these incursions create extend not only to the immediate vicinity but also to the entire dune system. These include altered soil chemistry and composition, resulting in high levels of weed and feral animal infestations.

The public who visit this area are 'invited' into the dunes through a lack of clearly defined pathways. This usurpation of public land by private residents then results in the public skirting around extended gardens and into the dune, in the mistaken belief they may be trespassing on private land. This creates informal paths and significantly increases strain upon an area already under considerable pressure.

These garden incursions, and the follow on effects they have, are a major contributor to the highly degraded nature of the Reserve. Until these problems are addressed, this area will remain in this state and be a future source of environmental weeds.

It is therefore recommended that all garden incursions be removed during the construction of the Coast Park shared-use pathway and a clearly defined track constructed for private resident access to the path and beach. The area should be rehabilitated using indigenous species in an amenity landscape fashion.

It is recommended that Council investigate options for:

- better disabled access to the beach, particularly north of the Torrens Outlet;
- clear boundary delineation between the dune frontage properties south of the Torrens Outlet and the dunes to discourage the encroachment of alien garden species, irrigation and landscaping;
- local resident access to the beach and Coast Park shared-use path in the area between the Torrens Outlet and the Henley Sailing Club locality;
- the number of formal access paths to be further reviewed throughout the Reserve and those that remain be well aligned and fenced;
- the strategic installation of signage or access fencing where appropriate to control informal access into the dunes, particularly in the vicinity of the Torrens Outlet area;
- the closure and rehabilitation of all informal north-south aligned pathways.

These issues can be considered when examining fencing and path options for the formal access paths and during the planning stage for the Coast Park Shared-use path in this area.

#### **8.1.4 Erosion**

Erosion is a significant management issue within the Reserve given that there is a small blowout at the Torrens Outlet (Management Zone 1) and that a large proportion of the

site will be affected by erosion as a result of the Coast Protection Board's sand management strategy. It is also an issue where vegetation growth is inadequate and where there is trampling by pedestrian access. Management options to address the effects of erosion include:

- fencing and formalising pedestrian access (as discussed in Section 8.1.3);
- use of signage (also discussed in Section 8.1.3);
- adoption of stabilisation techniques such as revegetation works.

The small blowout (Figure 18) located immediately south and adjacent the Torrens Outlet is situated at the base of a steep section of crescent shaped dune in front of housing. This is a point of obvious access into the dunes and the nearby formal steps appear to encourage access into the dunes. On several occasions during the vegetation survey conducted for this Management Plan people were noticed accessing the dunes from this point. It is therefore recommended that the informal access path adjacent the Torrens Outlet causing a blowout, be formalised and the dune rehabilitated during the Coast Park construction.

**Figure 18: Blowout in Management Zone 1- Henley South and West Beach Dune System, 2005**



### 8.1.5 Introduced fauna

Introduced species such as rabbits, foxes, feral cats and domestic dogs pose a major threat to indigenous flora and fauna along the coast and can adversely affect the success of any revegetation works undertaken. When and where these species are observed in the Reserve, appropriate control techniques will need to be considered by the City of Charles Sturt.

Rabbits, foxes, and feral cats are all 'proclaimed' species under Schedule 1 of the *Animal and Plant Control Act 1986*. Their sale or transport is illegal and landholders may be obliged to control them on their properties (State of the Environment Report for South Australia, Supplementary Report, 2003). These species have been identified as key threatening processes under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). Threat abatement plans for each of these species have been developed by the Australian Government, Department of the Environment and Heritage. These plans are available on:

<http://www.deh.gov.au/biodiversity/threatened/tap/index.html>

It is important that, at all times, the most humane control techniques available be utilised in the control of these species.

#### European Red Fox (*Vulpes vulpes*)

Foxes were introduced to Australia in 1855 for recreational hunting and by the 1870s fox populations had become established in the wild (DEH, 2004). The fox has played a major role in the decline of ground-nesting birds, small to medium sized mammals and reptiles. It is also thought to be responsible for a severe reduction in populations of many threatened species (DEH, 2004).

Historically foxes have been controlled through hunting and more recently, fencing and baiting programs. Currently, studies are being undertaken to develop biological controls, including contraceptive vaccines, which are aimed at reducing harm to non-target animals and making control methods more effective and humane.

City of Charles Sturt staff have conducted a successful fox control program over the past three years in association with numerous adjacent land managers. It is recommended that all future control continues to be in alignment with the Australian Government's *Threat Abatement Plan for Predation by the European Red Fox* and that advice be sought from the local authorised Pest Plant and Animal Control Officer.

#### European Wild Rabbit (*Oryctolagus cuniculus*)

The European rabbit is considered as Australia's most widespread and destructive pest. Introduced onto the mainland in 1859 near Geelong, they now occupy a large portion of southern Australia, including most of South Australia (State of the Environment Report for South Australia, 2003, Supplementary Report). Feral rabbits compete with native wildlife for food and habitat resources. They damage vegetation, degrade the environment, ringbark trees and shrubs and prevent plant regeneration. Rabbits have also been responsible for the extinction of several small ground-dwelling mammals and have contributed to the decline in numbers of many native flora and fauna (DEH, 2004).

Traditional control methods have included fencing, destroying burrows, shooting, trapping and poisoning. The introduction of the myxoma virus (causing myxomatosis) in 1950 and the more recent calicivirus have been effective in significantly reducing numbers. At present the focus of research is on improving the effectiveness of traditional control techniques and existing viruses and developing new ones.

Rabbits are a recurring problem within the Henley South and West Beach Dune Reserve and Council has an ongoing control program. Feral rabbit control programs need to be coordinated with other on ground conservation works and control of other invasive species such as foxes and feral cats. It is recommended therefore that all future control continues to be in alignment with the Australian Government's *Threat Abatement Plan for Competition and Land Degradation by Feral Rabbits* and that advice be sought from the local authorised Pest Plant and Animal Control Officer.

#### The Feral Cat (*Felis catus*)

It is thought cats may have been introduced to the Australian continent as early as the 17<sup>th</sup> century by Dutch shipwrecks. Colonies were established in the wild by the 1850s and intentional release occurred in the late 1880s in the hope that they would control rabbits, mice and rats (DEH, 2004).

It is likely feral cats have contributed to the extinction of many small to medium sized mammals and ground-nesting birds. In some instances, feral cats have directly



threatened endangered species recovery programs (DEH 2004). Feral cats have often been sighted frequenting the rip-rap walls at Henley South and at the nearby dunes at Adelaide Shores. These animals have a negative impact on indigenous bird and reptile populations.

Regarding control methods for cats, it is recommended that a comprehensive control program be developed and implemented in accordance with the Australian Government's *Threat Abatement Plan for Predation by the Feral Cat* and that advice be sought from the local authorised Pest Plant and Animal Control Officer. Control of feral cats is difficult in urban environments such as the Henley South and West Beach Dune Reserve as it is important not to affect domestic dog and cat populations.

### Domestic Dogs

Whilst undertaking fieldwork for this Management Plan, it was observed that domestic dogs were allowed loose in the dunes by their owners. The presence of dogs in the dunes is detrimental to biodiversity conservation as they can damage native vegetation, disturb or harm native fauna, destabilise sand, act as vectors for weeds and increase nutrient levels where they defecate. Formalising access paths with fences perpendicular to the coast (as discussed in section 8.1.3) will address this problem to some extent, however it is also recommended that an audit of dog litter stations occur and any additional stations be installed at strategic locations if required. These stations should include bags for waste and signage outlining the reasons why dogs should not enter the dunes.

## 8.2 Management Issues and Strategies within each Management Zone

### 8.2.1 Management Zone 1

*Spinifex sericeus/ Atriplex cinerea/ Isolepis nodosa* Tussock Grassland

#### *Background*

Management Zone 1 is situated on exposed, unstable, sandy sites at the front of the coastal dune system (foredune) and for this reason is the least stable zone. The foredune environment is highly dynamic and subject to continuous and substantial changes in response to variations in weather, climate, tides, sea levels, waves and currents. The type and extent of shoreline change is determined by the relative intensity of tides, waves and sea level fluctuations. For example, changes that occur during severe storms will produce considerable changes in the position of the foredune and shape of the beach (Government of Western Australia, 2003). Such extreme changes in shoreline position need to be considered when managing this area as there is a high probability that such events will re-occur in the future.

Vegetation in this zone consists of primary sand-colonising plant species that play a vital role in building and stabilising coastal sand dune systems. This includes the native, low, fast-growing grass *Spinifex sericeus* (Rolling Spinifex), a colonising species that stabilises accumulations of windblown sand, spreading rapidly due to its strong creeping runners. Like other primary species, it can withstand highly saline conditions, inundation from the sea, undermining, sand burial and blasting, very low to non-existent nutrient levels, periods of drought and high surface sand temperatures.

Characteristics that enable these plants to survive in such extreme conditions include:

- leaves with a waxy coating or hairs that prevent salt entering or sand abrasion and/or leaves that are hairy, rolled, or fleshy, to store water internally, and prevent water loss;
- shallow, extensive root systems that enable plants to cope with sand burial or very deep root systems that enable plants to overcome water and nutrient deficiencies;
- high seed production and the ability to grow vegetatively (whereby parts broken off a plant can re-grow to form a new plant).

Figures 11 and 19-21 illustrate the current situation of Management Zone 1 at the Henley South and West Beach Dune Reserve. Note the typically large amount of exposed sand and the stunted nature of species that inhabit this zone.

To account for its highly variable formation and differing management requirements along the foredune system, Management Zone 1 has been sub-divided. Each of these areas north of the Torrens Outlet receives active sand replenishment by the Coastal Protection Branch. Management emphasis in these areas is to keep the dune low and control weeds.

**Figure 19: Type 1. Typical Foredune (Gilmore Road to Renwick Street)**



Planting on existing dune is to be low and visually unobtrusive (See Table 5 for a complete species list). Keep taller plants away from the brow of the foredune.

**Figure 20: Type 2. Sand Bank (South Street to Henley Beach Road)**



Planting on existing dune is to be low and visually unobtrusive. Species may include: *Carpobrotus rossii*, *Dianella brevicaulis*, *Enchylaena tomentosa*, *Isolepis nodosa*, and *Threlkeldia diffusa*.

*Spinifex sericeus* is to be used as the primary binding species within the sand carting area just rear of sand drift fencing.

**Figure 21: Type 3. Severe Foredune (Henley Beach Road to Gilmore Road)**



Management emphasis is to keep the dune low and control weeds, particularly *Ammophila arenaria*.

Planting on existing dune is to be low and visually unobtrusive. Species may include: *Carpobrotus rossii*, *Dianella brevicaulis*, *Enchylaena tomentosa*, *Isolepis nodosa*, and *Threlkeldia diffusa*.

*Spinifex sericeus* is to be used as the primary binding species within the sand carting area just rear of sand drift fencing.

This zone will move eastward with the recession of the dune system (as a result of the Coast Protection Board's sand management strategy for the Torrens Outlet area) and will be recolonised by pioneer species. The whole length of the Reserve, south of the Torrens Outlet, will be affected. During this process, it will be important to control all priority weeds within the erosion area to minimise their spread. Once the dune system has retreated to the managed alignment position, planting of indigenous colonising species should occur to stabilise the disturbed area. Use of these species will ensure the vegetation:

- is suited to the highly variable foredune environment;
- will be fast growing;
- helps bind mobile sand;
- provides habitat.

The Nature Conservation Society's *Bushland Condition Monitoring Manual Southern Mount Lofty Ranges Coastal Version* (Croft et al, 2004) should be adopted to monitor changes in the Reserve condition over time and will involve annual audits. In addition, photo points should be established to monitor changes (refer to the UFBP website for correct photo point monitoring techniques: <http://www.urbanforest.on.net>).

### *Management Recommendations*

#### **8.2.1.1 WEED CONTROL**

Numerous high priority weed species should be targeted for removal within this zone. The dominant weed in Management Zone 1 is the naturalised *Thinophyrum junceiforme* (Sea Wheat). It is not feasible to remove this plant. Although seven individual *Trachyandra divaricata* plants were recorded and removed within the Reserve, none were recorded in this Management Zone. Given that *Trachyandra divaricata* has now been documented within the Reserve, it is critical that ongoing monitoring for new plants occurs across all Management Zones. Any new plants or seed heads discovered must be removed immediately to prevent re-establishment and further spread.

Due to the unstable and fragile nature of coastal dunes, it is important to ensure weed control is staged and that revegetation with local provenance species coincides with these works. Weed control should never be carried out as an isolated measure, particularly in a highly degraded dune environment where many weeds are fulfilling useful roles, such as habitat provision and sand binding. See Appendices 3-9 for more detail on weeding and revegetation details. Table 4 lists the priority weeds for Management Zone 1.

To minimise the risk of littoral movement of weed stock through wind or storm activity during the Coast Protection Board's sand management strategy for the Torrens Outlet area, it is recommended *Gazania* sp. and *Euphorbia paralias* are targeted for staged removal within the erosion zone and monitoring for *Trachyandra divaricata* continues to take place.

**Table 4: Weed Control Prioritised Listing for Management Zone 1**

Priority	Scientific Name	Common Name	Comments
1	<i>Trachyandra divaricata</i>	Dune Onion Weed	At present not found in this zone. Monitor for new outbreaks. Remove any newly discovered individuals and seedheads immediately. Report new plants to City of Charles Sturt Coastal Officer.
2	<i>Gazania</i> sp.	Gazania	Naturalised throughout this zone. Very invasive and suppresses indigenous plants. Removal from the dune system will be the result of a long term management strategy. Remove infestation immediately south of Torrens Outlet to establish a considerable Gazania free area. Remove plants within recession area and revegetate with <i>Spinifex sericeus</i> .
3	<i>Euphorbia paralias</i>	Sea Spurge	Unsure of distribution after dune recession - remove plants within recession area and revegetate with <i>Spinifex sericeus</i> . All other plants to be controlled and removed in the medium term (over next 5 years).
4	<i>Ammophila arenaria</i>	Marram grass	Several large infestations exist within the Reserve. May be unfeasible to remove. Control infestation immediately south of Torrens Outlet to establish an <i>Ammophila arenaria</i> (Marram Grass) free area. Revegetate area with native grasses such as <i>Spinifex sericeus</i> (Rolling Spinifex).
5	<i>Coprosma repens</i>	Mirror Bush	Several mature plants exist within this Zone, south of South Street. Due to their invasive nature, these should be targeted for immediate removal.

### 8.2.1.2 REHABILITATION / REVEGETATION

Given the highly degraded nature of this dune system, it is recommended that rehabilitation works occur to increase biodiversity within the Reserve and to stabilise areas affected by dune recession. As the sand strategy is a long term project, and dune recession will occur over the next five years, allocated plants should be located behind the anticipated recession area. See Figure 11 for the potential erosion area.

When undertaking rehabilitation works it is important to recognise that this section of the dune system is highly dynamic and will accrete and erode significantly in response to seasonal changes and coastal processes. In addition, the Coast Protection Board considers these dunes to be a valuable source of sand along the Adelaide metropolitan coastline and removal is likely to occur again as part of the Board's management strategy for the Torrens Outlet area. Therefore, planting should be restricted to the rear of the managed alignment position to reduce the probability of plants being lost in storm events or affected by future sand management practices. Planting in the rear foredune area (refer to Figure 11) will provide a good stock of indigenous plants that may then naturally spread to the front of the foredune (Sandercock in Petherick, 2004, pers. comm.).

Recommended species, plant characteristics and numbers required for revegetation in Management Zone 1 are listed in Table 5 (refer to Appendices 7-9 for images and information on revegetation methods). These species are based on pre-European vegetation communities (refer to Kraehenbuehl, 1996) and environmental conditions within the Management Zone. Species recommended are likely to survive if the structure of the dunes changes as a result of sand accumulation. Note that numbers required are based on a Management Zone size of approximately 40 599m<sup>2</sup> and a planting density of 1 plant per 3m<sup>2</sup>. Seeds used in rehabilitation projects should be sourced locally, where available, or from the nearest source.

**Table 5: Species Recommended for Rehabilitation in Management Zone 1**

Scientific Name	Common Name	Plant Characteristics	Number Required
<i>Atriplex cinerea</i>	Grey Saltbush	Salt bush with grey foliage. Grows to 1m. To be located in more exposed areas.	600
<i>Carpobrotus rossii</i>	Pig-face	Ground creeper with thick, fleshy succulent leaves and large pink flowers. Ideal for sand stabilisation. Plant in more sheltered areas.	1700
<i>Dianella brevicaulis</i>	Short-stem Flax-Lily	Attractive dark green lily with purple fruits and flowers. Grows in clumps to 0.5m. Plant in more sheltered areas.	1100
<i>Isolepis nodosa</i>	Knobby Club-rush	Attractive green/brown sedge that grows in clumps to thigh high. Ideal sand binder that is often used in coastal streetscape plantings.	1500
<i>Olearia axillaris</i>	Coastal Daisy-bush	Attractive shrub to head high. Leaves dark green/blue on top, white below with small yellow flowers. Fast growing and an important stabiliser.	650
<i>Rhagodia candolleana</i>	Seaberry Saltbush	Scrambling saltbush to 1m with green/grey foliage and red berries. Fast growing hardy coastal plant. Locate at back of foredune where slightly more protected.	850
<i>Spinifex sericeus</i>	Rolling Spinifex	Important coloniser species. Light green hardy grass, growing to shin high with large spiky seeds. Ideal for sand stabilisation.	5000
<i>Threlkeldia diffusa</i>	Coastal Bonefruit	A low ground cover with green/maroon succulent foliage. Locate in more protected areas.	850
		<b>TOTAL</b>	<b>12250</b>

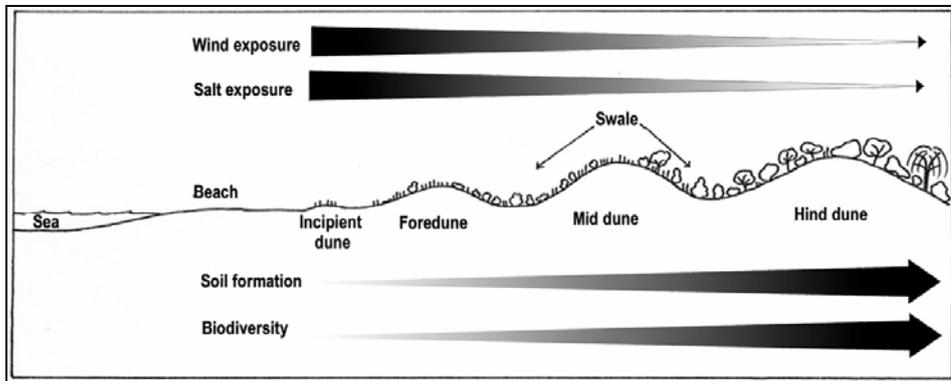
### 8.2.2 Management Zone 2

***Olearia axillaris* / *Rhagodia candolleana* / *Isolepis nodosa* / *Carpobrotus rossii* / *Senecio lautus* Swales**

#### Background

Management Zone 2 is semi-stable and features depression or swale areas located between the sand dunes. Environmental stress on plants is reduced in swales as the dunes provide some protection from harsh coastal conditions. These areas usually experience a decline in wind exposure, are more stable, have a tendency to collect water and are generally closer to the water table, enabling the development of low shrubs, rushes, sedges and groundcovers. This transition of species according to environmental conditions is termed 'dune succession' and is demonstrated in Figure 23.

**Figure 23: Dune Cross-section, Showing Changes in Vegetation and Environmental Conditions**



Source: Petherick, 2004

Figures 11 and 24 illustrate the current position and state of Management Zone 2 at the Henley South and West Beach Dune Reserve. Note how protection offered by the foredune enables a different association of vegetation to develop. The zone south of the Torrens Outlet will retreat as a result of the Coast Protection Board's sand management strategy for the West Beach foreshore. Either one or two swales will reform when the dune system retreats to the managed alignment position.

**Figure 24: Management Zone 2 - Henley South and West Beach Dune System**  
*Olearia axillaris* / *Rhagodia candolleana* / *Isolepis nodosa* / *Carpobrotus rossii* / *Senecio lautus* Swales



All revegetation and rehabilitation plans for Management Zone 2 should initially focus on targeted and sensitive weed control. Monitoring and controlling of new outbreaks of *Trachyandra divaricata* should be a high priority for this Management Zone. Whilst other weed species present in this zone are of priority, they are far less invasive and have a wider distribution along the Adelaide coastline. Control of *Trachyandra divaricata* infestations in the Cities of Port Adelaide Enfield and Onkaparinga have required costly weed control programs and an ongoing commitment to follow-up control and monitoring. It is therefore essential that this species does not become established within the Reserve.

It is recommended swale species are planted to increase biodiversity to stabilise disturbed areas. Furthermore, plant species from this vegetation association should be used to ensure plants are suited to the protected, damper swale environment.

The Nature Conservation Society's *Bushland Condition Monitoring Manual Southern Mount Lofty Ranges Coastal Version* (Croft et al, 2004) should be adopted to monitor changes in the Reserve condition over time and will involve annual audits. In addition, photopoints should be established to monitor changes (refer to the UFBP website for correct photo point monitoring techniques: <http://www.urbanforest.on.net>).

### *Management Recommendations*

#### **8.2.2.1 WEED CONTROL**

A number of high priority weed species should be targeted for removal within this Management Zone. *Trachyandra divaricata* (Dune Onion Weed) should be the major focus for monitoring with any plants and/or seed heads observed removed immediately to prevent re-establishment and further spread.

*Leptospermum laevigatum* also occurs within this zone and should be a priority for removal. As these plants are currently fulfilling valuable habitat and sand binding functions, their removal should be staged using the principles outlined in Appendix 3-5:

Table 6 lists the priority weeds for Management Zone 2. Weed control methods and weeding calendars for these priority weed species are detailed in Appendices 3-6. When removing introduced plant species, it is important that they be replaced with appropriate indigenous vegetation to prevent erosion.

Full recession of the dunes will not occur within five years. Thus it is important to control all priority weeds seaward of the managed alignment position (Figure 11) to reduce seed production and subsequent weed infestations in areas unaffected by the recession.



**Table 6: Weed Control Prioritised Listing for Management Zone 2**

Priority	Scientific Name	Common Name	Comments
1	<i>Trachyandra divaricata</i>	Dune Onion Weed	All documented plants have been removed from this zone. Monitor for new outbreaks. Immediately remove any newly discovered individuals and seedheads. Report new plants to City of Charles Sturt Coastal Officer.
2	<i>Arctotis stoechadifolia</i>	White Arctotis	Highly invasive and mat forming, suppresses native plant regeneration. Medium sized population exist in a 300m area north and south of Torrens Outlet. Plants should be eradicated in the construction phase of Coast Park shared-use path.
3	<i>Leptospermum laevigatum</i>	Coast Tea-tree	Plant is rapidly infesting this zone. Eradication is important. Stage removal as plants are stabilising the area. Replace with appropriate indigenous species. Monitor for germination.
4	<i>Argyranthemum frutescens</i>	Marguerite Daisy	A small population exists approximately 200m north of Torrens Outlet. Remove as a matter of priority.
5	<i>Gazania</i> sp.	Gazania	Naturalised throughout the Reserve. Very invasive and suppresses indigenous plants. Will need to be subject to long term control strategies. Remove infestation immediately south of Torrens Outlet to establish a considerable Gazania free area.
6	<i>Euphorbia paralias</i>	Sea Spurge	Unsure of distribution during dune recession - if population is small eradicate plants, otherwise contain and control with a view to remove in the medium term. Direction of removal should be from the sea toward the land in order to reduce weed seed mobility.
7	<i>Euphorbia terracina</i>	False Caper	Present from rear swale to eastern boundary of Reserve. Plants should be eradicated in construction phase of Coast Park shared-use path.
8	<i>Acacia cyclops</i>	Western Coastal Wattle	Mostly present in hind dune, however several larger specimens exist within the swale. The removal of these should be staged.
9	<i>Oenothera stricta</i>	Evening Primrose	Has the potential to naturalise within the Reserve. Important to remove while populations are relatively small.
10	<i>Cynodon</i> sp.	Couch	Moisture available in the swales enables this plant's presence. Eradicate before it becomes more established and spreads throughout this Management Zone. Will out-compete native vegetation.
11	<i>Osteospermum fruticosum</i>	Seascape Daisy	Populations are low at present. Plants will be eradicated in construction phase of Coast Park shared-use path.
12	<i>Ammophila arenaria</i>	Marram Grass	Several large infestations exist within the Reserve. Will need to be subject to long term control strategies. Remove infestation immediately south of Torrens Outlet to establish a Marram Grass free area. Revegetate area with native grasses such as <i>Spinifex sericeus</i> (Rolling Spinifex).
13	<i>Galenia pubescens</i>	Coastal Galenia	Found adjacent to access paths and along the eastern boundary of the Reserve. Eradicate where population is small, control and contain larger populations. Replace removed plants with appropriate indigenous species.
14	<i>Pennisetum setacium</i>	Fountain Grass	A small infestation exists on the sea wall adjacent the Esplanade at Henley South. Remove seed heads and eradicate plants as a priority.

### 8.2.2.2 REHABILITATION / REVEGETATION

Given the highly degraded nature of this dune system, it is recommended that rehabilitation works occur to increase biodiversity within the Reserve and to stabilise areas affected by dune recession. Ideally, rehabilitation works should commence after the dune system has receded to decrease the risk of plant loss. However, as the Coast Protection Board's sand management strategy for the Torrens Outlet area is a long term project, allocated plants should be located behind the anticipated recession area (see Figure 11).

Recommended species, plant characteristics and numbers required for revegetation in Management Zone 2 are listed in Table 7 (refer to Appendices 7-9 for images and information on revegetation methods). These species are based on pre-European vegetation communities (refer to Kraehenbuehl, 1996) and environmental conditions within the Management Zone. Note that numbers required are based on Management Zone size of approximately 38 350m<sup>2</sup> and a planting density of 1 plant per 3m<sup>2</sup>. Seed used in rehabilitation projects should be sourced locally where available or from the nearest source.

**Table 7: Species Recommended for Rehabilitation in Management Zone 2**

Scientific Name	Common Name	Plant Characteristics	Number Required
<i>Acacia cupularis</i> <sup>#</sup>	Cup Wattle	Bushy, spreading shrub 1 to 3m high and 4 to 6m wide. Thick light green phyllodes with yellow wattle flowers. Important pioneer species.	350
<i>Acacia longifolia</i> var. <i>sophorae</i> <sup>#</sup>	Coastal Wattle	Large shrub to 3m high and 5m wide with thick green phyllodes and yellow wattle flowers. Fast growing, hardy plants that bind sand and provide shelter.	300
<i>Adriana klotzschii</i>	Coast Bitter-bush	Large attractive shrub to head high with dark green leaves, red stems and flowers with a red tinge.	550
<i>Atriplex cinerea</i>	Grey Saltbush	Salt bush with grey foliage. Grows to 1m.	100
<i>Carpobrotus rossii</i>	Native Pigface	Ground creeper with thick, fleshy succulent leaves and large pink flowers. Ideal for sand stabilisation. One plant can occupy 3m <sup>2</sup> .	2000
<i>Dianella brevicaulis</i>	Short-stem Flax-Lily	Attractive dark green lily with purple fruits and flowers. Grows in clumps to 0.5m <sup>2</sup> .	850
<i>Disphyma crassifolium</i>	Round-leaved Pigface	Succulent ground cover featuring green/ red leaves and small daisy-like pink flowers. Quick growing plant that can occupy 3m <sup>2</sup> . Plant in heavier soil.	250
<i>Enchylaena tomentosa</i>	Ruby Saltbush	Prostrate shrub, grey/blue in colour, drying to black, with red berries.	500
<i>Isolepis nodosa</i>	Knobby Club-rush	Attractive green/ brown sedge that grows in clumps to thigh high. Ideal sand binder that is often used in coastal streetscape plantings.	850
<i>Lotus australis</i>	Austral Trefoil	Small attractive perennial herb with light green leaves, flowers pink or white.	200
<i>Kennedia prostrata</i>	Running Postman	Mat-forming ground cover with soft green leaves and bright red pea flowers. Grows to 1.5m <sup>2</sup> .	250
<i>Muehlenbeckia gunnii</i>	Coastal Lignum	Climber found growing on shrubs. Dark green lobe-shaped leaves. Plant near existing vegetation.	100
<i>Nitraria billardiieri</i>	Nitre Bush	Hardy spreading shrub to head high. Features thick green/grey foliage, white flowers and fleshy yellow, red or purple fruit. Provides habitat and protection for indigenous species. Difficult to propagate and grow.	50
<i>Olearia axillaris</i>	Coastal Daisy-bush	Attractive shrub to head high. Leaves dark-green/ blue on top, white below with small yellow flowers. Fast growing and an important stabiliser.	400
<i>Pelargonium australe</i>	Native Pelargonium	Robust perennial herb growing to knee high. Heart-shaped leaves of light green colour with closely clustered pink flowers.	200
<i>Rhagodia candolleana</i>	Seaberry Saltbush	Scrambling saltbush to 1m with green/grey foliage and red berries. Fast growing hardy coastal plant.	500
<i>Scaevola crassifolia</i>	Cushion Fanflower	Spreading shrub to waist high with dark green serrated leaves and blue fan-like flowers in clusters.	350
<i>Senecio laetus</i>	Variable Groundsel	Attractive annual or biennial herb to knee high. Bright green leaves with yellow flowers.	300
<i>Spinifex sericeus</i>	Rolling Spinifex	Important coloniser species. Light green hardy grass, growing to shin high with large spiky seeds. Ideal for sand stabilisation.	1900
<i>Tetragonia implexicoma</i>	Bower Spinach	Succulent perennial, ground running or creeper. Leaves thick, fleshy, and green in colour. Flowers small and yellow, small fruits green changing to red/ black when ripe.	150
<i>Threlkeldia diffusa</i>	Coastal Bonefruit	A low ground cover with green/ maroon succulent foliage.	1100
		<b>TOTAL</b>	<b>11,250</b>

<sup>#</sup> There have been some issues with gall wasp on *Acacia* species at the nearby Semaphore Park dunes. Trees For Life conducted an experiment cutting the galls off *Acacias* and found those with the galls removed grew back better than those with the galls still present (Hemmings, 2004, pers. comm.). It is recommended that this control technique be adopted if galls become an issue at Henley South and West Beach.

### 8.2.3 Management Zone 3

*Olearia axillaris/ Acacia longifolia var. sophorae/ Rhagodia candolleana/ Nitraria billardierei/ Myoporum insulare* Low Shrubland

#### *Background*

This Management Zone is the most stable and includes the hind dune. It features groundcovers and low to medium sized woody shrubs that are more densely spaced than in previous Management Zones. As Figure 23 demonstrated, environmental stresses change along a gradient, with a reduction in wind speed and salinity, and increases in soil stability and humus content (Harvey and Caton, 2003). These changes allow for increased biodiversity and enable the development of a low shrubland vegetation community.

Prior to European settlement this zone would have been located several hundred metres inland. Development on remnant dune systems has resulted in the loss of the majority of this vegetation community along the Adelaide metropolitan coastline.

Figures 11 and 25 depict the current position and state of Management Zone 3. Note the increase in size and density of vegetation in this part of the dune system as a result of decreased environmental stress. Post dune recession, this Management Zone may remain relatively unchanged or may be restricted to a thin strip along the eastern boundary of the site.

**Figure 25: Management Zone 3, Henley South and West Beach Dune System, 2005**

*Olearia axillaris/Acacia longifolia var. sophorae/ Rhagodia candolleana/ Nitraria billardierei/ Myoporum insulare* Low Shrubland



All revegetation and rehabilitation plans for this zone should initially focus on targeted, sensitive weed control until the dune recedes to the managed alignment position. *Trachyandra divaricata* should be monitored and contained as a priority. Several other high priority weeds also occur within this zone and are currently fulfilling useful roles such as habitat provision and stabilisation. It is important to ensure weed control is staged with indigenous plants used in the revegetation process.



It is currently proposed that the Coast Park shared-use pathway be constructed in the rear of the dunes between the Ozone Street car park and Henley Sailing Club, cutting directly through this Management Zone. Following lengthy stakeholder and public consultation the preference for path alignment was deemed to be the 'dune edge' option, which runs along the sloping section of the hind dune. The final location of the path alignment is yet to be confirmed.

Although the path will initially have an impact upon existing native vegetation it will nonetheless provide a good opportunity to:

- eradicate weeds;
- address the garden encroachment issues;
- revegetate the dunes in the area and increase biodiversity;
- provide a formal north south access route.

It is recommended that advantage be taken of the construction phase, to address these weed encroachment and revegetation issues simultaneously.

Planting of low coastal shrubland species should occur once the dune has receded to increase biodiversity and stabilise disturbed areas. Plant species from this vegetation association should be used to ensure plants are suited to the environmental conditions experienced in this Management Zone.

The Nature Conservation Society's *Bushland Condition Monitoring Manual Southern Mount Lofty Ranges Coastal Version* (Croft et al, 2004) should be adopted to monitor changes in the Reserve's condition over time and will involve annual audits of the Reserve. In addition, photopoints should be established to monitor changes (refer to the UFBP website for correct photopoint monitoring techniques: <http://www.urbanforest.on.net>).

## *Management Recommendations*

### **8.2.3.1 WEED CONTROL**

There are a number of high priority weed species that should be targeted for removal within this Management Zone. *Trachyandra divaricata* should be the major focus for monitoring in Management Zone 2. Any new plants should be reported to the City of Charles Sturt Coastal Officer and removed immediately to prevent re-establishment and further spread.

*Leptospermum laevigatum* also occurs within this zone and should therefore be a priority for removal. As these plants are currently fulfilling valuable habitat and sand binding functions, their removal should be staged using the principles outlined in Appendix 5.

The construction phase of the Coast Park shared-use pathway will provide an opportunity to directly address many of the weed issues affecting this zone, particularly between Ozone Street and Henley Sailing Club. Priority weeds outside of the path construction area should be strategically targeted and replaced with appropriate indigenous species.

Table 8 lists the priority weeds for Management Zone 2. Weed control methods and weeding calendars for these priority weed species are detailed in Appendices 3-6. When removing introduced plant species, it is important that plants within the swale area north of the Torrens Outlet are replaced with appropriate indigenous vegetation to prevent erosion.

**Table 8: Weed Control Prioritised Listing for Management Zone 3**

Priority	Scientific Name	Common Name	Comments
1	<i>Trachyandra divaricata</i>	Dune Onion Weed	At present all populations within this Management Zone have been referenced and removed. Remove and report any newly germinated individuals. Monitor for regeneration.
2	<i>Arctotis stoechadifolia</i>	White Arctotis	Highly invasive and mat forming, suppresses native plant regeneration. Medium sized populations exist within 300m north and south of Torrens Outlet. Plants should be targeted for eradication during construction of Coast Park shared-use path.
3	<i>Leptospermum laevigatum</i>	Coast Tea-tree	Plant is rapidly regenerating throughout this zone. Eradication is important. Stage removal as plants are stabilising area. Replace with appropriate indigenous species.
4	<i>Succulent spp./Cacti spp.</i>	Succulents and Cacti	Particularly troublesome garden escape between Torrens Outlet and Henley Sailing Club. Plants should be targeted as a priority for eradication during construction of Coast Park shared-use path.
5	<i>Mesembryanthemum crystallinum</i>	Ice Plant	Isolated patches throughout the Zone. Plants should be targeted for eradication during construction of Coast Park shared-use path.
6	<i>Gazania sp.</i>	Gazania	Naturalised throughout the Reserve. Very invasive and suppresses indigenous plants. Will need to be subject to long term control strategies. Remove infestation immediately south of Torrens Outlet to establish a considerable <i>Gazania</i> free area.
7	<i>Lycium ferocissimum</i>	African Boxthorn	Only a few plants remain after Council eradication program. Plants are currently small in size. These should be a priority for removal before they become more established. Monitor for regeneration.
8	<i>Euphorbia paralias</i>	Sea Spurge	Unsure of distribution after dune recession - if population is small eradicate plants, otherwise contain and control with a view to removing plants in the medium term. Slash before seed ripens.
9	<i>Carpobrotus edulis</i>	Hottentot Fig	Relatively low populations within this Management Zone. Removal is a priority due to their ability to hybridise with the native <i>Carpobrotus rossii</i> and their wide distribution within this zone.
10	<i>Euphorbia terracina</i>	False Caper	Present from rear swale to eastern boundary of Reserve. Plants should be targeted for eradication during construction of Coast Park shared-use path.
11	<i>Acacia cyclops</i>	Western Coastal Wattle	Mostly present in hind dune however several larger specimens exist within the swale. As they are providing habitat their removal should be staged.
12	<i>Galenia pubescens</i>	Coastal Galenia	Found adjacent to access paths and eastern edge of Reserve. Eradicate where populations are small, control and contain larger populations. Replace with appropriate indigenous species.
13	<i>Cynodon sp.</i>	Couch	Garden escape, generally present along the Reserve's eastern boundary and into rear swales. Moisture enables this plant's presence. Eradicate before it becomes more established. Will out-compete native vegetation.
14	<i>Pennisetum clandestinum</i>	Kikuyu	Garden escape, generally present along the Reserve's eastern boundary and into rear swales. Moisture enables this plant's presence. Eradicate before it becomes more established. Will out-compete native vegetation.
15	<i>Coprosma repens</i>	Mirror Bush	Garden escape. One plant documented within this zone adjacent to a pedestrian access path near Mellor Street. Due to their invasive nature these plants should be eradicated immediately.

### 8.2.3.2 REHABILITATION / REVEGETATION

Given the highly degraded nature of Management Zone 3, it is recommended that revegetation works occur to increase biodiversity and to stabilise any areas affected by dune recession. This zone is least likely to be effected by recession and plant species selected will be capable of adapting to any changes that may occur.

Recommended species, plant characteristics and numbers required for revegetation works in this Management Zone are listed in Table 9 (refer to Appendices 7-9 for photographs and information on revegetation methods). These species are based on pre-European vegetation communities (refer to Kraehenbuehl, 1996) and environmental conditions within the Management Zone. Species recommended are likely to survive if the structure of the dunes change as a result of sand accumulation.

It is recommended that *Pimelea serpyllifolia* ssp. *serpyllifolia* (Thyme Riceflower) also be considered for revegetation as it grows naturally in the Semaphore Park dunes to the north and there is some concern over the plants' survival in this area (Wales in Petherick, 2004, pers. comm.). The species has not been listed in the following table as it known to be very difficult to propagate, however should be used in the Reserve if the contracted grower is able to supply some plants. Note that numbers required are based on Management Zone size of approximately 10 400m<sup>2</sup> and a planting density of 1 plant per 3m<sup>2</sup>. Seed to be used in rehabilitation projects should be locally sourced where available or from the nearest source.

**Table 9: Species Recommended for Rehabilitation in Management Zone 3**

Scientific Name	Common Name	Plant Characteristics	Number Required
<i>Acacia cupularis</i> <sup>#</sup>	Cup Wattle	Bushy, spreading shrub between 1-3m high and 4 to 6m wide. Thick light green phyllodes with yellow wattle flowers. Important pioneer species.	100
<i>Acacia longifolia</i> var. <i>sophorae</i> <sup>#</sup>	Coastal Wattle	Large shrub to 3m high and 5m wide with thick green phyllodes and yellow wattle flowers. Fast growing, hardy plants that bind sand and provide shelter.	150
<i>Acacia nematophylla</i> <sup>#</sup>	Coast Wallowa	A medium to large spreading shrub with fine cylindrical phyllodes. Fast growing. Provides habitat	100
<i>Adriana klotzschii</i>	Coast Bitter-bush	Large attractive shrub to 2m high with dark green leaves, red stems and flowers with a red tinge.	50
<i>Austrodanthonia caespitosa</i>	Common Wallaby-grass	Native grass growing 20-90cm in height. Plant small clumps in sheltered areas.	50
<i>Austrostipa flavescens</i>	Coast Spear-grass	Grass growing to 1.2m. Plant in small clumps in sheltered areas.	50
<i>Austrostipa nodosa</i>	Tall Spear-grass	Grass growing to 1m. Plant in small clumps in sheltered areas.	50
<i>Carpobrotus rossii</i>	Native Pigface	Ground creeper spreading to 3m <sup>2</sup> with thick, fleshy succulent leaves and large pink flowers. Ideal for sand stabilisation.	600
<i>Dianella brevicaulis</i>	Short-stem Flax-Lily	Attractive dark green lily with purple fruits and flowers. Grows in clumps to 0.5m <sup>2</sup> .	250
<i>Disphyma crassifolium</i>	Round-leaved Pigface	Succulent ground cover with green-red leaves and small daisy-like pink flowers. Quick growing, up to 3m <sup>2</sup> . Plant in heavier soil.	100



<i>Dodonaea viscosa</i> var. <i>spatulata</i>	Sticky Hop Bush	Erect shrub to 1.5m high with bright green, shiny leaves. Fruit is a winged paper-like capsule.	100
<i>Enchylaena tomentosa</i>	Ruby Saltbush	Prostrate shrub, grey-blue in colour, with red to yellow berries.	200
<i>Isolepis nodosa</i>	Knobby Club-rush	Attractive green-brown sedge. Grows in clumps to 1m high. Ideal sand binder.	250
<i>Kennedia prostrata</i>	Running Postman	Mat-forming ground cover with soft green leaves and bright red pea flowers. Grows to a width of 1.5m.	100
<i>Leucopogon parviflorus</i>	Bearded Coastal Heath	Erect shrub growing between 3 and 5m high. Pale green leaves are sometimes curled backwards. Flowers are very small, white and produce fleshy white fruit.	50
<i>Muehlenbeckia gunnii</i>	Coastal Climbing Lignum	Climber found growing on shrubs. Dark green lobe-shaped leaves. Plant near existing indigenous vegetation.	50
<i>Myoporum insulare</i>	Common Boobialla	Tall, spreading shrub to over 2m high. Thick fleshy green leaves with white and purple flowers, purple fruits.	100
<i>Nitraria billardierei</i>	Nitre Bush	Hardy spreading shrub to 2m high. Foliage thick green/grey. Flowers white with fleshy yellow, red or purple fruit. Provides habitat and protection for indigenous fauna.	50
<i>Olearia axillaris</i>	Coastal Daisy-bush	Attractive shrub to 2m high. Leaves dark-green-blue on top, white below with small yellow flowers. Fast growing and an important stabiliser.	50
<i>Poa poliformis</i>	Coast Tussock-grass	A fine-leaved erect grass growing to 1m high. Plant in clumps in sheltered areas.	50
<i>Rhagodia candolleana</i>	Seaberry Saltbush	Scrambling saltbush to 1m with green-grey foliage and red berries. Fast growing hardy coastal plant.	250
<i>Scaevola crassifolium</i>	Cushion Fanflower	Spreading shrub to 1.5m high with dark green serrated leaves and blue fan-like flowers in clusters.	100
<i>Senecio lautus</i>	Variable Groundsel	Attractive annual or biennial herb to 0.5m high. Bright green leaves with yellow flowers.	100
<i>Spinifex sericeus</i>	Rolling Spinifex	Important coloniser species. Light green hardy grass, growing to 0.25m high with large spiky seeds. Ideal for sand stabilisation.	450
<i>Tetragonia implexicoma</i>	Bower Spinach	Succulent perennial twiner. Leaves thick, fleshy and green. Flowers small and yellow, small fruits green changing to red/black when ripe.	50
		<b>TOTAL</b>	<b>3450</b>

# There have been some issues with gall wasp on *Acacia* species at the nearby Semaphore Park dunes. Trees For Life conducted an experiment cutting the galls off *Acacias* and found those with the galls removed grew back better than those with the galls still present (Hemmings in Petherick, 2004, pers. comm.). It is recommended that this control technique be adopted if galls become an issue at Henley South and West Beach.

## 8.2.4 Management Zone 4

***Olearia axillaris/Scaevola crassifolia/Dianella brevicaulis/Isolepis nodosa***  
**Landscape/Low Shrubland**

### *Background*

Management Zone 4 is primarily located adjacent to the eastern boundary where the Reserve is at its widest, between the Torrens Outlet and the Henley Sailing Club. Smaller landscape zones occur at the far southern and northern ends of the Reserve. Figures 11 and 26 depict the current status of this zone.

The area between Ozone Street car park and Henley Sailing Club is highly degraded with little indigenous vegetation. This state can be attributed primarily to the recent dune formation, a history of mismanagement and various issues associated with the immediacy of housing upon the dunes. These issues include:

- numerous informal paths;
- illegal dumping of garden and housing debris;
- illegal extensions of gardens and lawns;
- illegal sprinkler system installations at the rear of properties;
- increased nutrient loads from fertiliser applications.

Consequently, the area has been negatively modified in its soil chemistry and composition, its physical profiles and its flora and fauna communities. Several weed species have their densest populations in this zone, for example, *Acacia cyclops* (Western Coastal Wattle), *Cynodon* sp. (Couch), *Succulent* and *Cacti* spp., *Lycium ferocissimum* (Boxthorn), *Arctotis stoechadifolia* (White Arctotis) and *Casuarina glauca* (Swamp Sheoak). The density and diversity of these infestations are a consequence of the above mentioned factors. To prevent the reoccurrence of similar outbreaks it is essential these issues are addressed.

Plans are currently underway to develop a Coast Park Shared-use path within the eastern portion of the Dune Reserve. The path will dissect the dune between the Ozone Street car park just north of Torrens Outlet and south to Henley Sailing Club. Details of the public consultation process and outcomes can be seen in the *Coast Park from Ozone Street Car Park to Henley Sailing Club - Concept Design Report* (Howard et al., 2004). The precise path location and construction techniques within the boundaries of the preferred 'Dune Edge Option' were still being finalised (as of March 2005) based upon detailed consultation and topographic and vegetation surveys.

It is recommended that all priority weeds within this Management Zone be removed as part of the path's construction phase. These will be immediately replaced with plantings of indigenous species used in an informal landscape fashion. Revegetation plantings will aim to balance the needs of the environment (i.e. habitat provision and biodiversity) with the local residents' needs for privacy and view retention, in a manner which is aesthetically pleasing.

To minimise the impact upon the local environment by machinery and general activity during the construction phase of the Coast Park shared-use pathway it is recommended that:

- indigenous vegetation should be clearly identifiable (eg bunting, or similar) for machinery operators;
- access to construction areas should only be from designated access routes as identified by the City of Charles Sturt Coastal Officer;
- several vehicle turning bays be allocated as identified by consultation with the City of Charles Sturt Coastal Officer.

As soil disturbance causes erosion and encourages weed proliferation, it is important to ensure special attention is given to these issues once path construction is complete.

Recommendations for design concepts and landscape construction techniques, for resident access to the beach in the area between Ozone Street car park and Henley Sailing Club, are pending further investigation and consultation.

**Figure 26: Management Zone 4 - Henley South and West Beach  
Dune System, 2005**

*Olearia axillaris/Scaevola crassifolia/Dianella brevicaulis/Isolepis nodosa*  
Landscape/Low Shrubland



## Management Recommendations

### 8.2.4.1. WEED CONTROL

Weed control in this Management Zone will be an ongoing issue given its history of garden encroachments and altered soil conditions. It is recommended special attention be paid to weed control due to the favourable conditions for weed growth and the persistence of many of these species. This zone should be monitored for the establishment of *Trachyandra divaricata* (Dune Onion Weed).

Within this zone, numerous high priority weed species should be targeted for removal. Table 10 lists the priority weeds for Management Zone 4. Weed control methods and weeding calendars for priority weed species are detailed in Appendices 3-6 respectively. When removing introduced plant species, it is important to ensure they are replaced with appropriate indigenous vegetation.

**Table 10: Weed Control Prioritised Listing for Management Zone 4**

Priority	Scientific Name	Common Name	Comments
1	<i>Trachyandra divaricata</i>	Dune Onion Weed	Monitor for regeneration. Remove and report any newly germinated individuals to the City of Charles Sturt Coastal Officer.
2	<i>Arctotis stoechadifolia</i>	White Arctotis	Several large groups exist in this zone. Remove in the area between Ozone Street and Henley Sailing Club in conjunction with construction of the Coast Park pathway.
3	<i>Succulent spp. and Cacti spp.</i>	Succulents and Cacti	Dense infestations exist within this zone particularly near the Henley Sailing Club. Remove during construction of Coast Park pathway.
4	<i>Galenia pubescens</i>	Coastal Galenia	Control and contain. Revegetate with native vegetation.
5	<i>Pennisetum setaceum</i>	Fountain Grass	One mature plant at present adjacent Mellor Street. Remove and monitor for regeneration.
6	<i>Cynodon sp.</i>	Couch	Control and contain populations. Remove in the area between Ozone Street and Henley Sailing Club in conjunction with construction of the Coast Park pathway.
7	<i>Pennisetum clandestinum</i>	Kikuyu	Well established in this zone. Remove in the area between Ozone Street and Henley Sailing Club in conjunction with construction of the Coast Park pathway.
8	<i>Casuarina glauca</i>	Swamp Sheoak	Several mature plants exist near stormwater outlet in this area. Remove in the area between Ozone Street and Henley Sailing Club in conjunction with construction of the Coast Park pathway.

### 8.2.4.2 REHABILITATION/ REVEGETATION

It is recommended that rehabilitation works occur simultaneously with the construction of the Coast Park shared-use path in this area to increase biodiversity, stabilise eroded areas and to assist with weed control. The planting style and species choice will reflect a landscaping style. Examples of indigenous vegetation used in a landscape context can be seen at the Largs Bay and West Beach dune systems.

Recommended species, plant characteristics and numbers required are detailed in Table 11. These species are based on pre-European vegetation communities (refer to Kraehenbuehl, 1996). They have however been adjusted to suit environmental conditions within this artificial Management Zone. Seed to be used in rehabilitation projects should

be sourced locally where available or from the next nearest source (refer to Appendices 7-9 for photographs and information on revegetation methods). The numbers required are based on Management Zone size of approximately 6 400m<sup>2</sup> and a planting density of 1 plant per 2m<sup>2</sup>.

Clear boundary delineation between the beach frontage properties and dunes needs to be assessed by Council to discourage the encroachment of alien garden species. Local resident access in this area to the beach and to the Coast Park shared-use path needs to be reviewed by Council to incorporate into its construction phase. These issues can be considered when examining fencing options for the formal access paths and during the planning stage for the Coast Park in this area.

**Table 11: Species Recommended for Rehabilitation in Management Zone 4**

Scientific Name	Common Name	Plant Characteristics	Number Required
<i>Acacia cupularis</i> <sup>#</sup>	Cup Wattle	Bushy, spreading shrub between 1 and 3m high and 4 to 6m wide. Thick light green phyllodes with yellow wattle flowers. Important pioneer species.	100
<i>Acacia longifolia</i> var. <i>sophorae</i> <sup>#</sup>	Coastal Wattle	Large shrub to 3m high and 5m wide with thick green phyllodes and yellow wattle flowers. Fast growing, hardy plants that bind sand and provide shelter.	50
<i>Acacia nematophylla</i> <sup>#</sup>	Coast Wallowa	A medium to large spreading shrub with fine cylindrical phyllodes. Fast growing. Provides habitat.	50
<i>Adriana klotzschii</i>	Coast Bitter-bush	Large attractive shrub to head high with dark green leaves, red stems and flowers with a red tinge.	50
<i>Austrodanthonia caespitosa</i>	Wallaby Grass	Native grass growing 20-90cm in height. Plant small clumps in sheltered areas.	
<i>Austrostipa flavescens</i>	Spear Grass	Grass growing to 1.2m. Plant in small clumps in sheltered areas.	50
<i>Austrostipa nodosa</i>	Spear Grass	Grass growing to 1m. Plant in small clumps in sheltered areas.	50
<i>Carpobrotus rossii</i>	Native Pigface	Ground creeper with thick, fleshy succulent leaves and large pink flowers. Ideal for sand stabilisation. One plant can grow to 3m <sup>2</sup> .	500
<i>Dianella brevicaulis</i>	Short-stem Flax-lily	Attractive dark green lily with purple fruits and flowers. Grows in clumps to 0.5m <sup>2</sup> .	300
<i>Disphyma crassifolium</i>	Round-leaved Pig-face	Succulent groundcover featuring green/ red leaves and small daisy-like pink flowers. Quick growing plant that can occupy up to 3m <sup>2</sup> . Plant in heavier soil.	150
<i>Dodonaea viscosa</i> var. <i>spatulata</i>	Sticky Hop Bush	Erect shrub to chest high with bright green, shiny leaves. Fruit is a winged paper-like capsule.	100
<i>Enchylaena tomentosa</i>	Ruby Saltbush	Prostrate shrub, grey/blue in colour, drying to black, with red berries. One plant can grow to 3m <sup>2</sup> . Plant on outskirts of stormwater outlets.	150
<i>Isolepis nodosa</i>	Knobby Club-rush	Attractive green/ brown sedge that grows in clumps to thigh high. Ideal sand binder that is often used in coastal streetscape plantings.	200
<i>Kennedia prostrata</i>	Running Postman	Mat-forming groundcover with soft green leaves and bright red pea flowers. Grows to 1.5m wide.	100



<i>Lepidosperma gladiatum</i>	Coast Sword Sedge	Rigid sedge to 1m high. Stems and leaves are sharp. Difficult to propagate.	50
<i>Leucopogon parviflorus</i>	Bearded Coastal Heath	Erect shrub growing between 3 and 5m high. Pale green leaves are sometimes curled backwards. Flowers are very small, white and produce fleshy white fruit. Difficult species to propagate.	50
<i>Lotus australis</i>	Australian Trefoil	Small attractive perennial herb with light green leaves. Flowers pink or white.	100
<i>Muehlenbeckia gunnii</i>	Coastal Climbing Lignum	Climber found growing on shrubs. Dark green lobe-shaped leaves. Plant near existing indigenous vegetation.	150
<i>Myoporum insulare</i>	Common Boobialla	Tall, spreading shrub to over head high. Thick fleshy leaves with white and purple flowers, purple fruits.	50
<i>Nitraria billardierei</i>	Nitre Bush	Hardy spreading shrub to head high. Features thick green/grey foliage, white flowers and fleshy yellow, red or purple fruit. Provides habitat and protection for indigenous species. Difficult plant to propagate and grow.	50
<i>Olearia axillaris</i>	Coastal Daisy-bush	Attractive shrub to head high. Leaves dark-green/ blue on top, white below with small yellow flowers. Fast growing and an important stabiliser.	100
<i>Pelargonium australe</i>	Australian Pelargonium	Robust herb to shin high. Stems and leaves velvety with soft hairs. Flowers pink with red spots.	100
<i>Poa poiformis</i>	Coast Tussock-grass	A fine-leaved erect grass growing to thigh high. Plant in clumps in sheltered areas.	50
<i>Rhagodia candolleana</i>	Seaberry Saltbush	Scrambling saltbush to 1m with green/grey foliage and red berries. Fast growing hardy coastal plant.	150
<i>Scaevola crassifolia</i>	Cushion Fanflower	Spreading shrub to waist high with dark green serrated leaves and blue fan-like flowers in clusters.	150
<i>Senecio lautus</i>	Variable Groundsel	Attractive annual or biennial herb to knee high. Bright green leaves with yellow flowers.	100
<i>Spinifex sericeus</i>	Rolling Spinifex	Important coloniser species. Light green hardy grass, growing to shin high with large spiky seeds. Ideal for sand stabilisation.	250
<i>Tetragonia implexicoma</i>	Bower Spinach	Succulent perennial, either ground running or creeper. Leaves thick and fleshy, green in colour. Flowers small and yellow, small fruits green changing to red/ black when ripe.	150
<i>Threlkeldia diffusa</i>	Coastal Bonefruit	A low ground cover with green/ maroon succulent foliage.	100
		<b>TOTAL</b>	<b>3500</b>

# There have been some issues with gall wasp on *Acacia* species at the nearby Semaphore Park dunes. Trees For Life conducted an experiment cutting the galls off *Acacias* and found those with the galls removed grew back better than those with the galls still present (Hemmings in Petherick, 2004, pers. comm.). It is recommended that this control technique be adopted if galls become an issue at Henley South and West Beach.

### 8.2.5 Management Zone 5

*Isolepis nodosa/ Sporobolus virginicus/ Distichlis distichophylla/ Threlkeldia diffusa/ Carpobrotus rossii* - Stormwater Outlets

#### *Background*

This Management Zone is an artificial community consisting of numerous stormwater outlets present along the Reserve's eastern edge, and immediately adjacent areas that are affected by stormwater inundation. Stormwater alters the natural state of the dune system through addition of nutrient rich water in a normally low nutrient and relatively dry environment. These conditions favour the growth of introduced plant species to the detriment of native vegetation. Stormwater also acts as a vector for weed transport. As a result, this Management Zone is currently highly degraded with few indigenous plants.

Figures 11 and 27 depict the current position and typical state of dune stormwater outlets in Management Zone 5 at the Henley South and West Beach Dune Reserve. Note the increased vegetation in this zone and the presence of weeds such as *Pennisetum clandestinum* (Kikuyu) that prefer the nutrient-rich conditions.

**Figure 27: Management Zone 5 - Henley South and West Beach Dune System**  
*Isolepis nodosa/ Sporobolus virginicus/ Distichlis distichophylla/ Threlkeldia diffusa/ Carpobrotus rossii* Stormwater Outlets



Revegetation and rehabilitation plans for this zone should initially focus on sensitive, targeted weed control, with the removal of high priority species. As with the other Management Zones, *Trachyandra divaricata* (Dune Onion Weed) should be the prime focus for monitoring and control within stormwater outlet areas; although at present none have been found in these zones. Infestations of *Pennisetum clandestinum* (Kikuyu) are prevalent.

As the areas affected by stormwater outflow are relatively small, it is recommended that each outlet be dealt with on a case-by-case basis. Revegetation should occur as soon as possible to assist weed control and increase biodiversity. Plant species recommended in Table 11 should be used to ensure species are suited to the increased nutrient and moisture levels experienced in this environment.

Most outlets present in the car parks that lead to the foreshore generally drain into the swale area of the dune. These areas are monitored and debris is collected regularly or after significant rain events. Outlets are cleared every 5 years of sand build-up to ensure effective operation. Council, in conjunction with the Environmental Protection Authority are reviewing all stormwater outlets on an annual basis. Currently the strategy is to upgrade larger type stormwater pipes and culverts. The target is to have a Gross Pollutant Trap structure attached to all outlets greater than 500mm in diameter which lead into the waterways. Plans are currently underway to trial the use of existing swale areas as possible locations of aquifer recharge using the sand dunes as a filter. These are expected to begin in the Grange area within the next two years (Minks, 2005, pers. comm.).

The Nature Conservation Society's *Bushland Condition Monitoring Manual Southern Mount Lofty Ranges Coastal Version* (Croft et al, 2004) should be adopted to monitor changes in the Reserve condition over time and will involve annual audits of the Reserve. In addition, photopoints should be established to monitor changes (refer to the UFBP website for correct photopoint monitoring techniques: <http://www.urbanforest.on.net>).

### Management Recommendations

#### 8.2.5.1. WEED CONTROL

Weed control will be an ongoing issue given stormwater outlets are a source of weed transportation and their environmental conditions favour weed growth. It is recommended this zone receive special attention to weed control given the favourable conditions for growth and persistence of these species.

This zone should be monitored for the establishment of *Trachyandra divaricata* (Dune Onion Weed), although it is less likely to be an issue here than in other Management Zones as conditions are less favourable for the weed and have enabled the growth of other aggressive introduced plants.

There are numerous high priority weed species within this zone that should be targeted for removal. Table 12 lists the priority weeds for control in Management Zone 4. Due to the highly degraded nature of these sites, it is recommended that all weeds are controlled and the area revegetated. Jute matting, or similar, should be used as a weed suppressant and soil stabiliser. Weed control methods and weeding calendars for priority weed species are detailed in Appendices 3-6.

**Table 12: Weed Control Prioritised Listing for Management Zone 5**

Priority	Scientific Name	Common Name	Comments
1	<i>Trachyandra divaricata</i>	Dune Onion Weed	At present only small isolated populations exist within the Reserve. Monitor for regeneration. Remove and report any newly germinated individuals.
2	<i>Galenia pubescens</i>	Coastal Galenia	Control and contain. Replace with native vegetation.
3	<i>Cynodon</i> sp.	Couch	Control and contain populations. Replace with appropriate indigenous plants.
4	<i>Pennisetum clandestinum</i>	Kikuyu	Well established in this zone. Control and replace with appropriate indigenous plants. Likely to be an ongoing problem.
5	<i>Ricinus communis</i>	Castor Oil Plant	One plant exists in the outlet closest south of the Torrens. This should be removed immediately.

### 8.2.5.2 REHABILITATION/ REVEGETATION

It is recommended that rehabilitation works occur to increase biodiversity within the Reserve, stabilise eroded areas and to assist with the control of weeds. The planting of tubestock and weed control around these sites will increase plant survival rates. When undertaking planting, a space will need to be left as an access point for machinery that removes sediment accumulating in the stormwater outfall areas until suitable alternative stormwater management techniques are implemented.

Recommended species, plant characteristics and numbers required are detailed in Table 13. These species are based on pre-European vegetation communities (refer to Kraehenbuehl, 1996). They have however been adjusted to suit environmental conditions within this artificial Management Zone. Seed to be used in rehabilitation projects should be sourced locally where available or from the nearest source (refer to Appendices 7-9 for images and information on revegetation methods). The numbers required are based on Management Zone size of approximately 950m<sup>2</sup> and a planting density of 1 plant per 1.5m<sup>2</sup>.

**Table 13: Species Recommended for Rehabilitation in Management Zone 5**

Scientific Name	Common Name	Plant Characteristics	Number Required
<i>Acacia longifolia</i> var. <i>sophorae</i> <sup>#</sup>	Coastal Wattle	Large shrub to 3m high and 5m wide with thick green phyllode and yellow wattle flowers. Fast growing, hardy plants that bind sand and habitat.	10
<i>Allocasuarina verticillata</i>	Drooping Sheoak	Tree between 2 and 3m tall in the coastal environment, with long, drooping, green branchlets. Females produce cones. Plants drop litter and provide shading which will help to suppress weed growth.	20
<i>Bolboschoenus caldwellii</i>	Sea Club-rush	An aquatic rush that tolerates saline conditions. Plant in clumps.	50
<i>Carpobrotus rossii</i>	Native Pigface	Ground creeper with thick, fleshy succulent leaves and large pink flowers. Ideal for sand stabilisation. One plant can grow to 3m <sup>2</sup> .	50
<i>Dianella brevicaulis</i>	Short-stem Flax- lily	Attractive dark green lily with purple fruits and flowers. Grows in clumps to 0.5m <sup>2</sup> .	50
<i>Distichlis distichophylla</i>	Emu Grass	Indigenous grass commonly found in saline, sandy soils on the coast.	100
<i>Dodonaea viscosa</i>	Sticky Hop Bush	Erect shrub to chest high with bright green, shiny leaves. Fruit is a winged paper-like capsule.	10
<i>Enchylaena tomentosa</i>	Ruby Saltbush	Prostrate shrub, grey/blue in colour, drying to black, with red berries. One plant can grow to 3m <sup>2</sup> .	50
<i>Isolepis nodosa</i>	Knobby Club-rush	Attractive green/ brown sedge that grows in clumps to thigh high. Ideal sand binder.	50
<i>Myoporum insulare</i>	Common Boobialla	Tall, spreading shrub to over head high. Thick fleshy leaves with white and purple flowers, purple fruits.	10
<i>Rhagodia candolleana</i>	Seaberry Saltbush	Scrambling saltbush to 1m with green/grey foliage and red berries. Fast growing hardy coastal plant.	50
<i>Suaeda australis</i>	Austral Seablite	Succulent shrub to 0.5m. Leaves green, red or purple depending on ground salinity.	50
<i>Threlkeldia diffusa</i>	Coastal Bonefruit	A low ground cover with green/ maroon succulent foliage.	50
<i>Sporobolus virginicus</i>	Salt Couch	Native grass species commonly found in wet saline areas.	100
<b>TOTAL</b>			<b>650</b>

<sup>#</sup> There have been some issues with gall wasp on *Acacia* species at the nearby Semaphore Park dunes. Trees For Life conducted an experiment cutting the galls off *Acacias* and found those with the galls removed recovered better than those with the galls still present (Hemmings in Petherick, 2004, pers. comm.). It is recommended that this control technique be adopted if galls become an issue at Henley South and West Beach.

## 9. Summary of Management Recommendations/ Suggestions

Report Location/ Management Issue	Key Points/ Recommendations
4.2.1 Indigenous Vegetation	<p>The Reserve has been divided into the following vegetation communities that will act as a guide for future rehabilitation works:</p> <ul style="list-style-type: none"> <li>• <i>Spinifex sericeus/ Atriplex cinerea/ Isolepis nodosa</i> <u>Foredune</u></li> <li>• <i>Olearia axillaris/ Rhagodia candolleana/ Isolepis nodosa/ Carpobrotus rossii/ Senecio lautus</i> <u>Swales</u></li> <li>• <i>Acacia longifolia</i> var. <i>sophorae/ Rhagodia candolleana/ Nitraria billardierei/ Myoporum insulare</i> <u>Low Shrubland</u></li> <li>• <i>Olearia axillaris/Scaevola crassifolia/Dianella brevicaulis/Isolepis nodosa</i> <u>Landscape – Landscape/Low Shrubland</u></li> <li>• <i>Isolepis nodosa/ Sporobolus virginicus/ Distichlis distichophylla/ Threlkeldia diffusa/ Carpobrotus rossii</i> <u>Stormwater Outlets.</u></li> </ul>
4.3.1 Native Fauna	<p>It is recommended that:</p> <ul style="list-style-type: none"> <li>• <i>Adriana klotzschii</i> (Coast Bitter-bush) continue to be included in revegetation works to assist in the creation of a corridor for <i>Theclinesthes albocincta</i> (Bitter-bush Blue Butterfly).</li> </ul>
8.1.1 Weeds	<p>Weeds are the primary threat to biodiversity within the Reserve. Some weed species are in low abundance and are therefore easily eradicated. These weeds should receive attention before those that have already become widespread. Refer to Section 8.1.1, Appendices 3-4 and weed control recommendations in individual Management Zones for these low abundance species.</p> <p><i>Trachyandra divaricata</i> (Dune Onion Weed) is identified as the number one priority weed for the Reserve as it presents a serious threat to biodiversity. Experience within the Semaphore region suggests these plants have the potential to form vast monocultures and out-compete native vegetation. It is critical that <i>Trachyandra divaricata</i> does not become established within the Henley South and West Beach Dune Reserve. All plants discovered should be removed immediately with any seedheads securely bagged. The location of these plants should be reported promptly to the City of Charles Sturt Coastal Officer for GPS referencing.</p> <p>Control of other priority weed species must be closely linked with appropriate revegetation and habitat replacement techniques.</p> <p>Monitoring It is recommended that:</p> <ul style="list-style-type: none"> <li>• annual site assessments be undertaken using the <i>NCS Bushland Condition Monitoring Manual Southern Mount Lofty Ranges Coastal Version</i> to assess the success of this control strategy and to record changes in the weed's distribution.</li> </ul>
8.1.3 Access and Fencing	<p>It is recommended that:</p> <ul style="list-style-type: none"> <li>• the number of formal access paths be reviewed and fencing be strategically installed along several of the paths to prevent informal access into the dunes;</li> <li>• appropriate signage be installed to raise awareness of the need for path closure and the community to adhere to designated access ways;</li> <li>• the beach end of access paths be marked, possibly with treated pine posts, to assist beach users in identifying beach exit points;</li> <li>• the provision of disabled access to the beach be considered and revised by Council;</li> <li>• some form of boundary delineation be constructed between the beach frontage properties and the dunes to discourage the encroachment of garden and inappropriate vegetation;</li> <li>• access for residents between Ozone Street car park and the Henley Sailing Club to the beach and Coast Park shared-use pathway be revised by Council and incorporated into its construction phase.</li> </ul>

<p>8.1.4 Erosion</p>	<p>It is recommended that:</p> <ul style="list-style-type: none"> <li>plantings should be to the western side of the managed alignment position (refer to Section 8.1.4 and recommendations featured in Management Zones 1-3);</li> <li>the informal access path adjacent to the Torrens Outlet causing a blowout be formalised and the dune rehabilitated during the Coast Park construction phase;</li> <li>Council's policy of constructing dune forming fences between Lexington Road and South Street should continue to occur, to aid reconstruction of the dunes (to be installed between October and early December).</li> </ul>
<p>8.1.6 Introduced Fauna</p>	<p>It is recommended that:</p> <ul style="list-style-type: none"> <li>Council seek advice from the local authorised Pest Plant Animal Control Officer when and where introduced fauna is recorded in the Reserve;</li> <li>an audit of dog litter stations occurs and any additional stations be installed at strategic locations if required. These should include bags for waste and signage outlining the reasons why dogs should not enter the dunes.</li> </ul>
<p>8.2 Management Issues and Strategies within each Management Zone</p>	<p>Targeted and staged weed control must be a high priority until dune recession occurs as a result of the Coast Protection Board's sand management strategy for the Torrens Outlet area.</p> <p>Planting of indigenous colonising species should occur to stabilise the disturbed area. Recommended species and numbers for each Management Zone are described in Sections 8.2.1 - 8.2.5.</p> <p>The Nature Conservation Society's <i>Bushland Condition Monitoring Manual Southern Mount Lofty Ranges Coastal Version</i> should be adopted to monitor changes in the Reserve's condition over time and will involve annual site audits. In addition, photopoints are to be established to monitor changes in vegetation over time (refer to UFBP website for correct photopoint monitoring technique).</p> <p>Priority weed lists for each Management Zone details weeds specific to those zones, their distributions and recommended control strategies.</p> <p>It is important that removed weeds are replaced with appropriate indigenous vegetation (refer to relevant tables and Appendices 7-9 for images of indigenous species and revegetation techniques) to increase biodiversity, prevent erosion and assist with weed control.</p> <p>Ideally, rehabilitation works should commence after the dune system has receded to decrease the risk of plant loss. However, as the sand removal strategy is a long-term project, allocated plants should be located behind the anticipated recession area. (Figure 11).</p> <p>Seed for rehabilitation projects should be locally sourced.</p> <p>Management Zone 1:</p> <p>The foredune is subject to extreme changes in shoreline position. This needs to be considered when managing this area as there is a high probability that significant changes will re-occur. For example, planting should be restricted to the rear of the managed alignment position (see Figure 11) to reduce the probability of plants being lost in storm events or affected by future sand management practices. Planting in the rear foredune area will provide a good stock of indigenous plants that may then naturally spread to the front of the foredune.</p> <p>Due to the narrowness of the dunes, the area north of Gilmore Road is the most susceptible to future storm damage and sea level rise. The following sub-divisions are necessary to clarify management issues in this zone.</p>

	<p>Type 2 - Sand Bank</p> <p>It is recommended that:</p> <ul style="list-style-type: none"> <li>• plantings are to be &lt;0.75m high.</li> </ul> <p>Type 3 - Severe Foredune</p> <p>It is recommended that:</p> <ul style="list-style-type: none"> <li>• only grasses and groundcovers to &lt;0.5m height are planted; and</li> <li>• <i>Ammophila arenaria</i> (Marram Grass) be removed to discourage further growth in dune height.</li> </ul> <p>In both these areas it is further recommended that:</p> <ul style="list-style-type: none"> <li>• dune height is not increased with inappropriate planting;</li> <li>• weeds be eliminated to remove the likelihood of weed transport along coast due to storm activity;</li> <li>• sand drift fencing is continued, to create dune protection of foreshore infrastructure;</li> <li>• <i>Spinifex sericeus</i> is planted in sand transport area only, to reduce the possibility of the dune rising in height.</li> </ul> <p>Management Zone 3:</p> <ul style="list-style-type: none"> <li>• It is suggested that <i>Pimelea serpyllifolia</i> ssp. <i>serpyllifolia</i> (Thyme Riceflower) also be considered for revegetation in this Management Zone; it grows naturally in local dune systems and there is some concern over the species' survival in this area. This species has not been listed in recommendations for rehabilitation for Management Zone 3 as it is known to be very difficult to propagate. However, it should be used in the Reserve if the contracted grower is able to supply some plants.</li> <li>• Weed control in Management Zones 3 and 4 between the Ozone Street car park and the Henley Sailing Club be undertaken in conjunction with, and included in, specifications for the construction of Coast Park's shared-use pathway to limit ongoing degradation and increase biodiversity of these areas. This will prevent further damage to the area by using machinery on a single occasion.</li> </ul> <p>Management Zone 4:</p> <p>It is recommended that:</p> <ul style="list-style-type: none"> <li>• indigenous vegetation should be clearly identifiable (eg bunting, or similar) by machinery operators;</li> <li>• access to construction areas should only be from designated access routes as identified in contract specifications;</li> <li>• several vehicle turning bays be allocated as identified by consultation with the City of Charles Sturt Coastal Officer.</li> </ul> <p>Management Zone 5:</p> <p>It is recommended that:</p> <ul style="list-style-type: none"> <li>• Council investigate alternative means of stormwater management to minimise impact on the dune environment.</li> </ul>
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## 10. Implementation Schedule and Approximate Budgets

The following budget outlines the on ground works to be implemented over a five-year period in the Henley South and West Beach Dune Reserve in accordance with recommendations featured in this Management Plan. As this is a flexible document, the five year timeframe may be adjusted according to works completed in the previous year/s and funding availability. Specific project schedules based on this implementation schedule and budget will be developed by the City of Charles Sturt and the Urban Forest Biodiversity Program on an annual basis.

Management of the coast is a joint responsibility and as such, funding will need to be sourced accordingly. The City of Charles Sturt will actively seek external funding for implementation of this Plan. Some of the possible funding bodies include the Urban Forest Million Trees Program, Department for Environment and Heritage Coastal Protection Branch, Coast Park, Mt. Lofty Ranges and Greater Adelaide Natural Resource Management Investment Strategy, and the Torrens and Patawalonga Catchment Water Management Board. These options will need to be explored in addition to utilising part of Council's Coastal Management Plan funding, assuming annual operating budget bids are successful.

In addition to the potential funding bodies, programs such as Green Corps, Youth Conservation Corps, Conservation Volunteers Australia, Maxima Horticultural Trainees, school groups and Dunecare volunteers could undertake works, all of which will add to the in-kind contribution, thus reducing actual costs to Council.



Year 1: July 2005 - June 2006

Action	JUL					AUG					SEPT				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	10	10	5	10	5	10	10	5	10	5	10	10	5	10	5
Weed Control (cost)	\$400	\$400	\$200	\$400	\$200	\$400	\$400	\$200	\$400	\$200	\$400	\$400	\$200	\$400	\$200
<b>Monthly Total per Zone</b>	<b>\$400</b>	<b>\$400</b>	<b>\$200</b>	<b>\$400</b>	<b>\$200</b>	<b>\$400</b>	<b>\$400</b>	<b>\$200</b>	<b>\$400</b>	<b>\$200</b>	<b>\$400</b>	<b>\$400</b>	<b>\$200</b>	<b>\$400</b>	<b>\$200</b>
<b>Monthly Total for Site</b>	<b>\$1,600</b>					<b>\$1,600</b>					<b>\$1,600</b>				

Action	OCT					NOV					DEC				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	10	10	5	10	5	10	10	5	10	5	5	5	5	5	5
Weed Control (cost)	\$400	\$400	\$200	\$400	\$200	\$400	\$400	\$200	\$400	\$200	\$200	\$200	\$200	\$200	\$200
Order Tubestock (# tubes)	3,300	3,700	1,475	2,975	550										
Purchase Tubestock	\$3,960	\$4,440	\$1,770	\$3,570	\$660										
<b>Monthly Total per Zone</b>	<b>\$4,360</b>	<b>\$4,840</b>	<b>\$1,970</b>	<b>\$3,970</b>	<b>\$860</b>	<b>\$400</b>	<b>\$400</b>	<b>\$200</b>	<b>\$400</b>	<b>\$200</b>	<b>\$200</b>	<b>\$200</b>	<b>\$200</b>	<b>\$200</b>	<b>\$200</b>
<b>Monthly Total for Site</b>	<b>\$16,000</b>					<b>\$1,400</b>					<b>\$1,000</b>				

Action	JAN					FEB					MAR				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	5	5	5	5
Weed Control (cost)	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$200	\$200	\$200	\$200	\$200
<b>Monthly Total per Zone</b>	<b>\$100</b>	<b>\$100</b>	<b>\$100</b>	<b>\$100</b>	<b>\$100</b>	<b>\$100</b>	<b>\$100</b>	<b>\$100</b>	<b>\$100</b>	<b>\$100</b>	<b>\$200</b>	<b>\$200</b>	<b>\$200</b>	<b>\$200</b>	<b>\$200</b>
<b>Monthly Total for Site</b>	<b>\$500</b>					<b>\$500</b>					<b>\$1,000</b>				

Action	APR					MAY					JUN				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	2.5	2.5	2.5	2.5	2.5	5	5	5	5	5	10	10	5	10	5
Weed Control (cost)	\$100	\$100	\$100	\$100	\$100	\$200	\$200	\$200	\$200	\$200	\$400	\$400	\$200	\$400	\$200
Revegetation (# tubes)						3,300	3,700	1,475	2,975	550					
Revegetation (cost)						\$6,732	\$7,548	\$3,009	\$6,069	\$1,122					
<b>Monthly Total per Zone</b>	<b>\$100</b>	<b>\$100</b>	<b>\$100</b>	<b>\$100</b>	<b>\$100</b>	<b>\$6,932</b>	<b>\$7,748</b>	<b>\$3,209</b>	<b>\$6,269</b>	<b>\$1,322</b>	<b>\$400</b>	<b>\$400</b>	<b>\$200</b>	<b>\$400</b>	<b>\$200</b>
<b>Monthly Total for Site</b>	<b>\$500</b>					<b>\$25,480</b>					<b>\$1,600</b>				

<b>Annual Total per Zone</b>											<b>\$13,992</b>	<b>\$15,288</b>	<b>\$6,879</b>	<b>\$12,939</b>	<b>\$3,682</b>
<b>Annual Total for Site</b>											<b>\$49,098</b>				



Year 2: July 2006 -June 2007

Action	JUL					AUG					SEPT				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	10	10	5	10	5	10	10	5	10	5	10	10	5	10	5
Weed Control (cost)	\$416	\$416	\$208	\$416	\$208	\$416	\$416	\$208	\$416	\$208	\$416	\$416	\$208	\$416	\$208
<b>Monthly Total per Zone</b>	<b>\$416</b>	<b>\$416</b>	<b>\$208</b>	<b>\$416</b>	<b>\$208</b>	<b>\$416</b>	<b>\$416</b>	<b>\$208</b>	<b>\$416</b>	<b>\$208</b>	<b>\$416</b>	<b>\$416</b>	<b>\$208</b>	<b>\$416</b>	<b>\$208</b>
<b>Monthly Total for Site</b>	<b>\$1,664</b>					<b>\$1,664</b>					<b>\$1,664</b>				

Action	OCT					NOV					DEC				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	10	10	5	10	5	10	10	5	10	5	5	5	5	5	5
Weed Control (cost)	\$416	\$416	\$208	\$416	\$208	\$416	\$416	\$208	\$416	\$208	\$208	\$208	\$208	\$208	\$208
Order Tubestock (# tubes)	3,700	3,925	1,350	325	100										
Purchase Tubestock	\$4,588	\$4,867	\$1,674	\$403	\$124										
Fencing and Signage						\$3,500									
<b>Monthly Total per Zone</b>	<b>\$5,004</b>	<b>\$5,283</b>	<b>\$1,882</b>	<b>\$819</b>	<b>\$332</b>	<b>\$3,916</b>	<b>\$416</b>	<b>\$208</b>	<b>\$416</b>	<b>\$208</b>	<b>\$208</b>	<b>\$208</b>	<b>\$208</b>	<b>\$208</b>	<b>\$208</b>
<b>Monthly Total for Site</b>	<b>\$13,320</b>					<b>\$5,164</b>					<b>\$1,040</b>				

Action	JAN					FEB					MAR				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	5	5	5	5
Weed Control (Cost)	\$104	\$104	\$104	\$104	\$104	\$104	\$104	\$104	\$104	\$104	\$208	\$208	\$208	\$208	\$208
<b>Monthly Total per Zone</b>	<b>\$104</b>	<b>\$104</b>	<b>\$104</b>	<b>\$104</b>	<b>\$104</b>	<b>\$104</b>	<b>\$104</b>	<b>\$104</b>	<b>\$104</b>	<b>\$104</b>	<b>\$208</b>	<b>\$208</b>	<b>\$208</b>	<b>\$208</b>	<b>\$208</b>
<b>Monthly Total for Site</b>	<b>\$520</b>					<b>\$520</b>					<b>\$1,040</b>				

Action	APR					MAY					JUN				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	2.5	2.5	2.5	2.5	2.5	5	5	5	5	5	10	10	5	10	5
Weed Control (cost)	\$104	\$104	\$104	\$104	\$104	\$208	\$208	\$208	\$208	\$208	\$416	\$416	\$208	\$416	\$208
Revegetation (# tubes)						3,700	3,925	1,350	325	100					
Revegetation (cost)						\$7,992	\$8,478	\$2,916	\$702	\$216					
<b>Monthly Total per Zone</b>	<b>\$104</b>	<b>\$104</b>	<b>\$104</b>	<b>\$104</b>	<b>\$104</b>	<b>\$8,200</b>	<b>\$8,686</b>	<b>\$3,124</b>	<b>\$910</b>	<b>\$424</b>	<b>\$416</b>	<b>\$416</b>	<b>\$208</b>	<b>\$416</b>	<b>\$208</b>
<b>Monthly Total for Site</b>	<b>\$520</b>					<b>\$21,344</b>					<b>\$1,664</b>				

<b>Annual Total per Zone</b>											<b>\$19,512</b>	<b>\$16,777</b>	<b>\$6,774</b>	<b>\$4,537</b>	<b>\$2,524</b>
<b>Annual Total for Site</b>	<b>\$50,124</b>														



Year 3: July 2007 -June 2008

Action	JUL					AUG					SEPT				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	10	10	5	5	5	10	10	5	5	5	10	10	5	5	5
Weed Control (cost)	\$432	\$432	\$216	\$216	\$216	\$432	\$432	\$216	\$216	\$216	\$432	\$432	\$216	\$216	\$216
<b>Monthly Total per Zone</b>	<b>\$432</b>	<b>\$432</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>	<b>\$432</b>	<b>\$432</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>	<b>\$432</b>	<b>\$432</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>
<b>Monthly Total for Site</b>	<b>\$1,512</b>					<b>\$1,512</b>					<b>\$1,512</b>				

Action	OCT					NOV					DEC				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	10	10	5	5	5	10	10	5	5	5	5	5	5	5	5
Weed Control (cost)	\$432	\$432	\$216	\$216	\$216	\$432	\$432	\$216	\$216	\$216	\$216	\$216	\$216	\$216	\$216
Order Tubestock (# tubes)	3,250	3,225	525	200											
Purchase Tubestock	\$4,160	\$4,128	\$672	\$256											
Fencing and Signage						\$3,500									
<b>Monthly Total per Zone</b>	<b>\$4,592</b>	<b>\$4,560</b>	<b>\$888</b>	<b>\$472</b>		<b>\$3,932</b>	<b>\$432</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>
<b>Monthly Total for Site</b>	<b>\$10,512</b>					<b>\$5,012</b>					<b>\$1,080</b>				

Action	JAN					FEB					MAR				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	5	5	5	5
Weed Control (cost)	\$108	\$108	\$108	\$108	\$108	\$108	\$108	\$108	\$108	\$108	\$216	\$216	\$216	\$216	\$216
<b>Monthly Total per Zone</b>	<b>\$108</b>	<b>\$108</b>	<b>\$108</b>	<b>\$108</b>	<b>\$108</b>	<b>\$108</b>	<b>\$108</b>	<b>\$108</b>	<b>\$108</b>	<b>\$108</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>
<b>Monthly Total for Site</b>	<b>\$540</b>					<b>\$540</b>					<b>\$1,080</b>				

Action	APR					MAY					JUN				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	2.5	2.5	2.5	2.5	2.5	5	5	5	5	5	10	10	5	5	5
Weed Control (cost)	\$108	\$108	\$108	\$108	\$108	\$216	\$216	\$216	\$216	\$216	\$432	\$432	\$216	\$216	\$216
Revegetation (# tubes)						3,250	3,225	525	200						
Revegetation (cost)						\$7,280	\$7,224	\$1,176	\$448						
<b>Monthly Total per Zone</b>	<b>\$108</b>	<b>\$108</b>	<b>\$108</b>	<b>\$108</b>	<b>\$108</b>	<b>\$7,496</b>	<b>\$7,440</b>	<b>\$1,392</b>	<b>\$664</b>	<b>\$216</b>	<b>\$432</b>	<b>\$432</b>	<b>\$216</b>	<b>\$216</b>	<b>\$216</b>
<b>Monthly Total for Site</b>	<b>\$540</b>					<b>\$17,208</b>					<b>\$1,512</b>				

<b>Annual Total per Zone</b>											<b>\$18,504</b>	<b>\$14,916</b>	<b>\$4,116</b>	<b>\$2,972</b>	<b>\$1,620</b>
<b>Annual Total for Site</b>											<b>\$42,128</b>				



Year 4: July 2008 -June 2009

Action	JUL					AUG					SEPT				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	10	10	5	5	5	10	10	5	5	5	10	10	5	5	5
Weed Control (cost)	\$448	\$448	\$224	\$224	\$224	\$448	\$448	\$224	\$224	\$224	\$448	\$448	\$224	\$224	\$224
<b>Monthly Total per Zone</b>	<b>\$448</b>	<b>\$448</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>	<b>\$448</b>	<b>\$448</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>	<b>\$448</b>	<b>\$448</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>
<b>Monthly Total for Site</b>	<b>\$1,568</b>					<b>\$1,568</b>					<b>\$1,568</b>				

Action	OCT					NOV					DEC				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	10	10	5	5	5	10	10	5	5	5	5	5	5	5	5
Weed Control (cost)	\$448	\$448	\$224	\$224	\$224	\$448	\$448	\$224	\$224	\$224	\$224	\$224	\$224	\$224	\$224
Order Tubestock (# tubes)	2,000	2,050	100												
Purchase Tubestock	\$2,640	\$2,706	\$132												
<b>Monthly Total per Zone</b>	<b>\$3,088</b>	<b>\$3,154</b>	<b>\$356</b>	<b>\$224</b>	<b>\$224</b>	<b>\$448</b>	<b>\$448</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>
<b>Monthly Total for Site</b>	<b>\$7,046</b>					<b>\$1,568</b>					<b>\$1,120</b>				

Action	JAN					FEB					MAR				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	5	5	5	5
Weed Control (cost)	\$112	\$112	\$112	\$112	\$112	\$112	\$112	\$112	\$112	\$112	\$224	\$224	\$224	\$224	\$224
<b>Monthly Total per Zone</b>	<b>\$112</b>	<b>\$112</b>	<b>\$112</b>	<b>\$112</b>	<b>\$112</b>	<b>\$112</b>	<b>\$112</b>	<b>\$112</b>	<b>\$112</b>	<b>\$112</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>
<b>Monthly Total for Site</b>	<b>\$448</b>					<b>\$448</b>					<b>\$896</b>				

Action	APR					MAY					JUN				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	2.5	2.5	2.5	2.5	2.5	5	5	5	5	5	10	10	5	5	5
Weed Control (cost)	\$112	\$112	\$112	\$112	\$112	\$224	\$224	\$224	\$224	\$224	\$448	\$448	\$224	\$224	\$224
Revegetation (# tubes)						2,000	2,050	100							
Revegetation (cost)						\$4,640	\$4,756	\$232							
<b>Monthly Total per Zone</b>	<b>\$112</b>	<b>\$112</b>	<b>\$112</b>	<b>\$112</b>	<b>\$112</b>	<b>\$4,864</b>	<b>\$4,980</b>	<b>\$456</b>	<b>\$224</b>	<b>\$224</b>	<b>\$448</b>	<b>\$448</b>	<b>\$224</b>	<b>\$224</b>	<b>\$224</b>
<b>Monthly Total for Site</b>	<b>\$448</b>					<b>\$10,524</b>					<b>\$1,344</b>				

<b>Annual Total per Zone</b>											<b>\$10,976</b>	<b>\$11,158</b>	<b>\$2,716</b>	<b>\$2,352</b>	<b>\$2,352</b>
<b>Annual Total for Site</b>											<b>\$29,554</b>				



Year 5: July 2009 -June 2010

Action	JUL					AUG					SEPT				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	10	10	5	5	5	10	10	5	5	5	10	10	5	5	5
Weed Control (cost)	\$464	\$464	\$232	\$232	\$232	\$464	\$464	\$232	\$232	\$232	\$464	\$464	\$232	\$232	\$232
<b>Monthly Total per Zone</b>	<b>\$464</b>	<b>\$464</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$464</b>	<b>\$464</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$464</b>	<b>\$464</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>
<b>Monthly Total for Site</b>	<b>\$1,624</b>					<b>\$1,624</b>					<b>\$1,624</b>				

Action	OCT					NOV					DEC				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	10	10	5	5	5	10	10	5	5	5	5	5	5	5	5
Weed Control (cost)	\$464	\$464	\$232	\$232	\$232	\$464	\$464	\$232	\$232	\$232	\$232	\$232	\$232	\$232	\$232
<b>Monthly Total per Zone</b>	<b>\$464</b>	<b>\$464</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$464</b>	<b>\$464</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>
<b>Monthly Total for Site</b>	<b>\$1,624</b>					<b>\$1,624</b>					<b>\$1,160</b>				

Action	JAN					FEB					MAR				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	5	5	5	5
Weed Control (cost)	\$116	\$116	\$116	\$116	\$116	\$116	\$116	\$116	\$116	\$116	\$232	\$232	\$232	\$232	\$232
<b>Monthly Total per Zone</b>	<b>\$116</b>	<b>\$116</b>	<b>\$116</b>	<b>\$116</b>	<b>\$116</b>	<b>\$116</b>	<b>\$116</b>	<b>\$116</b>	<b>\$116</b>	<b>\$116</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>
<b>Monthly Total for Site</b>	<b>\$580</b>					<b>\$580</b>					<b>\$1,160</b>				

Action	APR					MAY					JUN				
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Weed Control (hours)	2.5	2.5	2.5	2.5	2.5	5	5	5	5	5	10	10	5	5	5
Weed Control (cost)	\$116	\$116	\$116	\$116	\$116	\$232	\$232	\$232	\$232	\$232	\$464	\$464	\$232	\$232	\$232
<b>Monthly Total per Zone</b>	<b>\$116</b>	<b>\$116</b>	<b>\$116</b>	<b>\$116</b>	<b>\$116</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>	<b>\$464</b>	<b>\$464</b>	<b>\$232</b>	<b>\$232</b>	<b>\$232</b>
<b>Monthly Total for Site</b>	<b>\$580</b>					<b>\$1,160</b>					<b>\$1,624</b>				

<b>Annual Total per Zone</b>											<b>\$3,828</b>	<b>\$3,828</b>	<b>\$2,436</b>	<b>\$2,436</b>	<b>\$2,436</b>
<b>Annual Total for Site</b>	<b>\$14,964</b>														

## Glossary

Definitions from:

Black, J., (1986);

Moore, J. and Wheeler, (2002);

Tonkin Engineering, (2002);

Department of Environment and Planning, (1987).

<b>allelopathic:</b>	the harmful effect of one organism on another by the release of inhibiting compounds.
<b>accretion:</b>	the accumulation of sand.
<b>achene:</b>	a dry, indehiscent, one-seeded fruit, as in the daisy family.
<b>alternate:</b>	leaves or flowers inserted individually at different heights along the branches.
<b>axil:</b>	the angle between the upper surface of a leaf or bract and the stem to which it is attached.
<b>bog method:</b>	the placing of a propagating tray, with soil into a bed of water allowing contents to remain wet without watering from above.
<b>depressed:</b>	flattened from above downwards.
<b>dioecious:</b>	male and female flowers developing on different individuals.
<b>drupe:</b>	a fruit in which the pericarp consists of three layers: (1) the <b>epicarp</b> or skin, (2) the <b>mesocarp</b> or juicy layer, and (3) the bony <b>endocarp</b> or stone; within the endocarp lies the seed or kernel. An example is the peach or the local <i>Nitraria billardierei</i> (Nitre Bush).
<b>ellipsoid:</b>	a 3-dimensional oval shape.
<b>elliptic:</b>	when a flat surface, such as that of a leaf, has rounded ends and is broadest near the middle.
<b>endocarp:</b>	the innermost layer of the pericarp.
<b>foredunes:</b>	the first line of sand dunes adjacent to the beach and colonised by grasses and herbs.
<b>glaucous:</b>	bluish-green, usually of a pale tint.
<b>globular:</b>	rounded like a globe or sphere (= <b>globose</b> ).
<b>gross pollutant trap:</b>	a device for trapping and storing debris and litter from stormwater for later removal.
<b>hind dunes:</b>	the subsequent lines of sand dunes running parallel to and on the landward side of the foredunes and colonised by low trees and shrubs.
<b>incipient dune:</b>	most seaward, newly forming dune of the dune system that is often changing due to coastal processes such as sand accretion and erosion.
<b>indehiscent:</b>	of fruits that do not split open to release their seeds.
<b>inflorescence:</b>	the arrangement of flowers on a stem.



<b>lanceolate:</b>	shaped like the head of a lance, tapering at both ends, but broadest below the middle.
<b>linear:</b>	long and narrow, with parallel edges.
<b>oblong:</b>	much longer than broad, and rounded at both ends.
<b>obovate:</b>	ovate with the broadest part above the middle.
<b>orbicular:</b>	flat, circular or almost so.
<b>ovate:</b>	when a flat surface, such as that of a leaf, is egg-shaped and broader below the middle.
<b>ovoid:</b>	egg-shaped with the narrower end at the base (of solid organs such as fruits).
<b>pappus:</b>	a ring of fine hairs or scales which surrounding the fruit in composite plants; aids seed dispersal by the wind.
<b>peduncle:</b>	stalk of a solitary flower, or common stalk of an inflorescence.
<b>pericarp:</b>	the fruit wall, developed from the ovary wall.
<b>phyllode:</b>	a leaf whose blade is reduced or absent and whose petiole (stalk) assumes the function of the whole leaf.
<b>prostrate:</b>	lying flat on the ground.
<b>provenance:</b>	geographic origin of the parent plant material.
<b>rhizome:</b>	a perennial underground stem, which is usually horizontal.
<b>sessile:</b>	without a stalk.
<b>spike:</b>	an undivided floral axis ( <b>peduncle</b> ) bearing sessile flowers.
<b>stratification:</b>	the subjection of seeds to periods (usually a few weeks) of low temperatures to break seed dormancy.
<b>swale:</b>	the low lying area between two sand dunes.
<b>terate:</b>	cylindrical.
<b>terminal:</b>	situated at the tip.
<b>zonation:</b>	the arrangement of vegetation communities in zones in response to variations in environmental conditions.



## References

- Auld, B.A. and Medd, R.W., 1987, *Weeds: An Illustrated Guide to the Weeds of Australia*, Inkata Press, Melbourne and Sydney.
- Australian Government, 2004, Department of the Environment and Heritage, <http://www.deh.gov.au/land/vegetation/reveg.html>;
- Australian Government, 2004, Natural Resource Management (online), Available: <http://www.nrm.gov.au>.
- Black, J.M., 1980, *Flora of South Australia*, vol. 3, 4<sup>th</sup> Edition, Government of South Australia, Adelaide.
- Blood, K., 2001, *Environmental Weeds: A Field Guide for South East Australia*, CH Jerram Science Publishers, Victoria.
- Bonney, N., 1994, *What Seed is That?*, Finsbury Press Pty. Ltd., Adelaide.
- Buchanan, R.A., 1989, *Bush Regeneration: Recovering Australian Landscapes*, TAFE Student Learning Publications, NSW
- Brundtland, G. (ed), 1987, *Our Common Future: The World Commission on Environment and Development*, Oxford University Press, Oxford.
- Carter, R.J. and Cooke, D.A., 1991, *Weed Control in Non-Crop Situations*, Adelaide College of TAFE, Adelaide.
- Commonwealth of Australia, 1995, *Living on the Coast: The Commonwealth Coastal Policy* (online), Available: <http://www.deh.gov.au/coasts/publications/coastal-policy/index.html>
- Commonwealth of Australia, 2002, *Programs of the First Phase of the NHT: Coastcare* (online), Available: <http://www.nht.gov.au/nht1/programs/coastcare/#objectives>.
- Commonwealth of Australia, 2004, *Programs of the First Phase of the NHT: Coast and Clean Seas* (online), Available: <http://www.nht.gov.au/nht1/programs/ccs/>.
- Couper-Smartt, J., 2003, *Port Adelaide: Tales from a "Commodious Harbour"*, Friends of S.A. Maritime Museum, Adelaide.
- CRC Weed Management, 2003, CRC for Australian Weed Management (online), Available: <http://www.weeds.crc.org.au/overview/index.html>.
- Culver, R., 1970, *Beach Erosion Assessment Study – Summary Report*, Civil Engineering Department, University of Adelaide, Adelaide.
- Department for Environment and Heritage (DEH), 2004, *The Management of Adelaide's Beaches* (online), Available: <http://www.environment.sa.gov.au/coasts/adelcoast.html>.
- Department of Environment and Planning, South Australia, 1987, *The Fragile Environment - Coastal Sand Dunes*, DEP, Adelaide.
- Environment Protection Authority, 2003, *State of the Environment Report for South Australia 2003*, EPA, Adelaide.
- Gara, T., 2004, *Aboriginal Fringe-dwellers in Adelaide in the late 19<sup>th</sup> – Early 20<sup>th</sup> Centuries* (online), Available <http://www.history.sa.gov.au>



- Gibbs, J, Grass Identification Manual, 2001, Native Grass Resources Group Inc., Adelaide.
- Government of Western Australia, 2003, *Coastal Planning and Management Manual: A Community Guide for Protecting and Conserving the Western Australian Coast*, Western Australian Planning Commission, Perth.
- Harvey, N. and Caton, B., 2003, *Coastal Management in Australia*, Oxford University Press, Melbourne.
- Heyligers, P.C., 1998, *Dispersal of Gladiolus Guernzii and Trachyandra divaricata in Australia* (online), Available: <http://www.science.uts.edu.au/sasb/monocotsIIAb2.html>.
- Heyligers, P.C., 2002, The occurrence of *Tetragonia decumbens* and *Trachyandra divaricata* in South Australia, *The Western Australian Naturalist*, vol. 23, No. 3.
- Horlock, J., 1998, *Coastal Weed Treatments Handbook*, Greening Australia, Victoria.
- Howard, M., Bateup, R. and Corbett, J., 2004, *Coast Park from Ozone Street Car Park to Henley Sailing Club, Concept Design Report*, Parsons Brinckerhoff, Adelaide.
- Kraehenbuehl, D., 1996, *Pre-European Vegetation of Adelaide: A Survey from the Gawler River to Hallett Cove*, Nature Conservation Society of South Australia Inc., Adelaide.
- Lamp, C.A., Forbes, S.J., and Cade, J.W., 2001, *Grasses of Temperate Australia: A Field Guide*, CH Jerram Science Publishers and Bloomings Books, Melbourne.
- New South Wales Department of Land and Water Conservation, 2001, *Coastal Dune Management: A Manual of Coastal Dune Management and Rehabilitation Techniques*, Coastal Unit, DLWC, Newcastle.
- Croft, S, Milne, T. and Pedler, J., 2005, *Bushland Condition Monitoring Manual, Southern Mount Lofty Ranges Coastal Version*, Nature Conservation Society, Adelaide.
- Mount Lofty Ranges Interim Integrated Natural Resource Management Group (MLR IINRM Group), 2003, *Integrated Natural Resource Management Plan for the Mount Lofty Ranges and Greater Adelaide Region*, MLR INRM Group, Adelaide.
- Parsons, W.T. and Cuthbertson, E.G., 1992, *Noxious Weeds of Australia*, Inkata Press, Melbourne and Sydney.
- Petherick, C.E., 2004, *Vegetation Management Plan for the Semaphore South Dune Reserve*, SA Urban Forest Biodiversity Program, Adelaide.
- Playfair, R., 1999, *Port Adelaide Enfield- Shared-use Path Largs Jetty to North Haven: Flora, Fauna and Soils Studies*, Resource Monitoring and Planning Pty Ltd, Adelaide.
- Ralph, M., 2003, *Growing Australian Native Plants from Seed*, Murray Ralph/Bushland Horticulture, Melbourne.
- Resource Assessment Commission, 1993, *Coastal Zone Enquiry: Final Report*, Australian Government Publishing Service, Canberra.
- Robertson, M., 1994, *Stop Bushland Weeds – A Guide to Successful Weeding in South Australia's Bushland*, The Nature Conservation Society of South Australia Inc., Adelaide.



- Smith, K., 2002, *Rehabilitation and Management Plan for the West Beach Dune System*, Greening Australia (South Australia) Inc., Adelaide.
- Smith, K., 2001, *Revegetation Action Plan for the Largs North Dunes*, Greening Australia (South Australia) Inc., Adelaide.
- South Australian Coast Protection Board, 1993a, '*Maintaining the Adelaide Coastline*', *Coastline*, No. 28, September, Department for Environment and Heritage, Adelaide.
- South Australian Coast Protection Board, 1993b, '*The Adelaide Metropolitan Coastline*', *Coastline*, No. 27, April, Department for Environment and Heritage, Adelaide.
- South Australian Coast Protection Board, 2003, '*Garden Plants that are Known to Become Serious Coastal Weeds*', *Coastline*, No. 34, June, Department for Environment and Heritage, Adelaide.
- South Australian Coast Protection Board, N/D, *Seagrasses of South Australia* (brochure), Department for Environment and Heritage, Adelaide.
- Taylor, R., N/D, *A Handbook for Revegetation and Weed Control on the Southern Fleurieu Dunes* (CD-ROM), Coastcare.
- Telfer, S., 2001, *Vegetation Management Plan for Aldinga Beach Reserve, EAC Ecological Evaluation*, Adelaide.
- Thom, B. and Harvey, N., 2000, *Triggers for late 20<sup>th</sup> Century reform of Australian Coastal Management*, Australian Geographical Studies, 38 (3).
- Transport SA, 2002, *Weeds of the Northern and Western Region: A Guide to the Identification and Management of Transport SA Priority Weeds*, Transport SA, Adelaide.
- Turner, M.S., 2001, *Conserving Adelaide's Biodiversity: Resources, Urban Forest Biodiversity Program*, Adelaide.
- Urban Forest Biodiversity Program (UFBP), 2004, *The Urban Forest Biodiversity Program – Introduction to the Program* (online), Available: <http://www.urbanforest.on.net/main.html>.
- University of Delaware, 2003, *Program for the Global Conference on Oceans and Coasts at Rio + 10: Toward the 2002 World Summit on Sustainable Development* (online). Available: <http://www.udel.edu/CMS/csmp/globaloceans/pdf/Program.pdf>.

### **Personal Communications**

- Caton, Brian, 2004, Member South Australian Coast Protection Board, 27<sup>th</sup> May.
- Caton, Brian, 2004, Member South Australian Coast Protection Board, 27<sup>th</sup> October.
- Caton, Brian, 2005, Member South Australian Coast Protection Board, 15<sup>th</sup> January.
- Cox, Stephen, 2005, Metropolitan Coast Communications Officer, 11<sup>th</sup> February.
- Clutterham, Alicia, 2005, Coastal Officer, City of Charles Sturt, 12<sup>th</sup> January.
- Grund, Roger, 2003, Chairperson Butterfly Conservation South Australia, 21<sup>st</sup> March.



Fotheringham, Doug, 2003, Senior Scientific Officer – Coastal Protection Branch (DEH), 27<sup>th</sup> February.

Hagan, Vicki, 2003, Bush-Anew, 5 August.

Harvey, Alison, 2004, Henley and Grange Dunecare, 5<sup>th</sup> January.

Hemmings, Pete, 2004, Owner Provenance Indigenous Plants, 19<sup>th</sup> February.

Minks, Paul, 2005, Civil Maintenance Teamleader, City of Charles Sturt, 11<sup>th</sup> January.

Moore, John, 2003, Western Australian Department of Agriculture, 19<sup>th</sup> August.

Sandercock, Ron, 2003, Technical Officer – Coastal Protection Branch (DEH), 27<sup>th</sup> February.

Sandercock, Ron, 2004, Technical Officer – Coastal Protection Branch (DEH), 9<sup>th</sup> April.

Sandercock, Ron 2004, Technical Officer – Coastal Protection Branch (DEH), 27<sup>th</sup> May.

Sandercock, Ron 2005, Technical Officer – Coastal Protection Branch (DEH), 9<sup>th</sup> March.

Tucker, Rob, 2004, Manager, Coastal Protection Branch, 23<sup>rd</sup> December.

Turner, Matt, 2004, GIS/Technical Officer, SA Urban Forest Million Trees Program, 20<sup>th</sup> February.

Wales, Val, 2003, Semaphore Park Dunecare Group, 15<sup>th</sup> October.



## Appendix 1: Context

### International

The importance of coastal management was internationally recognised at the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992. This conference, commonly referred to as the 'Earth Summit', was a landmark event with the concept of sustainable development<sup>1</sup> being brought to the forefront and the creation of Local Agenda 21 (UNCED, 1992). Agenda 21 is essentially a framework for governments to implement a program of action to achieve sustainable development.

Chapter 17 of this document addresses the protection of oceans, seas and coastal areas, and was important in that it "recognised the need for new approaches to marine and coastal area management" at the international, national, sub-regional and regional levels (Harvey and Caton, 2003). The Earth Summit led to the development of principles in sustainable development for the coastal zone, with key recommendations including the following statement:

'Each coastal State should consider establishing, or where necessary strengthening, appropriate control mechanisms...for integrated management and sustainable development of coastal and marine areas and their resources, at both the local and national levels'.

(UNCED, Chapter 17, 1992)

The Earth Summit was followed by the Council of the Organisation for Economic Cooperation and Development (OECD) and the first World Coastal Conference (1993) which adopted and developed guidelines for 'integrated coastal management' (ID&A, 2000). As Harvey and Caton (2003) note, an integrated approach to coastal management (ICM) involves comprehensive assessment, defining objectives, planning and management of coastal systems and resources, recognising traditional, cultural and historical perspectives and conflicting interests and issues.

Over a decade on from the Earth Summit, the Oceans and Coast Rio+10 Global Conference held in Paris 2001, found there has been significant international and national investment in coastal and marine management, with a major increase in the number of nations undertaking such management. According to the Centre for the Study of Marine Policy (University of Delaware, 2003), 'International entities have done extensive work in providing guidance for sustainable development of coastal and marine resources, and national governments and communities are increasingly experimenting with models of management emphasizing sustainable development, integration and the precautionary approach'. It was acknowledged however, that there is still much work to be done to ensure that environmental, social and economic outcomes in coastal zone management are achieved in a sustainable manner.

### National

These International initiatives provide a framework for national, state and local action plans to address coastal management issues in Australia.

International push for improved coastal management that gained prominence after the Earth Summit was followed by a period of significant reform in coastal management in Australia in the 1990s. This reform stemmed from pressure within Australia and Commonwealth Government initiatives that together resulted in reviews of operation at both the Commonwealth and State levels of government. Thom and Harvey (in Harvey and Caton, 2003) identify four themes/ influences they believe have been key factors in generating this reform in Australia.

<sup>1</sup> Sustainable development is defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland, 1987).



These are:

- *Global Environmental Change*: increasing acceptance of the concept of sustainable development, awareness of the potential magnitude of climate change;
- *Sustainable Development*: The Australian approach is termed 'ecologically sustainable development' (ESD), defined as "using, conserving and enhancing the community's resources so that ecological processes, on which life depends, and the total quality of life, now and in the future, can be increased" (AGDEH, 2004);
- *Integrated Natural Resource Management* and the development of *Integrated Coastal Management* (refer to page 77 for key elements of ICM);
- *Community Participation*: The influence of community-based movements, community taking on active and responsible roles, increasingly sharing planning and decision-making responsibilities with government.

Several initiatives at the national level have been significant in shaping coastal management in Australia, namely the Resource Assessment Commission's (RAC) *Coastal Zone Inquiry Final Report* (1993), the Australian Coastal Policy entitled '*Living on the Coast*' (1995) and the *Coast and Clean Seas* program (1997).

### **Coastal Zone Inquiry**

This report examined the coastal management responsibilities of the three tiers of government in Australia and emphasised the need for a more integrated approach to coastal management, where the environment is treated in a holistic sense rather than broken down into separate elements (Harvey and Caton, 2003). The Inquiry recommended a national approach to coastal management be adopted due to the increasing pressures from population and development.

One of the key features of the report was the recommendation to adopt a *National Coastal Action Program*. It proposed the Program "involve all government, community and industry groups with responsibility for and interests in the management of coastal zone resources" (Resource Assessment Commission, 1993). The Action Program contained the following core elements (RAC, 1993):

- [Setting and defining] national coastal zone objectives;
- Arrangements for implementing and managing the Program;
- Mechanisms for community and industry involvement (such as the proposed Coastcare program);
- Innovative management mechanisms (i.e. broader and more effective use of management tools).

According to Harvey and Caton (2003), the report supplied a basis "for the development of a national coastal policy, and together with the National Action Program provided the impetus for getting basic agreement on coastal issues" from the three levels of government.

### **Australian Coastal Policy**

The Australian Coastal Policy, entitled '*Living on the Coast*' (Commonwealth Government, 1995) arose from the Coastal Zone Inquiry. In addition to endorsing the concept of ESD, the Coastal Policy also outlines a number of specific objectives and principles, including sustainable resource use, integrated assessment, the precautionary principle, resource allocation, the user-pays principle, resource conservation, community participation, knowledge and understanding (Harvey and Caton, 2003).

The Policy supported the Coastal Zone Inquiry's recommendation for the need for a *National Action Program* and set an agenda for action. This agenda was designed to "improve community involvement in coastal management, address coastal issues such as

development and pollution, raise awareness and educate the community on coastal issues and promote expertise in neighbouring regions" (Harvey and Caton, 2003). The *National Action Program* contained a number of initiatives, including the Coastcare program, Commonwealth coastal strategic planning and local water quality management plans.

### **Coast and Clean Seas**

The first phase of Natural Heritage Trust (NHT I, 1997) saw the establishment of the *Coasts and Clean Seas* program, a \$125 million investment over a four-year period. The program had an emphasis on practical 'hands on' projects aimed at improving management of Australia's natural resources and restoring, conserving and enhancing the coastal and marine environment (Commonwealth Government of Australia, 2004). The program required collaboration between community groups and state and local governments. *Coast and Clean Seas* enabled the extension of the *National Action Program*, with the continuation of programs including *Coastcare*, *Marine Protected Areas* and *Coastal Monitoring and Vulnerability*. In addition, a large proportion of the program's funds were allocated to the creation of a number of new initiatives, including *Clean Seas*, *Coastal and Marine Planning*, *Marine Species Protection*, the *Coastal Resource Atlas* and the *Oceans Policy* (Harvey and Caton, 2003).

Both Coastcare and the Coast and Clean Seas programs involved the signing of *Memoranda of Understanding*, which defined the way the Commonwealth, State and Local Governments would co-operate over these programs, providing the basis for integration between governments and agencies (Caton, 2004, pers. comm.).

### **State**

The State Government is responsible for the protection of South Australia's seas and coasts. The South Australian "coast" is defined as 'one hundred metres inland from the mean high water mark in urban areas (550 metres in rural areas) to 3 nautical miles seaward of mean low water. It includes all land within any estuary, inlet, creek, bay or lake subject to the ebb and flow of the tide. The landward boundary may be varied by legislation' (*South Australia Coast Protection Act 1972*).

A number of Acts and documents are associated with the management of coastal environments in South Australia. The Commonwealth Government has a responsibility to implement International Treaties, although the State Government undertakes many of the recommendations and actions outlined in national frameworks such as the Coastal Policy, Oceans Policy and the Coast and Clean Seas Program.

The main coastal management instrument used by the State is the *South Australia Coast Protection Act 1972*. This act was created to make provision for the conservation and protection of beaches and the coast of South Australia. Empowered under this act is the Coast Protection Board, an authority that advises on coastal zone development plans and applications, has power of direction over coast protection structures and excavation and filling of material in accordance with regulations under the Development Act 1993. The Board is responsible for the management of the Metropolitan Adelaide Beach Management Strategy (reviewed in 1997). The Board's management policies are set in the Metropolitan Coast Protection District Management Plan (gazetted in 1985) and can also be found in the consolidated Coast Protection Board Policy Document 2004. Other relevant management instruments include:

- *Aboriginal Heritage Act 1993*
- *Aquaculture Act 2001*
- *Crown Lands Act 1929*
- *Development Act 1993*
- *Environmental Protection Act 1993*
- *Fisheries Act 1982*



- *Harbours and Navigation Act 1993*
- *Heritage Act 1993*
- *Local Government Act 1999*
- *Country Fires Act*
- *National Parks and Wildlife Act 1972*
- *Native Vegetation Act 1991*
- *Natural Resource Management Act 2004*<sup>1</sup>

The Living Coast Strategy for South Australia (Government of South Australia, 2004) outlines the State Government's environmental policy directions for sustainable management of South Australia's coastal, estuarine and marine environments. While it has an emphasis on promoting environmental stewardship, the Strategy also supports development of industries operating within sustainable frameworks. It encompasses a range of Government environmental initiatives and programs and sets out the policy directions that the State Government will be taking over the next five years to help protect and manage South Australia's coastal areas, estuaries and marine ecosystems for their conservation and sustainable use.

The Strategy identifies and addresses six key objectives for the State's coastal, estuarine and marine environments: These are to:

- Provide a legislative and policy framework for ecologically sustainable development and use of our coastal, estuarine and marine environments;
- Conserve and safeguard the natural and cultural heritage of our coastal, estuarine and marine environments;
- Control pollution of our coastal, estuarine and marine environments;
- Protect our coastal, estuarine and marine environmental assets;
- Improve understanding of our coastal, estuarine and marine environments;
- Develop and maintain partnerships between State and local governments, community and industry.

## Regional

South Australia does not have a comprehensive system of strategic regional coastal plans, as at February 2005. In the late 1990s two regional plans were established through *Coast and Clean Seas* funding: the *South East Coastal Strategy* and *Great Australia Bight 1000* for the State's West Coast (Caton, 2004, pers. comm.).

## Mount Lofty Ranges and Greater Adelaide

While governments and communities have taken a number of positive steps to protect and manage water, soils and natural biodiversity of inland, coastal and marine environments, those resources are still not being managed in a manner that ensures sustainability for future generations. Without effective action, there will be continued degradation of those assets that underpin the health and prosperity of the region.

(Mount Lofty Ranges Interim Integrated Natural Resource Management Group, 2003)

Under the second round of Natural Heritage Trust Funding (NHT 2), Australia has been divided into 56 regions for the distribution of funds for Integrated Natural Resource Management (INRM). South Australia has been divided into 8 INRM Regions: Aboriginal

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<sup>1</sup> The *Natural Resource Management Act 2004* repeals and replaces the *Animal and Plant Control [Agricultural & Other Purposes] Act 1988*, *Soil Conservation and Landcare Act 1989* and the *Water Resources Act 1997* – refer to <http://www.nrm.sa.gov.au/nrm/legislation.html>



Lands, Eyre Peninsula, Rangelands, Mount Lofty Ranges and Greater Adelaide (MLRGA - the Adelaide metropolitan coastline is situated within this region), Kangaroo Island, Northern and Yorke Agricultural District, South East and Murray Darling Basin.

Each region is required to produce an INRM Plan that 'considers all environmental, social and economic impacts of natural resource decisions on a regional basis' (Australian Government, 2004). Following plan production, 'Governments, and others, will invest in regional plans based on clear targets and appropriate monitoring to ensure the best NRM outcomes' (Australian Government, 2004). Caton (2004, pers. comm.) notes the two before-mentioned regional Plans for the State's South East and West Coast provided 'valuable building blocks for their regional INRM plans'.

The Plan for the MLRGA was prepared by the Mount Lofty Ranges Greater Adelaide Interim Integrated Natural Resource Management Group (MLRGA IINRM Group, 2003) with the following vision:

The natural resources of the MLRGA be managed sustainably for environmental, social and economic benefit. Regional communities be actively engaged in the management of natural resources, informed about the key issues, possessing appropriate skills, and provided with adequate support and facilitation.

A draft of the Management Plan was released for community consultation and comment in late 2002, with a final copy lodged with the Federal Government and public release occurring in late 2003. The Plan features the following components (MLR IINRM Group, 2003):

- Identification of main natural resource assets of the MLRGA region (water, soil and natural biodiversity) and the development of sustainability objectives for those assets;
- Review of state of the natural resource assets of the MLRGA region (through analysis of existing plans and strategies and targeted consultation with a variety of interest groups);
- Examination of the processes that threaten natural resources in the region, followed by a prioritised ranking of these processes;
- Establishment of goals, actions and targets for dealing with priority threatening processes as they relate to the region's key assets;
- Identification of opportunities for more effective management of those natural resources;
- Consideration of monitoring and evaluation requirements.

The section that addresses assets of the MLRGA region describes the coast, marine and estuarine environments as being a rich asset of the region and notes that they are also subject to 'significant pressure' from high population density, substantial tourism and inappropriate coastal and marine developments. The following table summarises the state of coastal and marine environments in MLRGA and identifies associated pressures, as described in the Management Plan (MLRGA IINRM Group, 2003).



Section of INRM Management Plan for the MLRGA Region	Comment
3.1 Introduction	Coastal and marine areas within the region are subject to a variety of uses - primary production, conservation, recreation and tourism. These uses tend not to currently have the same degree of planning or control as other landuses.
3.2.1 Marine Water Resources	Marine and estuarine water resources are under pressure from wastewater treatment effluent and contaminated stormwater discharges, which is directly linked with the extensive loss of seagrass beds and mangroves.
3.2.2 Soils	Substrates of coastal, estuarine and marine environments are included in this category. One of the pressures on sediment sources on the metropolitan coastline has been a community demand for sandy beaches with implications for sand sources.
3.2.3 Natural Biodiversity	<p>The region's coastal and marine environment comprises of a range of different habitats, including sandy beaches, dunes, rocky cliffs and headlands, and coastal lakes, containing a wide range of plant communities.</p> <p>A number of Reserves along the coastline assist in protecting endangered, vulnerable and rare species present in the area. These include Deep Creek, Hallett Cove and Marino Conservation Parks, Aldinga Scrub and Torrens Island. These Reserves provide protection from impacts such as coastal development.</p> <p>While coastal development has contributed to economic growth, there is some concern with matters such as: diminished access to coastal areas, loss of biodiversity and scenic amenity through vegetation clearance, off-road vehicles, illegal dumping of waste degrading coastal areas and invasion of coastal environmental weeds.</p> <p>In addition to their intrinsic value, coastal and marine environments are an important component of the region's culture and economy, providing commercial and recreational fishing opportunities as well as other recreational activities.</p>

While the MLRGA INRM Plan and Investment Strategy provide a basis for initiating and funding coastal conservation activities, it is hoped that future iterations will feature a more comprehensive coverage of coastal and marine issues within the Region.

The Management Plan focuses on defining actions and setting targets to address priority threatening processes. Targets are set at three distinct levels (MLRGA INRM Group, 2003):

- *Aspirational Targets* – Long-term targets with associated statements regarding the desired condition of natural resources in the longer term (i.e. 50 years).
- *Resource Condition Targets* (RCTs) – Specific, time-bound and measurable resource condition targets that have a 10-20 year timeframe for target achievement. These targets must be pragmatic and achievable. For example:

RCT 7.2.2 *No further decline in sand resources and associated marine and dune ecosystems: by 2012*

RCT 8.3.2 *A halt in the decline of seagrass, reef and other estuarine and marine environments, with clear targets established: by June 2006.*

*Management Action Targets* (MATs) – Short-term targets (1-5 years) relating to management actions or capacity building. Targets relate to management actions that will ensure progress towards the longer-term resource condition targets. For example:

MAT 6.2.9 *Develop... a comprehensive Risk Assessment program for marine, estuarine and coastal biodiversity, identifying areas/communities at risk, threatening processes, management strategies, baselines and targets: by Dec 2005.*



MAT 7.2.7 *Review/investigate priorities for sand management including a review of the Metropolitan Beach Protection Strategy: by 2005.*

The Management Plan for the region is also important in that it provides a basis for the development of an Investment Strategy (prepared through the MLR INRM Group), through which the community can access funding support for NRM actions through programs such as the Natural Heritage Trust. Funding is apportioned across five program areas:

- Capacity Building
- Monitoring and Evaluation
- Investigations and Planning
- On-ground Works
- Administration

The Management Plan and Investment Strategy are designed to be core reference documents for NRM planning in the region and the development of NRM funding programs. One of the positive aspects to come out of the NRM process in the MLRGA has been the recent appointment of a NRM Coast and Marine Officer that aims to support the MLRGA INRM Group and community to facilitate best practice, integrated coastal management outcomes across the region.

For further information on NRM Regions, Management Plans and Investment Strategies, refer to: <http://www.nrm.gov.au>.

### **SA Urban Forest Biodiversity Program**

The South Australian Urban Forest Biodiversity Program (UFBP) was created in 1997 to provide a coordinated approach to biodiversity management across the Adelaide metropolitan area. The vision of the program is to:

*'Redress biodiversity loss in metropolitan Adelaide by protecting remaining native flora and fauna and increasing the biomass of locally indigenous species'* (Turner, 2001).

The UFBP plays a facilitatory and funding role in coordinating linkages between local, state, national and international initiatives and strategies. One of the program's goals is to involve all levels of government and the community in managing biodiversity conservation, and to incorporate these considerations into planning and land management in the metropolitan area.

In 2001, UFBP produced the document *"Conserving Adelaide's Biodiversity: Resources"* (Turner, 2001), which provides a framework for sound urban biodiversity management in the Adelaide region. This resource is designed to be a tool for planners, land managers, educators, students, politicians and community groups, and aims to improve decision-making and planning across metropolitan Adelaide.

The publication contains maps identifying priority vegetation types and remnant vegetation sites, site descriptions, threats to biodiversity, management strategies, species lists and technical information on the region's flora and fauna. Refer to the UFBP website <http://www.urbanforest.on.net> for further information.



## Adelaide Metropolitan Coast

Management of the Adelaide metropolitan coast is the shared-responsibility of both State and Local Governments through a grant program provided by the South Australian Coast Protection Board, coupled with technical advice from government bodies and the Board (DEH, 2004). This management includes (DEH, 2004):

- Conservation for heritage, cultural, environmental and ecological values, including the impact of water quality on amenity, seagrasses and general coastal processes;
- The use of beaches for recreation and leisure activities;
- Development of a coastal dune buffer for the protection of foreshore development and maintenance of sandy beaches affected by storm erosion, including the impact of sea level rise from climate change;
- Monitoring the beach system so that necessary artificial replenishment and redistribution measures can be determined and undertaken.

The Coast Protection Board has been responsible for the maintenance of Adelaide's metropolitan beaches and minimising damage to residential properties and infrastructure through storm events since the early 1970s. The Board's management policies concentrate on beach replenishment as a successful strategy for coast protection and beach maintenance (DEH, 2004). These policies are based on research conducted in the 1970s that identified a natural erosion trend on the southern metropolitan beaches and proposed sand replenishment to address the ongoing loss of sand from the Adelaide coast and maintain the position of the coast (DEH, 2004). Ongoing data collection and research combined with social and political pressure to maintain the city's beaches have ensured that this strategy continues (DEH, 2004).

## Coast Park

Refer to page 1 for information on this initiative.

## Local

### Local Government

Local government is the most significant tier of government for on ground management of the coast, most notably with regard to land based discharges of stormwater and sewage, the management of coastal reserves (including dunes) and in coastal planning (Caton, 2004, pers. comm.). Local Councils oversee the everyday maintenance of the coast and seaside facilities, and share the responsibility of shore protection with the South Australian Government.

Councils make decisions on coastal development at the coast in two ways (Harvey and Caton, 2003):

1. Through the development and dissemination of strategic plans: in all Australian coastal councils, development plans must feature planning zones and objectives and principles for those zones. Zoning can reflect residential areas, areas subject to coastal erosion or flooding, or areas that may be potentially affected by climate change induced sea-level rise.
2. Through individual decisions in response to development applications involving the interpretation of development plans.

In South Australia, Local Governments are required to review their development plans every three years, each time seeking the approval of the Minister for Planning.

The City of Charles Sturt funds a full-time Coastal officer position which occurred as a result of the endorsement of Council's Coastal Management Plan in April 2002. This is a unique position as no other Council in the Adelaide metropolitan area has a full time



position dedicated to the coast. Council has been able to undertake a number of coastal initiatives through the funding of this position including the support of its coastal groups.

## Community Groups

'Among the settled parts of the Australian coast... Crown coastal reserves are usually under the care and control of council, but community groups frequently play a vital role in their management'

(Harvey and Caton, 2003).

Community groups play a vital role in coastal management, undertaking on-ground works, vegetation surveys, campaigning and raising issues of concern, as well as educating the public and maintaining awareness. There are three active Dunecare/Coastcare groups along the City of Charles Sturt coastline; the Semaphore Park Coastcare Group, the Tennyson Dunes Group and the Henley and Grange Dunecare Group. The Grange and West Lakes Kiwanis also work within the Tennyson Dunes mainly repairing walkway fencing.

The Henley and Grange Dunecare Group is the volunteer group that operates within this study area. The group was formed in 1992 (Harvey, 2004, pers. comm.) and has undertaken various coastal rehabilitation works throughout the area. The group has also been successful in applying for government grants for other projects including the establishment of a community nursery, interpretive signage and educational brochures.

Other groups that have undertaken coastal works in the area include the Henley Beach Primary School, West Beach Primary School, Fulham North Primary School and Navy SA.

There are also four *Adriana klotzschii* (Coastal Bitter-bush) planting sites within this project area that were established in 2003 (Clutterham, 2005, pers. comm.). Follow-up plantings have occurred in the following years in an attempt to establish a habitat corridor for the eventual release of the Bitter-bush Blue Butterfly, whose population is now reduced to two isolated locations, one at Torrens Island and the other at Normanville. These planting areas are part of a larger plan initiated by the South Australian Butterfly Association to reintroduce the species back to the metropolitan area.

Community-based activities at the Henley South and West Beach Dune Reserve have primarily been funded through Council and Phase 1 of the Coastcare program. Coastcare, part of the Commonwealth Government's *Coastal Action Program*, was established to assist community groups to work on schemes to promote ecologically sustainable development at the coast. Small grants were available to community groups to undertake activities including on-ground works, education and training, planning and monitoring. The objectives of the program were to:

- Engender in local communities (including local industries), a sense of stewardship for coastal and marine areas;
- Provide opportunities and resources for residents, volunteers, business and interest groups to participate in coastal management;



- Support community identification of natural and cultural heritage resources;
- Facilitate interaction between the community and bodies with responsibility for managing coastal areas.

(Commonwealth Government, 2002)

Funding of Coastcare (through NHT1) occurred over a five-year period from 1996–2001 and it was widely expected NHT2 would continue to fund this Program. Whilst Coastcare was included in the NHT2 Bi-Lateral Agreement, it took a considerable amount of time to come on-stream. Twenty Coastcare Facilitator positions exist nationally, three of which are located in South Australia, including a position based in the Adelaide metropolitan area. At this stage, these Coastcare positions are one-off 18-month positions (Commonwealth funded). This role is in addition to the NRM Coast and Marine Officer role (12-month position) discussed in the Regional Context section of this appendix.



## Appendix 2: Plant Species List for Henley South and West Beach Dune Reserve

Family	Scientific Name	Common Name	Rating SL
LEGUMINOSAE	* <i>Acacia cyclops</i>	Western Coastal Wattle	
LEGUMINOSAE	<i>Acacia cupularis</i>	Cup Wattle	R
LEGUMINOSAE	<i>Acacia longifolia</i> var. <i>sophorae</i>	Coastal Wattle	
LEGUMINOSAE	<i>Acacia nematophylla</i>	Coast Wallowa	K
EUPHORBIACEAE	<i>Adriana klotzschii</i>	Coast Bitter-bush	U
CRASSULACEAE	* <i>Aeonium</i> spp.	Succulent	
LILIACEAE	* <i>Agapanthus africanus</i>	Agapanthus	
CASUARINACEAE	* <i>Casuarina glauca</i>	Swamp Sheoak	
CASUARINACEAE	<i>Allocasuarina verticillata</i>	Drooping Sheoak	
GRAMINEAE	* <i>Ammophila arenaria</i>	Marram Grass	
ASTERACEAE	* <i>Arctotheca calendula</i>	Capeweed	
ASTERACEAE	* <i>Arctotis stoechadifolia</i>	White Arctotis	
ASTERACEAE	* <i>Argyranthemum frutescens</i>	Marguerite Daisy	
GRAMINEAE	* <i>Arundo donax</i>	Giant Reed	
LILIACEAE	* <i>Asparagus aethiopicus</i>	Asparagus Fern	
CHENOPODIACEAE	<i>Atriplex cinerea</i>	Coast Saltbush	
GRAMINEAE	* <i>Avena</i> sp.	Wild Oat	
GRAMINEAE	* <i>Bromus diandrus</i>	Great Brome	
CRUCIFERAE	* <i>Cakile maritima</i> ssp. <i>maritima</i>	Two-horned Sea Rocket	
AIZOACEAE	* <i>Carpobrotus edulis</i>	Hottentot Fig	
AIZOACEAE	<i>Carpobrotus rossii</i>	Native Pigface	
MYRTACEAE	* <i>Chamelaucium uncinatum</i>	Geraldton Waxflower	
RUBIACEAE	* <i>Coprosma repens</i>	Mirror Bush	
GRAMINEAE	* <i>Critesion</i> spp.	Barley Grass	
COMPOSITAE	* <i>Cynara cardunculus</i>	Artichoke Thistle	
GRAMINEAE	* <i>Cynodon</i> sp.	Couch	
COMPOSITAE	* <i>Daisy</i> sp.	Daisy (ornamental)	
LILIACEAE	<i>Dianella brevicaulis</i>	Short-stem Flax-lily	
SAPINDACEAE	<i>Dodonaea viscosa</i>	Sticky Hop-bush	
AIZOACEAE	* <i>Drosanthemum candens</i>	Rodondo Creeper	
GRAMINEAE	* <i>Ehrharta calycina</i>	Perennial Rye Grass	
CHENOPODIACEAE	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush	
EUPHORBIACEAE	* <i>Euphorbia paralias</i>	Sea Spurge	
EUPHORBIACEAE	* <i>Euphorbia terracina</i>	False Caper	
UMBELLIFERAE	* <i>Foeniculum vulgare</i>	Fennel	
OLEACEAE	* <i>Fraxinus rotundifolia</i>	Desert Ash	
FUMARIACEAE	* <i>Fumaria capreolata</i>	White Fumitory	
AIZOACEAE	* <i>Galenia pubescens</i> var. <i>pubescens</i>	Coastal Galenia	
COMPOSITAE	* <i>Gazania</i> sp.	Gazania	
CYPERACEAE	<i>Isolepis nodosa</i>	Knobby Club-rush	
GRAMINEAE	* <i>Lagurus ovatus</i>	Hare's Tail Grass	
CYPERACEAE	<i>Lepidosperma gladiatum</i>	Sword Rush	U
MYRTACEAE	* <i>Leptospermum laevigatum</i>	Coast Tea-tree	
PLUMBAGINACEAE	* <i>Limonium companyonis</i>	Statice	
BRASSICACEAE	* <i>Lobularia maritima</i>	Alyssum	
GRAMINEAE	* <i>Lolium perenne</i>	Perennial Rye Grass	
LEGUMINOSAE	<i>Lotus australis</i>	Austral Trefoil	U
SOLANACEAE	* <i>Lycium ferocissimum</i>	African Boxthorn	
LEGUMINOSAE	* <i>Medicago polymorpha</i> var. <i>polymorpha</i>	Burr-medic	
LEGUMINOSAE	* <i>Medicago truncatula</i>	Barrel Medic	
LEGUMINOSAE	* <i>Melilotus indica</i>	King Island Melilot	
AIZOACEAE	* <i>Mesembryanthemum crystallinum</i>	Ice Plant	
MYRTACEAE	* <i>Metrosideros excelsa</i>	New Zealand Christmas Bush	
POLYGONACEAE	<i>Muehlenbeckia gunnii</i>	Coastal Climbing Lignum	
MYOPORACEAE	<i>Myoporum insulare</i>	Common Boobialla	
ZYGOPHYLLACEAE	<i>Nitraria billardierei</i>	Nitre-Bush	
ONAGRACEAE	* <i>Oenothera stricta</i> ssp. <i>stricta</i>	Common Evening Primrose	
OLEACEAE	* <i>Olea europaea</i> ssp. <i>europaea</i>	Olive	
COMPOSITAE	<i>Olearia axillaris</i>	Coast Daisy Bush	
CACTACEAE	* <i>Opuntia stricta</i>	Prickly Pear	
ASTERACEAE	* <i>Osteospermum fruticosum</i>	Seascape Daisy	
OXILIDACEAE	* <i>Oxalis pes-caprae</i>	Soursob	



VEGETATION MANAGEMENT PLAN FOR THE HENLEY SOUTH AND WEST BEACH DUNE RESERVE

GRAMINEAE	* <i>Parapholis incurva</i>	Curly Ryegrass	
GERANIACEAE	<i>Pelargonium australe</i>	Australian Pelargonium	U
GERANIACEAE	* <i>Pelargonium</i> sp.	Pelargonium	
GERANIACEAE	* <i>Pennisetum clandestinum</i>	Kikuyu	
GRAMINEAE	* <i>Pennisetum setaceum</i>	Fountain Grass	
PLANTAGINACEAE	* <i>Plantago coronopus</i>	Bucks-horn Plantain	
PLANTAGINACEAE	* <i>Plantago lanceolata</i>	Ribgrass	
PORTULACACEAE	* <i>Portulaca oleracea</i>	Common Purslane	
COMPOSITAE	* <i>Reichardia tingitana</i>	False Sowthistle	
CHENOPODIACEAE	<i>Rhagodia candolleana</i> var. <i>candolleana</i>	Sea-berry Saltbush	
CHENOPODIACEAE	<i>Rhagodia parabolica</i>	Mealy Saltbush	
RHAMNACEAE	* <i>Rhamnus alaternus</i>	Buckthorn	
EUPHORBIACEAE	* <i>Ricinus communis</i>	Castor Oil Plant	
LAMIACEAE	* <i>Rosmarinus officinalis</i>	Rosemary	
POLYGONACEAE	* <i>Rumex crispus</i>	Curled Dock	
DIPSACACEAE	* <i>Scabiosa atropurpurea</i>	Scabious	
GOODENIACEAE	<i>Scaevola crassifolia</i>	Cushion Fanflower	
ASTERACEAE	* <i>Senecio angulatus</i>	Cape Ivy	
COMPOSITAE	<i>Senecio lautus</i>	Variable Groundsel	
CRUCIFERAE	* <i>Sisymbrium orientale</i>	Wild Mustard	
COMPOSITAE	* <i>Sonchus asper</i>	Prickly Sow Thistle	
COMPOSITAE	* <i>Sonchus oleraceus</i>	Common Sow-thistle	
GRAMINEAE	<i>Spinifex sericeus</i>	Rolling Spinifex	
GRAMINEAE	* <i>Stenotaphrum secundatum</i>	Buffalo Grass	
TAMARICACEAE	* <i>Tamarix aphylla</i>	Tamarisk	
COMPOSITAE	* <i>Taraxacum officinale</i>	Dandelion	
AIZOACEAE	* <i>Tetragonia decumbens</i>	Sea Spinach	
AIZOACEAE	<i>Tetragonia implexicoma</i>	Bower Spinach	
GRAMINEAE	* <i>Thinopyrum junceiforme</i>	Sea Wheat-grass	
CHENOPODIACEAE	<i>Threlkeldia diffusa</i>	Coast Bonefruit	
ASPHODELACEAE	* <i>Trachyandra divaricata</i>	Dune Onion Weed	
TROPAEOLUM	* <i>Tropaeolum majus</i>	Nasturtium	
GRAMINEAE	* <i>Vulpia</i> sp.	Fescue	

\* Denotes weed species in the Henley South and West Beach Dune Reserve

SL = Southern Lofty Ranges

Total Number of Species Recorded: 96

Total Number of Indigenous Species Recorded: 26

Total Number of Introduced Species Recorded: 70

Key to Conservation Ratings

**E** – Endangered, rare and in danger of disappearing from the wild in the short-term

**V** – Vulnerable, rare and in danger of disappearing from the wild in the long-term

**R** – Rare, occurring infrequently, either locally abundant in a limited area or sparsely distributed over a wide area

**K** – Status uncertain, but considered likely to be of conservation significance

**Q** – Not yet assessed but flagged as being of possible significance

**U** – Uncommon, declining and inadequately conserved, but not yet rare and vulnerable

Ratings from – Lang, P.J. & Kraehenbuehl, D.K. "Plants of particular conservation significance in South Australia's Agricultural Regions" (Jan 2002) unpublished database, DEH.

## APPENDIX 3: Priority Weed Species (in order of Priority Weeds Lists)

### *Trachyandra divaricata* - Dune Onion Weed



Photo: Claire Petherick



Photo: Vicki Hagan

**Above left:** Close-up *Trachyandra divaricata* plant and seed head -note seed heads ready to detach.  
**Above Right:** Infestation at Semaphore South Dune Reserve.

#### Family

- Asphodelaceae

#### Description

- *Trachyandra divaricata* is a tufted perennial herb to knee high with flat, shiny, hairless leaves. It flowers in winter to late spring, although several plants were noticed flowering after summer rainfall. Flowers have white petals with a pair of yellow spots near the base. Flower stems detach and blow as “tumbleweeds”, dispersing seeds. Mature plants produce up to 50,000 seeds by the end of the flowering period (Heyligers, 2002). Flowering stems are buoyant when dry.
- The Western Australian Department of Agriculture (Moore in Petherick, 2003, pers.comm.) made the following comments:
  - Seed is believed to be short-lived. If mature plants are killed and seed set prevented, then very few plants will be present. Monitoring should occur for four years;
  - Root fragments will regrow and occasionally stem fragments take root;
  - Individual plants live for between three and six years, however this is confused by some plants suckering from the base or falling over and rooting from the stem which makes the life of some individuals many years. However, in healthy vegetation the plant is suspected to not live longer than six years.
- There may be some confusion between *Trachyandra divaricata* and the native *Dianella brevicaulis* (Short-stem Flax-lily). The main differences are that the leaves of *Dianella brevicaulis* are indented and neither fleshy nor shiny, the inflorescence is much more delicate than that of Dune Onion Weed, and that *Dianella brevicaulis* features purple/white fruits and flowers.

#### Distribution

- This plant is a major problem in coastal Western Australia and New South Wales. There are two known populations in metropolitan Adelaide – serious infestations are present in the Port Adelaide Enfield dunes and a small population exists in the Port Noarlunga dunes. Recently individual plants have been sighted at the Tennyson and



Brighton dunes on the central metropolitan coast (Sandercock, 2004, pers. comm.). It has been recorded locally at Semaphore Park.

### Location in the Henley South and West Beach Dune Reserve

- Seven individual plants were discovered within the Reserve. Six plants were found approximately 200m north of Henley Beach Road. The seventh plant was recorded 175 metres south of the Torrens Outlet adjacent a walking path.

### Location in the Dune System

- Potentially grows from the face of the foredune to the hind dunes.

### Threat Assessment

- *Trachyandra divaricata* is the highest priority weed for the Reserve as it is highly invasive and capable of rapidly establishing in the dunes, potentially becoming a monoculture (as demonstrated in photograph on previous page). It is critical that the plant does not become further established in the Reserve and that it does not spread further south to other sand dune systems. It is toxic to some animals.
- Follow-up control will need to be on-going for several years, as the life of the seed bank is unknown and dry flower stalks can float for several months. In addition, CSIRO research has found that some seeds submerged in seawater remain viable after eight months (Heyligers, 2002). Monitoring of the Reserve and adjacent dune systems will be of utmost importance to prevent recolonisation and new outbreaks.

### Control Techniques\*

- Small plants may be hand-pulled, while larger plants will require a fork or trowel to loosen sand. Ensure the root system is removed and plants and seed heads are removed from site and destroyed to prevent recolonisation - dumped plants have been observed growing some months after removal in the Port Noarlunga dunes (Hagan in Petherick, 2003, pers. comm.). The Western Australian Department of Agriculture (2002) recommends the following chemical treatments:

Situation	Herbicides	Method
Apply in sensitive areas	500ml of glyphosate plus 2.5ml wetting agent per litre of water	Wick or blanket applicators or sponge gloves in winter or spring (prior to flowering) when plants are actively growing.
Large areas	20g/ha chlorsulfuron (750g/kg) or 0.4g plus 25ml wetting agent in 10L water	Spray in winter or spring when plants are actively growing. This will kill most annual legumes and the seedlings of some native species.

\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective, however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## ***Arctotis stoechadifolia* – White Arctotis**



**Above Left:** *Arctotis stoechadifolia* flower head. **Above Right:** Infestation near Torrens Outlet, West Beach

### **Family**

- Compositae

### **Description**

- *Arctotis stoechadifolia* is a prostrate perennial plant that grows in dense clumps. Grey-green leaves are divided with indented margins. Flower petals are white, cream, pink, bronze or blue, with blue centres and are approximately 10cm in diameter. Flowering occurs late spring to early summer.

### **Distribution**

- *Arctotis stoechadifolia* originates from Southern Africa and has become widespread near townships and settlements along the coast of South Australia due to its popularity as a garden plant.

### **Location in the Henley South and West Beach Dune Reserve**

- Several large infestations are present in Management Zone 2 and 3 of the Reserve from south of Lexington Road through to the Henley Sailing Club.

### **Location in the Dune System**

- *Arctotis stoechadifolia* is a hardy coastal plant that inhabits the area from the foredune through to the protected hind dune area. The plants present at Henley South and West Beach are thriving in the sheltered rear swales.

### **Threat Assessment**

- *Arctotis stoechadifolia* forms dense mats that smother native vegetation and eliminate smaller indigenous plants through shading and competition for resources. This results in a reduction in biodiversity as native vegetation can be replaced by thick monocultures of *Arctotis stoechadifolia*. This weed can also alter dune shape by causing dunes to have a steeper slope. This species should be removed in conjunction with the construction of the Coast Park shared-use path.

### **Control Techniques\***

- Spray *Arctotis stoechadifolia* from mid winter through to early spring with glyphosate at the prescribed rate of 100ml/10L water plus a surfactant. Follow-up control may be required. Hand-pulling of plants can occur throughout the year, however care must be taken to ensure the plant is removed from the dunes and carefully disposed of. Revegetate with appropriate indigenous species such as *Carpobrotus rossii* (Native Pigface).

\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Leptospermum laevigatum* - Coastal Tea-tree



**Above Left:** *Leptospermum laevigatum* leaves and woody fruit. **Above Right:** Established *Leptospermum laevigatum* plant in swale, West Beach.

### Family

- Myrtaceae

### Description

- A large shrub to 4m high. The leaves are 2cm long, grey-green in colour, flat, broad and hairless. Leaves are also aromatic when crushed, producing a fragrance resembling eucalyptus oil (South Australian Coast Protection Board, 2003). White flowers are solitary and approximately 15-20 mm in diameter, comprising five petals and numerous stamens. Flowering occurs from August to November and is followed by the production of woody, cup-shaped capsules that contain between six to eleven valves that release seeds when opened.

### Distribution

- *Leptospermum laevigatum* is an Australian native that originates from Victoria, New South Wales and Tasmania. There has been some debate over whether it is also native to the Victor Harbor region; however the consensus is that it was originally introduced to the state as a garden ornamental, possibly by early whalers and sealers (Sandercock, 2005, pers. comm.). Its weedy distribution covers South Australia, Queensland, Western Australia and Victoria (where located beyond its natural range). *Leptospermum laevigatum* grows extensively on sandy soils in South Australia, with a large population present locally at the Henley South and West Beach dune systems. It inhabits coastal dunes, headlands and scrubs where conditions are harsh and windswept.

### Location in the Henley South and West Beach Dune Reserve

- Serious infestations exist within the Reserve. The most northerly occurrences are just south of Gilmore Road. Most plants are distributed south of the Torrens Outlet with the most southerly in the swale adjacent Cavendish Street.

### Location in the Dune System

- *Leptospermum laevigatum* is a versatile plant that can withstand strong winds, salt and sand spray, drought, frost and periodic inundation. These traits enable the species to occupy the zone from the foredune through to the hind dune.

### Threat assessment

- *Leptospermum laevigatum* is known to invade disturbed dunes, significantly altering the environment by forming dense thickets that shade out other indigenous plants, reducing biodiversity and adversely affecting the habitat of native fauna.



### Control techniques\*

- Many of the plants within the reserve provide habitat and soil stability. To continue providing these benefits and yet prevent further spread, it is important to remove the plants in a staged manner (see Appendix 5 for control techniques). Plants can be removed individually or pruned back over several years, ensuring that limbs are removed from the dunes as they are more than likely to contain seed bearing fruit (Taylor, N/D). Indigenous plants will need to replace gaps left by removal. Smith (2001) recommends the cut and swab method during spring and summer, using triclopyr and diesel at a rate of 1:10. Taylor (N/D) comments that regrowth from a basal cut is uncommon, however monitoring for regrowth and seedlings should occur in the immediately surrounding area.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Argyranthemum frutescens* – Marguerite Daisy



Photo: Ron Sandercock



Photo: Ron Sandercock

**Above Left:** *Argyranthemum frutescens* flowers. **Above Right:** *Argyranthemum frutescens* infestation at Beachport, Victoria

### Family

- Compositae

### Description

- This species is a knee high shrubby daisy. The leaves are light green and fleshy. Flowers are small (up to 3cm long) white daisies with a yellow centre containing many seeds. It can be confused with the native *Senecio lautus* (Variable groundsel) as a seedling, but once mature *Senecio lautus* has a yellow flower, unlike the white flower of *Argyranthemum frutescens* (CPB, 2003).

### Distribution

- *Argyranthemum frutescens* is native to the Canary Islands. In South Australia it is found in high rainfall areas from the South East to Eyre Peninsula. It is found as a garden escape in sandy dunes and other sunny coastal areas such as clifftops.

### Location in the Henley South and West Beach Dune Reserve

- Eleven plants were located in the swale 200m south of Lexington Street.

### Location in the Dune System

- This species prefers the protection of swales and the landward face of dunes.

### Threat Assessment

- This species is most invasive in dune areas where there is disturbance. It competes aggressively with less vigorous native flora. Spread and dispersal occur via seed production. Due to the low numbers presently within the Reserve and the potential for spread it is recommended that all *Argyranthemum frutescens* plants are targeted for immediate removal.

### Control Techniques\*

- Physical removal when small is the most viable method, ensuring minimal disturbance to sand. Larger plants can be cut and swabbed using glyphosate. Smaller plants can be sprayed.

\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## Succulent/Cacti spp.



Above: *Succulents* escaped from gardens south of Torrens Outlet

### Family

- Various

### Description

- This group of plants feature numerous succulent and cacti species that often appear as individual plants in the middle and hind dunes of the Reserve. The terms 'succulent' and 'cacti' are broadly used to define plants with thick, fleshy, water-storing leaves. Species featured in this group include Prickly Pear (*Opuntia* sp.), Century Plant (*Agave Americana*) and many garden escapes that prosper in the dunes.

### Distribution

- Succulents often originate from tropical and dry subtropical regions. They have been introduced to the coastal environment as garden escapes through deliberate plantings, dumped garden refuse and natural spread from private gardens.

### Location in the Henley South and West Beach Dune Reserve

- The most northerly occurrence of succulents is approximately 75m south of Gilmore Road. They increase in number and density further south and reach a peak in a large infestation 10m north of Henley Sailing Club. The most southerly examples are 50m south of Cavendish Street, West Beach. There is a strong correlation between the incidence of succulent/cacti spp. and residential houses.

### Location in the Dune System

- Due to their ability to withstand harsh winds and drought conditions, succulents and cacti are capable of inhabiting areas from the foredune through to the hind dunes.

### Threat Assessment

- These plants increase nutrient levels, resulting in conditions favourable to other weeds that would not usually be able to grow in low nutrient conditions experienced in the coastal environment. Succulents and cacti species alter dune formation, harbour rabbits and rodents and significantly alter the visual amenity of an area (CPB, 2003). These species all require immediate removal.



### **Control Techniques\***

- Removal techniques will vary with plant species, although it is important to ensure all material is removed from the dunes as succulents and cacti reproduce vegetatively. Resources such as Parsons and Cuthbertson (1992) and Taylor (N/D) should be consulted for removal techniques for specific succulent and cacti species. Coastal and Environmental Officers may be able to provide further information.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Mesembryanthemum crystallinum* – Ice Plant



Photo: Claire Petherick

**Above Left:** *Mesembryanthemum crystallinum* close-up of flowerheads. **Above Right:** Established *Mesembryanthemum crystallinum* patch, Taperoo Dune Reserve.

### Family

- Aizoaceae

### Description

- *Mesembryanthemum crystallinum* is a prostrate annual succulent with angular leaves covered in glossy wart-like glands. Growth commences from a rosette. Flowers are white featuring several rows of thin delicate petals, occurring in spring and early summer. Plants turn reddish brown at maturity.

### Distribution

- Native to Europe and Africa

### Location in the Henley South and West Beach Dune Reserve

- A few isolated specimens are located north and south of the Torrens Outlet. Most occurrences are south of West Beach Road alongside a north-south aligned formal walkway.

### Location in the Dune System

- It is commonly found in degraded, more stable areas of sand dunes.

### Threat Assessment

- *Mesembryanthemum crystallinum* is highly allelopathic, providing conditions favourable only for the survival of its own seedlings (Sandercock in Petherick, 2004, pers. comm.) It is a rampant, mat forming plant which can smother native plants. All plants should be removed in conjunction with the construction of the Coast Park shared-use path. Replace plants with native species such as *Disphyma crassifolium* (Round-leaved Pig-face), *Threlkeldia diffusa* (Coastal Bonefruit), or *Tetragonia implexicoma* (Bower Spinach).

### Control Techniques\*

- Plants can be hand pulled and should be carefully disposed of to prevent further spread. Ensure all plant parts are removed from site to prevent further re-infestation. Monitoring for new infestations will be essential. Spot spraying is also effective. Plants should be eradicated to prevent further establishment. Monitoring of the site will be critical.

\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## **Gazania sp. - Gazania**



**Above left:** *Gazania* flower and leaves. **Above right:** *Gazania* plants invading swale, West Beach.

### **Family**

- Compositae

### **Description**

- *Gazania* is a perennial garden daisy of variable colours ranging from cream to gold, with black or dark purple markings close to the petal base. Flowering occurs throughout the year, but mainly from spring through to autumn. It is available commercially.

### **Distribution**

- Originally from South Africa, *Gazania* is a garden escape that has become naturalised in all Australian states and territories except the Australian Capital Territory. *Gazania* is a serious weed in coastal South Australia, including the Adelaide metropolitan coastline, with major infestations present in the City of Charles Sturt dunes.

### **Location in the Henley South and West Beach Dune Reserve**

- *Gazania* is widely distributed throughout the dune Reserve across all Management Zones.

### **Location in the Dune System**

- *Gazania* is a hardy, salt tolerant plant that is highly adaptable, enabling it to occupy the area from the foredune scarp through to the back dune (Taylor, N/D).

### **Threat Assessment**

- *Gazania* is an aggressive plant that readily establishes in coastal environments where it significantly alters the vegetation community structure by suppressing native plants. Eradication will be an ongoing problem given the frequency of the plant's usage in residential gardens. It is recommended that community awareness of the environmental impacts of this garden escape be raised. With the support of Coast Park, the Coastal Protection Branch (DEH) and SA Urban Forest Biodiversity Program have recently produced a coastal weeds *Coastline* publication that addresses serious coastal weeds, including *Gazania*, which are still being planted in residential gardens. Literature such as the above brochure could be distributed to residential houses along the Esplanade and to coastal councils and land managers to assist in raising awareness of the issue of garden escapes in the coastal environment.

### Control Techniques\*

- Hand-pull smaller plants and use a trowel for more established plants. Ensure the root system is removed and that plants are disposed of carefully. Alternatively, the edges of the *Gazania* mat can be folded over to stop the plant's spread. Plants can be slashed throughout the year although repeated treatments will be required. In terms of chemical applications, Smith (2001) recommends spot spraying with metsulfuron and a penetrant during spring, at a rate of 5-7 grams per 100 litres of water, ensuring that native plants are covered to prevent off-target damage.
- As the Reserve is severely infested with *Gazania* sp., it is recommended the Bradley Method of weed control (Buchanan, 1989) be adopted, whereby weed control works out from the least affected areas. Consistent with this, it is recommended the infestation immediately south of the Torrens Outlet be removed as a priority to create a sizeable *Gazania* free area. This should be carried out as part of the construction phase of the Coast Park shared-use path in the area between Ozone Street car park and Henley Sailing Club. Following this, efforts for removal should be concentrated on working towards the centre of the Reserve from the northern and southern ends. It is essential that all weed eradication programs be closely associated with revegetation using indigenous species recommended in this Management Plan

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Lycium ferocissimum* - African Boxthorn



Photo: Vicki Hagan



Photo: Claire Petherick

**Above Left:** Close-up of *Lycium ferocissimum* fruit, spines and leaves. **Above Right:** *Lycium ferocissimum* invading hind dune vegetation at Semaphore South.

### Family

- Solanaceae

### Description

- *Lycium ferocissimum* is a large perennial shrub that occasionally grows to 5m, although it is usually around 2m in the dune environment. Stems are rigid, featuring many branches and a series of long spines along the main stem. Leaves are flat, bright green and arranged in clusters of between 5 and 12 (Blood, 2001). Plants produce attractive white and purple flowers from two years of age, with fruit mainly occurring in summer. The fruit is a fleshy round orange-red berry. The plants can sometimes lose their leaves in winter, producing new growth in spring.

This species can be confused with the native *Nitraria billardierei* (Nitre Bush), *Bursaria spinosa* (Christmas Bush) and *Lycium australe* (Australian Boxthorn - endangered in the Southern Mount Lofty Region). The following table (adapted from Taylor, N/D) describes the essential differences between these species.

Species	<i>Lycium ferocissimum</i>	<i>Lycium australe</i>	<i>Nitraria billardierei</i>	<i>Bursaria spinosa</i>
Leaves	Flat obovate bright green fleshy, obovate to elliptic.	Thick, fleshy, narrowly obovoid to ellipsoid, slightly compressed. Grey-green.	Thick glaucous grey-green.	Linear to lanceolate or obovate to ovate.
Flower	White to lilac tube with five petals.	White to lilac with dark markings.	White, 5-6 petals with reflexed lobes.	White, five petals in clusters or large terminal.
Fruit	Bright orange-red berry, globose to broadly ovoid.	Ovoid to ellipsoid orange-red berry.	Purple oblong grape-like.	Dry brown flat oval capsule with notch.

NB: glossary available on page 71.

### Distribution

- Originally from South Africa, *Lycium ferocissimum* was introduced into Australia as a hedge plant. It is a weed in all states and territories, with legislation for its control in each, except for the Australian Capital Territory and Western Australia. It is found in all parts of South Australia apart from those that are extremely arid. Most populations are in the southern half of the state where there is higher rainfall. It is a major environmental weed in the Mount Lofty Ranges and is present locally at the West Beach Dune Reserve and across the Charles Sturt dunes. It often occurs under roosting spots where seeds have been dropped by birds.

### Location in the Henley South and West Beach Dune Reserve

- There are presently five plants remaining within the dune system. These are found between the Torrens Outlet and the Henley Sailing Club in the hind dune.

### Location in the Dune System

- *Lycium ferocissimum* can withstand harsh coastal conditions and inhabits coastal foredune, swale and hind dune areas, with the greatest populations occurring in swales where there is more moisture available. It is also known to inhabit cliffs and escarpments.

### Threat assessment

- When left unchecked, *Lycium ferocissimum* forms dense, impenetrable thickets that out-compete native species. The plant is declared noxious in South Australia - its *control or destruction is required throughout the state* (Parsons and Cuthbertson, 1992). Priority for removal must be given to the areas that are least infested with the weed and where plants are starting to become established in patches of native vegetation.
- *Lycium ferocissimum* harbours pest animals such as foxes and rabbits, however it also provides safe nesting sites for indigenous bird species. While plants in Henley South and West Beach are only small to medium in size, the fact that they may provide habitat for indigenous fauna needs to be taken into consideration when removing. Areas where *Lycium ferocissimum* is removed will need to be replaced with vegetation of a similar structure to provide habitat for native fauna. This plant has the potential to become dominant in the dune system as it is highly invasive, oppressive and is readily dispersed by animals. All plants must be eradicated in the short term.

### Control Techniques\*

- Hand-pull small young seedlings. Cut and swab or spot spray during spring-summer when plants are over 30-40cm in height. Smith (2001) and Taylor (N/D) recommend a triclopyr and diesel mixture, or alternatively a strong mixture of glyphosate be applied immediately to the cut plant, taking care to ensure the cambium layer of the plant is treated. This, combined with adequate chemical application, will ensure that the chemical is translocated to the plant's storage organs, destroying dormant growing buds and preventing suckering (Carter and Cooke, 1991). It is important that plants are monitored over a number of years to eradicate regrowth germination of new plants.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Euphorbia paralias* - Sea Spurge



**Above Left:** Individual *Euphorbia paralias* plant. **Above Right:** *Euphorbia paralias* infestation, West Beach.

### Family

- Euphorbiaceae

### Description

- *Euphorbia paralias* is an herbaceous perennial to 1 metre high with a strong, deep taproot. Stems are upright and woody, producing a milky sap when broken. Flowers are very small, yellow-green and arranged in clusters at the top of stems. Flowering occurs from September through to May. Leaves are bluish green, fleshy, hairless and waxy, sometimes turning yellow-red due to dying foliage and/or reactions to the saline conditions of the environment. A single plant can produce approximately 5000 viable seeds per year (Blood, 2001).

### Distribution

- *Euphorbia paralias* originates from Europe and North Africa. It is found along Australia's southern coast and offshore islands from Fremantle, Western Australia, to Ulladulla, New South Wales, and Tasmania. It is widespread in South Australia, including along the Adelaide metropolitan coastline. Numerous infestations are present along the Charles Sturt coast. Its entry into Australia is prohibited.

### Location in the Henley South and West Beach Dune Reserve

- There are several large populations within the Reserve. The plant is present in Management Zones 1, 2 and 3.

### Location in the Dune System

- *Euphorbia paralias* colonises incipient and hind dunes. The plant can tolerate a variety of conditions including highly saline environments, sand accretion and blasting, full sun, drought and fluctuating ground water levels. *Euphorbia paralias* can rapidly colonise eroded areas with little vegetation, such as blowouts, often becoming the dominant plant.

### Threat Assessment

- Several populations are well established in Management Zones 2, 3 and 4. These populations are becoming monocultures, suppressing the growth of indigenous plants such as *Senecio lautus* (Variable Groundsel), *Carpobrotus rossii* (Native Pigface) and *Threlkeldia diffusa* (Coastal Bonefruit). *Euphorbia paralias* is likely to be an ongoing problem given its widespread distribution, high seed production and the fact that seed can remain buoyant in sea water for at least eight years, with more than half still being viable after two years afloat (Blood, 2001). Populations within the Reserve need



to be controlled to prevent further spread - any new infestations that arise should be eradicated immediately.

### **Control Techniques\***

- Hand pull using gloves, as the sap is known to cause dermatitis reactions in some people. Hand-pulled flowering plants should be removed from the Reserve and carefully disposed of to prevent recolonisation or further distribution. Plants may be slashed in spring to reduce seed set. Taylor (N/D) recommends the use of glyphosate at designated rates with a suitable surfactant as an effective means of control. Ensure that appropriate local native plants replace removed weeds.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## ***Carpobrotus edulis* – Hottentot Fig**



Photo: Ron Sandercock

### **Family**

- Aizoaceae

### **Description**

- This species is a fleshy ground-running succulent. Leaves are approximately 4-10 cm long and 5-17 mm wide, dull green and often with a reddish tinge, and triangular in section. Stems of the herb grow on or just below the surface of the sand. Flowers have many yellow petals that in time change to pink, and reach up to 8cm in diameter (CPB, 2003). Fruit is globular and range in colour from yellow to red/purple, and is 20 mm in diameter. Roots extend along the entire length of the plant.
- This species can be confused with the native *Carpobrotus rossii* (Native Pigface). *Carpobrotus rossii* has a pink flower with a white base, unlike the yellow flower of *Carpobrotus edulis*. Another introduced species, *Carpobrotus aequilaterus* (Angular Pigface) has similar features to both *Carpobrotus edulis* and the native *Carpobrotus rossii* and may be hybridising with *Carpobrotus rossii* (CPB, 2003). *Carpobrotus aequilaterus* has a large purple flower and yellow/pink centre.

### **Distribution**

- *Carpobrotus edulis* is native to South Africa and widely grown as a sand stabiliser. In South Australia, the species distribution extends from the coastal areas of the South East to the Eyre Peninsula, including Yorke Peninsula, Northern Lofty and Murray regions (CPB, 2003). It is naturalised in Western Australia.

### **Location in the Henley South and West Beach Dune Reserve**

- Several plants exist between Lexington Road and the Henley Sailing Club in the hind dunes. Identification is extremely difficult when not in flower.

### **Location in the Dune System**

- *Carpobrotus edulis* prefers the protection of the swale and hind dunes but will tolerate conditions further forward.

### **Threat Assessment**

- *Carpobrotus edulis* invades coastal cliffs and sand areas, displacing native plants as it forms dense mats which smothers other species. This plant competes aggressively and is hardy, tolerating grazing. The plant reduces biodiversity through hybridisation with the local native, *Carpobrotus rossii*.
- Spreading occurs both by seed and vegetative reproduction. Seed dispersal is via birds and mammals that eat the fruit which contain hundreds of seeds. Vegetative



reproduction occurs when a segment of leaf or stem breaks from the parent plant and then takes root and establishes, growing up to 1m per year (CPB, 2003).

### **Control Techniques**\*

- It is important to mark plants in spring, whilst the plant is in flower to ensure correct identification. Marked plants can then be removed the following winter. Replant using the local species. Plants can be physically removed, ensuring no segments remain behind. Little information is available for chemical controls. Trials should be carried out by a licensed Pest Plant Officer in conjunction with the City of Charles Sturt Coastal Officer.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Euphorbia terracina* - False Caper

**Right:** *Euphorbia terracina* infestation at the base of the hind dune, Semaphore South. **Below:** Individual *Euphorbia terracina* plant, Semaphore South.



Photo: Claire Petherick



Photo: Claire Petherick

### Family

- Euphorbiaceae

### Description

- An erect perennial herb to 80 cm high, with several greenish-red leaf stems rising from a shortened crown at ground level. Stems produce a milky sap which can cause dermatitis reactions. Leaves are bluish-green to yellow-green (depending on soil), linear/lanceolate in shape, and approximately 1.5-4cm long (Parsons and Cuthbertson, 1992). Flowers are green, cup-shaped, producing three-lobed fruit containing grey or mottled brown-black seeds. The plant has a hardy taproot and is toxic to livestock.

### Distribution

- *Euphorbia terracina* is found in well-drained sandy soils with significant populations in Victoria and a small amount in New South Wales. It has naturalised in coastal sand dunes near Adelaide and southern Western Australia. In South Australia, it is widely distributed in coastal and near coastal regions from the west of Eyre Peninsula through to the South East (Taylor, N/D). *Euphorbia terracina* is commonly found in neglected areas and shallow soils high in calcium carbonate. It is native to the Mediterranean.

### Location in the Henley South and West Beach Dune Reserve

- *Euphorbia terracina* is mostly confined to a zone between Ozone Street and the Henley Sailing Club. A small infestation exists opposite Cavendish Street in the rear swale. It is present in Management Zones 2 and 3.

### Location in the Dune System

- This weed generally occupies the mid and hind dune areas where the environment is less saline and more protected from harsh coastal conditions. It is prevalent in disturbed areas along the eastern boundary of the site.

### Threat Assessment

- *Euphorbia terracina* is declared a noxious weed in South Australia, meaning its control or destruction is required throughout the whole state (Parsons and Cuthbertson, 1992). The plant competes aggressively with other species, is very adaptable, and can create monocultures in favourable conditions. The seed is highly viable and activates readily with disturbance (Taylor, N/D). The plant should be controlled and contained due to its noxious weed rating and ability to become further established in disturbed areas of the Reserve.

### Control Techniques\*

- Hand-pull using gloves to prevent dermatitis reactions, ensuring the plant is removed from site and destroyed to prevent re-establishment or transportation to other areas. Remove plants bearing seed; slash remaining plants and spray all regrowth. Spot spray using glyphosate with a surfactant to breakdown the water resistant coating on leaves. Parsons and Cuthbertson (1992) state that in Western Australia chlorsulfuron has proven to be successful on young plants, and triclopyr on more mature plants. It is important that removed plants are replaced with appropriate indigenous species to prevent erosion. Furthermore, the site must be monitored for regeneration, particularly in July and August.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Acacia cyclops* – Western Coastal Wattle



Above: Mature *Acacia cyclops* plant, West Beach.

### Family

- Leguminosae

### Description

- *Acacia cyclops* is a bushy shrub growing to 4m, although more commonly to 2m in the coastal environment. Bright green leaves feature between 3 and 5 parallel veins that meet at the tip. Yellow wattle flowers are usually arranged in clusters of three. Seed pods are twisted and contain seed surrounded by bright red arils. This plant can easily be confused with the indigenous species *Acacia longifolia* var. *sophorae*, *A. cupularis* and *A. ligulata*. The former has wider leaves and flowers that are arranged in a long cylinder-shaped cluster while the latter has leaves that feature a single central vein. The twisted seed pods of *Acacia cyclops* are unique to this species.

### Distribution

- *Acacia cyclops* is an Australian plant indigenous to the western coast of South Australia. *Acacia cyclops* is thought to have been introduced to the Southern Mount Lofty Ranges through revegetation works and escaped garden plantings. A small population of this species is present locally at Henley South and West Beach.

### Location in the Henley South and West Beach Dune Reserve

- A small population of *Acacia cyclops* exist near the Henley Sailing Club in the rear swale and high on the hind dune.

### Location in the Dune System

- *Acacia cyclops* prefers the protection of swales and the hind dunes.

### Threat Assessment

- *Acacia cyclops* competes with indigenous species and is spreading within the Reserve. It can form dense thickets that suppress native vegetation. The species is providing habitat and food for indigenous bird species in the older established plantings. For this reason, staged removal over a five year period, should take place and plants replaced with indigenous *Acacia* species that will also provide habitat and food for native fauna.



## Control Techniques\*

- Initially, all juvenile plants should be eradicated and replaced with appropriate native species such as *Acacia cupularis*, *A. ligulata* or *A. nematophylla*. Staged removal of larger plants will need to occur over a five year period, ensuring that sufficient native vegetation is available for native fauna (See Appendix 5 for techniques). Cut and swab plants using strong mix of triclopyr and diesel or glyphosate. Monitor for new seedling growth. Small seedlings and young plants may be hand pulled, although care must be taken to ensure correct identification.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Galenia pubescens* – Coastal Galenia



**Above Left:** Close up of *Galenia pubescens* leaves and spent flowerheads. **Above Right:** Established *Galenia pubescens* plant on hind dune, Henley South.

### Family

- Aizoaceae

### Description

- *Galenia pubescens* is a soft grey-green groundcover with pinkish white flowers. It is well established within the Henley South and West Beach Dune Reserve and is found in degraded areas, particularly along access paths. According to Taylor (N/D), it will die back over long dry summer periods and will then recover with autumn rain.

### Distribution

- Native to South Africa. It is widespread throughout most coastal regions.

### Location in the Henley South and West Beach Dune Reserve

- *Galenia pubescens* is spread throughout the entire length of the dune Reserve but is confined to the disturbed areas of the rear swale or hind dunes.

### Location in the Dune System

- *Galenia pubescens* prefers the protected but disturbed areas of the rear swales and hind dunes, predominantly along access paths and footpaths.

### Threat Assessment

- *Galenia pubescens* prevents the germination of native plants due to its ground hugging habit and also smothers established vegetation. It is a problem plant along the Adelaide coastline, including the Charles Sturt coastal systems.

### Control Techniques\*

- Plants can be grubbed or hand-pulled throughout the year, although they will need to be replaced with appropriate native plants. Galenia may also be sprayed in early spring with glyphosate and an appropriate surfactant at recommended rates. Alternatively, plants may be cut and swabbed.

\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## ***Pennisetum setaceum* – Fountain Grass**



**Above:** *Pennisetum setaceum* plants on sea wall, Henley South.

### **Family**

- Gramineae

### **Description**

- A coarse, densely tufted perennial grass to 1metre tall. The inflorescence is a long, cylindrical, pink-purple and feathery spike. Leaves grow to 20-65cm long and 2-4mm wide, with smooth leaf sheath (Coastal Protection Branch, 2003).

Due to its distinctive appearance, *Pennisetum setaceum* is not easy confused with any native species (Gibbs, 2001)

### **Distribution**

- *Pennisetum setaceum* originates from North and East Africa, and the Middle East. It is cultivated as an ornamental garden grass in Australia. It is commonly available commercially and used in landscaping. It is often found as a garden escape, rapidly distributing along main roads and coastal cliffs. *Pennisetum setaceum* is naturalised in South Australia, Victoria, New South Wales, Queensland, Northern Territory, Western Australia and the Northern Territory (Blood, 2001).

### **Location in the Henley South and West Beach Dune Reserve**

- A small, resilient infestation of *Pennisetum setaceum* exists opposite Lexington Street along the sea wall. A single plant was documented adjacent Mellor Street. This appears to have escaped from a nearby garden.

### **Location in the Dune System**

- *Pennisetum setaceum* appears to prefer the rear swale and hind dunes where soil has a greater water holding capacity and is protected from harsh winds.

### **Threat Assessment**

- *Pennisetum setaceum* is well adapted to fire and often regenerates after fire (CPB, 2003). It grows in thick clumps, interfering with the growth and survival of native species.
- Seeds are spread via wind, water, fire, birds and other animals, people's clothing, as well as vehicles and garden waste. Seeds remain viable for approximately 7 years in soil (CPB, 2003).



Due to the small number of plants and their potential for spread within the Reserve it is recommended all plants are targeted for immediate removal.

**Control Techniques\***

- It is recommended that seed-heads are first removed and destroyed away from the site before slashing and spraying. Hand-pull or spot spray juveniles. Spray with glyphosate at the rate of 150ml per 10 litres of water.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Oenothera stricta* - Evening Primrose



Photo: Claire Petherick

**Left:** Individual *Oenothera stricta* plant. **Below:** *Oenothera stricta* infestation at Taperoo Dune Reserve.



Photo: Claire Petherick

### Family

- Onagraceae

### Description

- *Oenothera stricta* is an erect perennial herb to 1m that is sometimes woody. Flowers have four petals between 2-4cm in length, are yellow, changing to burgundy red and usually only fully open during low light conditions and are comprised of and. Leaves are hairy, linear to lanceolate in shape and range from 2cm to 6 cm in length (Auld and Medd, 1987).

### Distribution

- *Oenothera stricta* originates from South America. It is widespread throughout Australia and is commonly found in disturbed areas along roadsides and on sandy soils. It is known to be present in sand dunes along the northern Adelaide metropolitan coast.

### Location in the Henley South and West Beach Dune Reserve

- The most northerly occurrences of *Oenothera stricta* are opposite Lexington Road, the most southerly being opposite Cavendish Street. The largest populations are found immediately either side of the Torrens Outlet.

### Location in the Dune System

- The extent of this species' distribution in sand dune environments is not known, however within the Henley South and West Beach Dune Reserve it occupies the area from the back of the foredune through to the mid dune area. It can withstand sand burial although it appears to favour semi-stable areas.

### Threat assessment

- At present, only several small populations exist within the dunes. The species has the capacity, however, to out-compete native species. *Oenothera stricta* is naturalised within nearby dune systems and consequently should be controlled and contained during the construction phase of the Coast Park shared-use path to ensure it does not become further established.



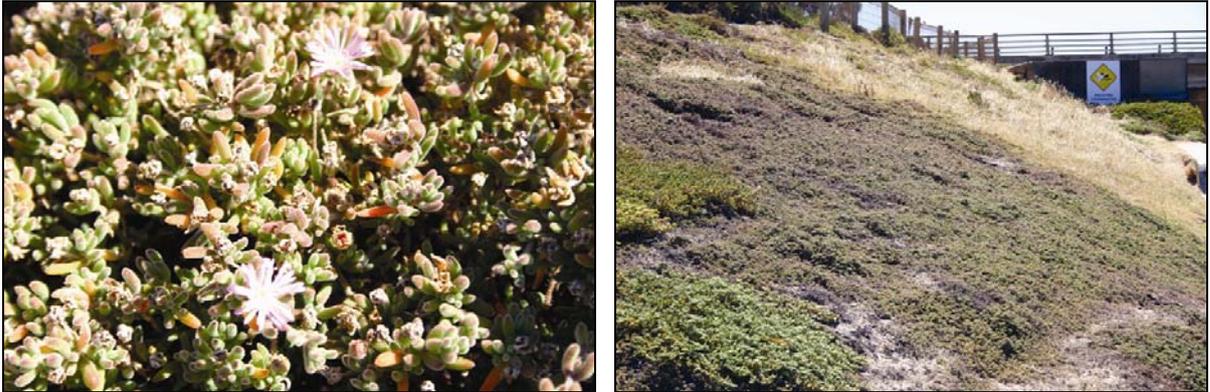
**Control techniques\***

- Use a weed fork to remove plants manually prior to seeding, taking care to remove as much of the deep taproot as possible without causing excessive soil disturbance. The p plants with the following herbicide applications recommended by the Western Australian Department of Agriculture (2002). Note that *Oenothera stricta* is considered to be relatively tolerant of glyphosate.

Situation	Herbicides	Method
Young actively growing plants	1g triasulfuron plus 100ml spray oil in 10L water or 4L/ha 2,4-DB (400g/L).	Spot spray plants in spring or autumn.
Comment	Both herbicides are considered to be fairly selective in bushland situations although 2,4-DB is recommended in areas that contain many seedlings of native species. Re-spray any regrowth.	

\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Drosanthemum candens* – Rodondo Creeper



**Above Left:** *Drosanthemum candens* leaves and flowers. **Above Right:** *Drosanthemum candens* infestation on hind dune, Henley South

### Family

- Aizoaceae

### Description

- *Drosanthemum candens* is a trailing perennial herb with bright pink flowers and small succulent leaves. *Drosanthemum candens* may be mistaken for the natives *Disphyma crassifolium* (Round-leaved Pigface), *Enchylaena tomentosa* (Ruby Salt Bush) and *Threlkeldia diffusa* (Coastal Bone Fruit).

### Distribution

- *Drosanthemum candens* is native to South Africa. It is used as an ornamental ground-cover. It is found in South Australia, Victoria and Western Australia.

### Location in the Henley South and West Beach Dune Reserve

- A small population exists on the rock wall opposite Henley Beach Road. A larger infestation is present immediately north of the Torrens Outlet, high on the rear dune. The most southerly populations are along the path adjacent Graydale Street.

### Location in the Dune System

- Little is known about the distribution of *Drosanthemum candens*, however it appears to occupy the protected and disturbed areas of the rear swales and hind dunes.

### Threat Assessment

- Due to its mat forming nature, native plant regeneration is greatly hampered where this plant exists.

### Control Techniques\*

- Limited information is available on the control of *Drosanthemum candens*. Trials using glyphosate could be conducted by a licensed pest plant operator in conjunction with the Council's Coastal Officer. When manually removing the plant ensure (where possible) no leaf segments remain in the soil. Revegetate the area, using local native species.

\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Tetragonia decumbens* – Sea Spinach



**Above Left:** *Tetragonia decumbens* leaves and flowers. **Above Right:** Established *Tetragonia decumbens* plant in swale, Henley South.

### Family

- Aizoaceae

### Description

- *Tetragonia decumbens* is prostrate perennial growing to 5m in width. Leaves are semi-succulent and green. Small yellow flowers with numerous stamens occur in spring. Brown winged fruits are buoyant and readily distributed along ocean currents and blown across the ground by strong winds (Heyligers, 2002). *Tetragonia decumbens* can be confused with the indigenous *Tetragonia implexicoma*.

### Distribution

- Native to South Africa, *Tetragonia decumbens* is believed to have been introduced to Australia via contaminated ballast water. It was first observed in Adelaide at Glenelg Beach in 1963.

### Location in the Henley South and West Beach Dune Reserve

- *Tetragonia decumbens* is restricted to several small infestations between South Street and Henley Beach Road.

### Location in the Dune System

- Commonly found in disturbed areas such as near seawalls or car parks (Heyligers, 2002). The plant has also been observed growing in the swales and mid-dunes along the coast at Semaphore (Petherick, 2004).

### Threat Assessment

- While not an aggressive weed, *Tetragonia decumbens* should be removed as soon as possible as climatic conditions are favourable for further establishment of this species and numbers in the Reserve are currently low.

### Control Techniques\*

- Limited information is available on the control of *Tetragonia decumbens*. Trials using glyphosate could be conducted by a licensed pest plant operator in conjunction with the Council's Coastal Officer. When manually removing the plant ensure (where possible) no leaf segments remain in soil.

\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Cynara cardunculus* – Artichoke Thistle

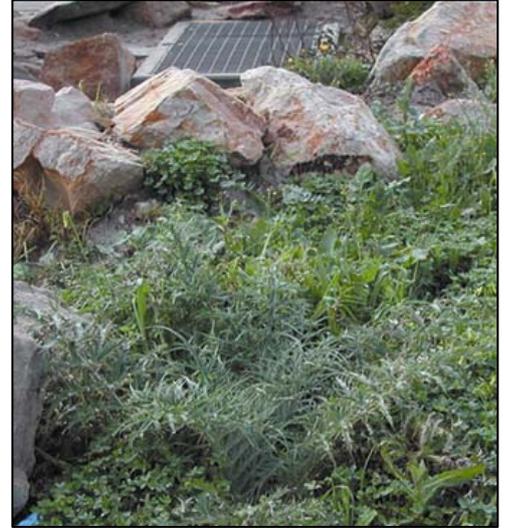


Photo: Claire Petherick

**Above Left:** *Cynara cardunculus* flower head. **Above Right:** Established *Cynara cardunculus* plant in stormwater outlet, West Beach.

### Family

- Asteraceae

### Description

- *Cynara cardunculus* is a perennial herb growing to 2m in favourable conditions. Flowers are blue to purple, occurring from November to February.

### Distribution

- Native of the Mediterranean. It is present in all states and territories in Australia and is a noxious weed in South Australia and Victoria. Dense infestations are present in South Australia, including the Adelaide region.

### Location in the Henley South and West Beach Dune Reserve

- At present only one large specimen exists in the rear swale, near the south west corner of Henley Sailing Club car park.

### Location in the Dune System

- Generally confined to moister environments (such as areas subject to stormwater inundation) or heavier soils.

### Threat Assessment

- Further inland, *Cynara cardunculus* is capable of forming impenetrable thickets. Along the dunes it is not considered to be a serious threat, with the exception areas subject to stormwater inundation.

### Control Techniques\*

- Smith (2002) recommends spot spraying the plant during spring with triclopyr (5-7 grams per 100 litres of water) and a penetrant. Take care when removing this plant as contact can cause dermatitis reactions and spines may inflict slight injury.

\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## Cynodon sp - Couch



Photo: Claire Petherick



Photo: Claire Petherick

**Above Left and Right:** *Cynodon* sp. invading Semaphore South Dune Reserve.

### Family

- Gramineae

### Description

- *Cynodon* sp. is a prostrate mat-forming perennial grass that is bluish-green in colour. Leaf blades are narrow, flat or folded and between 2-15cm in length. Stems are branched and creeping, featuring many nodes (Transport SA, 2002). Flower stems are erect, up to 25 cm in height and composed of small flowers with purple spikes. Flowering occurs late spring to early summer. The grass may be confused with native grasses *Sporobolus virginicus* (Salt Couch) and *Distichlis distichophylla* (Emu Grass) commonly found in saline areas.

### Distribution

- *Cynodon* sp. is a grass commonly used in lawns and is found throughout Australia. It grows in a variety of soil types ranging from sand to clay (Lamp et al, 2001). *Cynodon* sp. is native to the Kimberley region and tropics worldwide.

### Location in the Henley South and West Beach Dune Reserve

- It is present along the eastern boundary of the site and is being watered by sprinkler run-off from the adjacent lawn reserves. Several patches are also present in the swales (Management Zone 2) in the northern section of the Reserve. It is a particularly problematic garden escape near houses immediately south of the Torrens Outlet.

### Location in the Dune System

- *Cynodon* sp. is often present in the hind dunes and swales where it has regrown from dumped lawn clippings, spread from adjacent gardens or deliberately planted to extend domestic lawns.

### Threat Assessment

- *Cynodon* sp. is an invasive grass that can densely cover bare areas (Transport SA, 2002). It will out-compete native ground-cover plants and continue to spread if not controlled. *Cynodon* sp. grows amongst native species, making control very difficult.

### Control techniques\*

- Spot spray *Cynodon* sp. over summer using glyphosate at a mix of 1:100 with water and surfactant. Taylor (N/D) also recommends the use of herbicides on large patches of couch, suggesting that the area be tackled 'a bit at a time', ensuring that dead patches are filled with appropriate native species. It is important to ensure the chemical is not overused and there is a short period between applications due to the residual nature of glyphosate in sandy environments.
- In areas where *Cynodon* sp. is infesting native vegetation and manual control or the use of glyphosate is impractical it can also be sprayed using the selective herbicide fluazifop -p-butyl at a rate of 1:100. Be careful not to spray where native grasses are present.
- In terms of manual control, small populations of *Cynodon* sp. can be removed by loosening sand around the root system, while large infestations can be slowly weeded back on a regular basis (Taylor N/D). Once again, it is vital that removed *Cynodon* sp. is replaced with appropriate native species. Ensure that all material is removed from the dunes to prevent re-establishment. Check for regrowth.
- Solarisation is another technique that may be applied to control this grass and involves using heat from the sun to 'cook' weeds and their seeds. According to Greening Australia Victoria (Horlock, 1998), this involves covering the ground with a transparent or black plastic sheet which is sealed air tight by burying edges of the sheet. During summer, temperatures generated under the sheet may reach as much as 60°C and prolonged exposure (usually around 4 weeks) will kill the majority of weeds and some of the seed stock (Horlock, 1998).

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## ***Rhamnus alaternus* – Buckthorn**



Above: *Rhamnus alaternus* leaves and fruit.

### **Family**

- Rhamnaceae

### **Description**

- *Rhamnus alaternus* is a large shrub or small tree which grows to 1.5-5m high. It is densely branched from ground level with smooth upper stems (Robertson, 1994). It has broad, oval-shaped, leaves which are 2-7.5cm in length. Leaves are alternate and leathery, with a dark green upper surface and a pale, glossy underside. Flowers are yellow-green, 3-4 mm in diameter, with 5 petals, fused at the base and fragrant. They are clustered in short spikes along the stem. Fruit is an egg shaped, smooth, firm berry 5mm long, which begin as green, through red, and ripening to black with several seeds (Robertson, 1994 and Blood, 2001). Roots are woody and branched with a diameter similar to the trunk (Blood, 2001).
- This species can be confused with the indigenous *Alyxia buxifolia* (Sea Box) and *Adriana klotzschii* (Coast Bitter-bush).

### **Distribution**

- *Rhamnus alaternus* is native to the Mediterranean Region and is commonly used in Australia as an ornamental garden hedge. In South Australia, the species distribution extends from the South East to the Eyre Peninsula near the coast. Other areas include the Northern and Southern Lofty Ranges, Murray and Yorke Peninsula regions. Also found in Victoria, Tasmania, Western Australia and New South Wales.

### **Location in the Henley South and West Beach Dune Reserve**

- The most northern specimen of *Rhamnus alaternus* exists 175m south of Gilmore Road. Several plants are present between Lexington Road and Ozone Street. The most southerly plant is located 175m south of the Torrens Outlet.

### **Location in the Dune System**

- *Rhamnus alaternus* prefers the protection offered by swales, and will occupy the hind dune.



### Threat Assessment

- *Rhamnus alaternus* competes aggressively and has a rapid growth rate. It can tolerate disturbed, exposed and polluted environments, as well as drought, frost and wind exposed conditions (Blood, 2001). It invades dry coastal vegetation, grassland and grassy woodlands. The species regenerates readily by seed and is dispersed via birds and mammals that eat the seed.

### Control Techniques\*

- For small plants and young seedlings hand-pull and remove the bulk of the roots. For larger plants, cut stems at ground level and swab. Robertson (1994) recommends a mix of triclopyr and diesel at a ratio of 1:30 liberally applied immediately to the cut surface. Follow-up techniques of hand pulling and the treatment of regrowth should occur.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Osteospermum fruticosum* - Seascape Daisy



Photo: Claire Petherick

### Family

- Compositae

### Description

- *Osteospermum fruticosum* is a perennial herb that grows to 30-45 cm. It has green foliage and purple and white flowers.

### Distribution

- The extent of *Osteospermum fruticosum* distribution in Australia is not known. It is a garden escape and a weed of coastal areas in South Australia, including the Adelaide metropolitan coastline. Populations of *Osteospermum fruticosum* are present locally in the Henley South and West Beach dune systems.

### Location in the Henley South and West Beach Dunes

- There are several plants scattered throughout the eastern part of the Reserve. Numbers are relatively low.

### Location in the Dune System

- *Osteospermum fruticosum* is located at the back of the dune system where some shelter is provided from harsh coastal conditions.

### Threat Assessment

- *Osteospermum fruticosum* can readily establish in coastal environments where it significantly alters the vegetation community structure by suppressing native plants. It is important to eradicate this species while populations are low. It may be an ongoing problem if it is planted in nearby residential and council gardens.

### Control techniques\*

- Hand-pull smaller plants and use a trowel for more established plants, ensuring that the root system is removed. Dispose of carefully. Spray with glyphosate at a rate of 1.5:100 in spring and autumn. Ensure native plants are covered when spraying to prevent off-target damage.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Pennisetum clandestinum* - Kikuyu



**Above:** *Pennisetum clandestinum* infestation in stormwater outlet, West Beach.

### Family

- Gramineae

### Description

- *Pennisetum clandestinum* is a robust, mat-forming perennial grass with creeping stems to 3m long. Leaf blades are between 5-40 cm in length, flat, bright green to yellow-green and either hairless or slightly hairy (Lamp et al, 2001). Flowers are concealed (except for thread-like filaments) and occur from January to April.

### Distribution

- *Pennisetum clandestinum* originates from East Asia and is commonly used in Australia as a pasture and lawn grass. Naturalised in all states and territories it is also listed as one of the 'World's Worst Weed of Crops' (Blood, 2001). It is present locally in stormwater outlets which discharge into dunes along the Charles Sturt coastline.

### Location in the Henley South and West Beach Dune Reserve

- *Pennisetum clandestinum* is present in stormwater outlets (Management Zone 5) and adjacent housing where it may have escaped from gardens or used to extend lawns into the dunes.

### Location in the Dune System

- The grass inhabits areas that receive substantial water and thrives in nutrient-rich environments, hence its presence in stormwater outlet areas or close to housing.

### Threat assessment

- The grass will be a problem in Management Zones 3, 4 and 5 where there is sufficient moisture available. Here, *Pennisetum clandestinum* will be aggressive and out-compete native plants. *Pennisetum clandestinum* is often introduced to dune systems via dumping of garden clippings. It also releases allelopathic substances that inhibit the growth of other plants. It should be removed and replaced with appropriate indigenous species.



### Control techniques\*

- *Pennisetum clandestinum* can be dug out, taking care to ensure the plant is removed from the Reserve and disposed of carefully. *Pennisetum clandestinum* can be spot sprayed with glyphosate at a rate of 1:100 with water and a surfactant. This needs to occur over the warmer months, when the plant is actively growing (*Pennisetum clandestinum* is dormant over cooler months). Follow-up spraying will most likely be required. Care must be taken to not contact native plants with chemicals.
- Solarisation is another control technique that involves using heat from the sun to 'cook' weeds and their seeds. According to Greening Australia Victoria (Horlock, 1998) this involves covering the ground with a transparent or black plastic sheet which is sealed air tight by burying the edges of the sheet. During summer, temperatures generated under the sheet may reach as much as 60°C and prolonged exposure (usually around 4 weeks) can kill the majority of weeds and seed stock (Horlock, 1998).

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Tamarix aphylla* - Tamarisk, Athel Pine



Above: Mature *Tamarix aphylla* trees, Henley South.

### Family

- Tamaricaceae

### Description

- *Tamarix aphylla* is an evergreen tree growing between 10-18m in height, although usually smaller in the coastal environment. The bark is reddish brown, smooth on the branches and deeply furrowed into long narrow ridges on the trunk. The plant has a deep root system and is prone to suckering. Leaves are glaucous and have stems that appear to be segmented. Pink and white flowers are small and sessile, occurring in clusters at the end of twigs in spring and summer. Bell-shaped fruits containing numerous seeds mature in late summer. Mature trees set a large amount of seed, although most is often sterile.

### Distribution

- *Tamarix aphylla* originates from northern Africa, the Mediterranean and Asia. It was originally introduced into Australia as a shade plant and has since escaped, becoming a weed in arid areas of South Australia, New South Wales and Queensland. It commonly occurs along watercourses in central Australia.

### Location in the Henley South and West Beach Dune Reserve

- Two large planted trees exist between Lexington Street and Ozone Street alongside a pedestrian access path. Another large colony exists at the southern end of Henley Sailing Club car park.

### Location in the Dune System

- The distribution status of *Tamarix aphylla* is uncertain - in the Henley South and West Beach Dune Reserve it is located in the more stable, heavier soils of the hind dune area, however at the West Beach Dune System (central Adelaide metropolitan coast), stunted specimens are present on the high foredune and the following interdune swale.

### Threat Assessment

- *Tamarix aphylla* creates dense thickets through suckering. They displace native flora, cause increases in soil salinity, alter soil hydrology and geomorphology and also reduce the amount of resources available for native fauna. The plant grows well in open sun, can tolerate saline soils and will grow in areas of low and erratic rainfall. With the exception of the population at Henley Sailing Club car park all other plants



within the Dune Reserve must be eradicated, however care must be taken as the plants are stabilising the area of hind dune they inhabit. To limit erosion and instability, the use of jute matting is recommended as part of the revegetation process.

### **Control Techniques\***

- Parsons and Cuthbertson (1992) recommend that young plants are dug out and burnt off site, ensuring that as much of the root system as possible is removed to prevent suckering. For large plants, as with the case at Henley South and West Beach, trees should be cut at the base and swabbed immediately with picloram and 2,4-D or triclopyr, picloram and 2,4-D. Smith (2002) recommends cutting and swabbing or frilling plants over spring and summer at a rate of 1:10 with diesel. Indigenous vegetation will need to be planted at least one season prior and immediately after to compensate for the loss of habitat and soil stability these plant currently provide. This will also ensure the dune does not destabilise. Monitoring for regrowth will be essential in controlling these weeds.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Ammophila arenaria* - Marram Grass



**Left:** Close-up of *Ammophila arenaria*, Semaphore South.  
**Below:** *Ammophila arenaria* population near Henley Sailing Club.



Photo: Claire Petherick

### Family

- Gramineae

### Description

- An erect perennial grass to 120cm tall with long, spreading rhizomes. Leaves are stiff with strongly inrolled margins, grey to green in colour and arranged in dense tufts. Leaves are also smooth and hairless (unlike the native grass *Spinifex sericeus*, Rolling Spinifex). The seeding head is pale green to straw colour, flowering from September to February, with seeds that are often sterile. Reproduction is primarily through vegetative spread.

### Distribution

- *Ammophila arenaria* has been extensively used in previous dune stabilisation projects, which has significantly aided its spread. It is native to Europe and has become weedy in temperate zones of Australia. In South Australia, the species distribution extends from the South East through to the Far West Coast, excluding the Nullarbor dunes (Taylor, N/D). Several medium to large infestations occur within the Henley South and West Beach Dune Reserve.

### Location in the Henley South and West Beach Dune Reserve

- Several large infestations exist in what are now the hind dunes and rear swales (originally having been used in the area to establish dunes in the 1970s).

### Location in the Dune System

- *Ammophila arenaria* can occupy the area from the base of the foredune through to the hind dunes. It can alter foredune shape, creating steeper dunes that are more prone to erosion by waves (Blood, 2001).

### Threat Assessment

- There is some debate over the value of *Ammophila arenaria*. It is generally not recommended for use in revegetation projects, although it has not been targeted for removal due to the benefit the species provides in dune stabilisation. *Ammophila arenaria* alters dune shape, competes with indigenous plants such as *Spinifex sericeus*, and prevents the establishment of seedlings as the plant's long leaves act as a broom, sweeping sand in a circular motion around the plant. It can, however, eventually 'shut down' when soil conditions become more stable and allow indigenous species to grow amongst it. *Ammophila arenaria* should be replaced with the



indigenous grass, *Spinifex sericeus* (Rolling Spinifex) and other suitable native species.

### **Control Techniques**\*

- Taylor (N/D) comments that revegetation with native species is deemed to be the only means of control required. Indigenous seedlings can be planted in *Ammophila arenaria* as the plant provides native seedlings with some protection without impacting on their survival. This method has the advantage of ensuring removal of the plant does not occur without replacement.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Coprosma repens* - Mirror Bush



Above: *Coprosma repens* plant, West Beach.

### Family

- Rubiaceae

### Description

- *Coprosma repens* is a medium shrub, growing to between 2-4m, with glossy, slightly fleshy dark green leaves. Small greenish-white flowers arranged in clusters are produced in summer. Plants are dioecious, with female plants producing orange-red berries in autumn and winter (CPB, 2003).

### Distribution

- Native to New Zealand, *Coprosma repens* is now a common seaside plant throughout Australia. In South Australia, *Coprosma repens* is present in the Southern Mount Lofty Ranges, on the Eyre Peninsula and Kangaroo Island, and is a serious problem in higher rainfall areas, such as the South East.

### Location in the Henley South and West Beach Dune Reserve

- Several mature plants were surveyed just south of South Street. One further plant exists 50m south of the Torrens Outlet.

### Location in the Dune System

- *Coprosma repens* predominantly occupies the swale and hind dunes, although it is capable of surviving on the face of the foredune.

### Threat Assessment

- *Coprosma repens* is a garden escape that is a serious weed in coastal environments, where it inhibits and suppresses the growth of native vegetation.

### Control Techniques\*

- Seedlings and small plants can be hand-pulled while larger plants should be cut and swabbed using glyphosate at a rate of 1:10. Follow-up weed control is often required as plants reshoot. Younger plants may also be sprayed using glyphosate at a rate of 1.5:100 with an added surfactant.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## ***Arundo donax* - Giant Reed**



**Above:** *Arundo donax* infestation in stormwater outlet, Henley South.

### **Family**

- Gramineae

### **Description**

- *Arundo donax* is a perennial herb reaching 7m that is sometimes confused with introduced Bamboo. Its roots are deep, fleshy and can reshoot if disturbed. Leaves are lanceolate. Flowering occurs between September and May. Characteristics include rapid growth and vegetative reproduction. It prefers moist areas and drainage lines.

### **Distribution**

- The species is native to Southern Europe and Asia, and has naturalised in all states and territories except for Tasmania and the Australian Capital Territory.

### **Location in the Henley South and West Beach Dune Reserve**

- An established clump is present in the stormwater outlet at the end of Lexington Road. Another clump exists immediately adjacent the Henley Sailing Club car park.

### **Location in the Dune System**

- *Arundo donax* prefers the presence of regular water, hence its existence in the stormwater outflow. The southern plant is receiving water from car park runoff.

### **Threat Assessment**

- Once established, it is known to aggressively out-compete and suppress native vegetation.

### **Control Techniques\***

- Apply glyphosate at a rate of 1:10 to cut stumps, stems or leaves after flowering. Monitoring for regrowth will be essential in controlling this plant.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## ***Ricinus communis* - Castor Oil Plant**



**Above Left:** Close up of *Ricinus communis* seed heads. **Above Right:** Mature plant in stormwater outlet, West Beach

### **Family**

- Euphorbiaceae

### **Description**

- A large, open perennial shrub growing between 2-3m with hollow, pale green branches. Leaves are very large, glossy, reddish brown to green and produce an unpleasant odour when crushed. Flowers are arranged in terminal clusters in the axils of the upper branches with red female flowers located above yellow male flowers. Fruits are large spiny capsules containing three large mottled and highly poisonous seeds. Fruits explode when ripe, dispersing seeds. Ingestion of as little as 2 seeds can be fatal and *Ricinus communis* is a common cause of childhood poisonings. The leaves are also considered to be mildly poisonous.

### **Distribution**

- *Ricinus communis* is native to Africa and Asia. It has been introduced to most countries including Australia and is naturalised in all Australian states except Tasmania. *Ricinus communis* is found along the New South Wales coast. Its entry to Australia is prohibited and legislation applies in New South Wales and the Northern Territory.

### **Location in the Henley South and West Beach Dune Reserve**

- A single large plant was recorded growing within the stormwater outlet area, immediately south of the Torrens Outlet.

### **Location in the Dune System**

- The plant usually occurs in degraded areas and prefers moist environments.

### **Threat Assessment**

- Whilst not likely to be highly invasive in the Henley South and West Beach Dune Reserve, it is important the existing plant be removed due to its poisonous nature and the potential for it to become further established within stormwater outlets and retention basins where there is sufficient moisture.



### Control Techniques\*

- Mature plants may be cut and swabbed or sprayed prior to seed development (early spring-summer). According to Parsons and Cuthbertson (1992), *Ricinus communis* is tolerant of some herbicides but does respond to spraying with glyphosate or picloram and 2,4-D. Seedlings should be hand-pulled or grubbed using gloves. Follow-up control of seedlings will need to occur over several years and the Reserve should be monitored for any new populations. Extreme care must be taken given the highly toxic nature of this plant.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.

## *Casuarina glauca* – Swamp Sheoak, Grey Bull-oak



Above: Mature *Allocasuarina glauca* tree adjacent stormwater outlet, West Beach.

### Family

- Casuarinaceae

### Description

- *Casuarina glauca* is a medium sized tree usually 10-15m tall, occasionally reaching 25m. Foliage is weeping, often developing a dense crown. Branchlets are green, jointed and cylindrical. Reduced leaves appear as teeth at the nodes. The species is dioecious, with female trees producing small dark red flowers and male trees flowering as light-green spikes 4-7 cm long. Fruits are woody cones 1-3 cm long containing an average of 70 seeds per cone. Bark is dark grey and rough. The plant has a tendency to sucker.

### Distribution

- *Casuarina glauca* is native to Australia, originating from coastal areas in eastern Australia. It is a good shelter tree and is often used as a windbreak. It is found on the coastal belt of South Australia, Victoria, News South Wales, Australian Capital Territory, Western Australia and Queensland (in particular Fraser Island).

### Location in the Henley South and West Beach Dune Reserve

- Several mature specimens were documented close together between a pathway and stormwater outlet 75m south of the Torrens Outlet.

### Location in the Dune System

- *Casuarina glauca* prefers the protected swales and hind dune environments where soil is heavier and sufficient water is available.



### **Threat Assessment**

- This species is hardy and widely adaptable, with the ability to grow in wind, cold conditions, dry to waterlogged soils and areas of high salinity. They are found growing along estuaries, mangroves, swamps, open woodland and near beachfronts.

### **Control Techniques\***

- Cut and swab using a mix of triclopyr and diesel at a ratio of 1:30. Glyphosate and water, at a rate of 1:10 with follow-up applications is also effective. Spray smaller plants using glyphosate at a rate of 1.5:100. Hand-pull smaller individuals.

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\* Every effort has been made to ensure this information is accurate. The techniques suggested have proven to be effective however feedback on alternative techniques is welcome. Chemical applications should only be conducted by a certified pest plant operator.





## Appendix 5: Common Weed Removal Techniques \*

(from Robertson, 1994)

### Hand Pulling

- Hand pulling of smaller plants is easiest in the wetter months of the year when the soil is soft and the seedlings are much easier to pull out.
- Seedlings: take hold of the plant at ground level and pull. If you pull at any point higher on the stem it may break and the plant will then require swabbing with herbicide.
- Small woody plants: take hold of the stem at ground level and gently rock the plant back and forth until it comes out cleanly.
- If possible place either feet or fingers on either side of the plant when pulling out. This helps to keep the soil in place and avoids unnecessary disturbance of the soil.
- Press down disturbed soil with hands or feet.
- Remove and dispose all seeds and vegetation propagules off site.

### Cutting and Swabbing

- The most effective time of the year to cut and swab plants is when they are actively growing, which varies between species.
- Remove all branches and trunk to a safe and manageable height (around 0.5m).
- Cut off all stems as low as possible using a chainsaw or pruning saw, secateurs or long-handled loppers. Make sure the cut is horizontal so that the herbicide rests on the cut area while being absorbed, rather than running down the side of the stem.
- Remove all stems and green shoots from the stump, so that no green leaves remain, no matter how small they are.
- Make additional cuts into the stump surface to provide more surface area for the chemical to penetrate.
- For trees with a lignotuber such as olives, it helps to cut the stump deeply at an angle with an axe or machete.
- Swab all cut surfaces immediately with a liberal amount of herbicide mixture. Add a dye to the herbicide mixture to help indicate where swabbing has already occurred. Swabbing must be done preferably within 15 seconds, or as soon as is practical to ensure optimum translocation. The cut surface cannot be allowed to dry out; otherwise the herbicide will be much less effective. Use a paintbrush or squeeze bottle to apply herbicide mixture.
- As the tissues which take up and move the poison are in the cambium layer, located immediately under the bark layer, it is best to concentrate on applying poison around the outer rim of the stump.
- Follow-up your work. If the stumps reshoot, a common occurrence with some species, then cut and swab or spray the new regrowth with herbicide.
- Repeat until the plant dies. *Large trees of certain species can take several poisonings before they are killed.*

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\* It is not within the scope of this Management Plan to make specific Occupation Health, Safety and Welfare recommendations. When undertaking works outlined in this Plan, ensure that all Occupational Health, Safety and Welfare requirements are met.



### Spraying\*

- The most effective time of the year to spray is when the plant is actively growing.
- Coastal environments are frequently very windy - spraying is often best done first thing in the morning when conditions tend to be calmer. *Under no circumstances should spraying be conducted when there are moderate to strong winds as the risk of off-target damage is too high.*
- Spraying is ineffectual in weather with temperatures either above approximately 30°C or below 15°C.
- Look for native plants and cover them with upturned buckets or sheeting while spraying. *If there are too many native plants amongst the weeds then this method should not be used.*
- Add dye to the herbicide mixture, to indicate where spraying has already occurred.
- If spraying regrowth near creeks or other water bodies, do not spray herbicide in or near the water, as it can have a negative effect on aquatic fauna such as frogs. In such cases, using chemicals without a surfactant is essential as these are designed to have a lesser impact on aquatic fauna. It is preferable to use more accurate methods such as cutting and swabbing adjacent to water bodies.
- Surfactants can also be used when spraying plants such as Bridal Creeper (*Asparagus asparagoides*) which have a waxy leaf surface. A surfactant can be added to the herbicide mix to increase the uptake of poison through the waxy leaf surface. Surfactants should not be used on or near plants growing in water as they are suspected of affecting frogs.
- Sprayable oils are also a very useful additive. These reduce spray drift, enhance pesticide uptake with many plant species, (particularly those with hairy leaves) and makes the herbicide rainfast within minutes, compared to the several hours required for normal applications without oil.
- Treat bulb plants when the bulb is old and exhausted and before new bulbs have formed, generally just before and during flowering. Poisoning at this stage will minimise the chance that the plant will reshoot in the next growing season.
- Where weeds have narrow vertical leaves, spraying might result in herbicide running off or drifting onto native plants. In this situation, wipe on herbicide mixture with a weed wand, sponge or wick applicator.

For more detailed information on weed control methods consult Robertson (1994).

Staged Removal of Larger Weeds that Provide Habitat	
Year 1	Remove 1 in 5 mature plants and replace with appropriate species.
Year 2	Remove 1 in 4 mature plants and replace with appropriate species.
Year 3	Remove 1 in 3 mature plants and replace with appropriate species.
Year 4	Remove 1 in 2 mature plants and replace with appropriate species.
Year 5	Remove all remaining plants and replace with appropriate species.

\* It is not within the scope of this Management Plan to make specific Occupation Health, Safety and Welfare recommendations. When undertaking works outlined in this Plan, ensure that all Occupational, Safety and Welfare requirements are met.



## Appendix 6: Bushland Weeding Code

(from Robertson, 1994)\*

(The following code is designed to aid in effective weeding in coastal zones)

- Know what weed you are targeting and which native species the weed may be confused with.
- Look before you weed – know where the native plants are.
- Choose the most effective and selective weeding technique for the plant and the location.
- 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 trampling over the site and scatter 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 any small weeds growing underneath.
- Avoid damage to native plants. Don't drop or fell large weeds onto native plants or drag boughs through the bush.
- Try to disturb the soil as little as possible. Replace any disturbed soil, press it down and replace plant litter.
- Remove any parts of weeds which could regrow from the Reserve: 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 to a new area.
- Remove weed seeds or bulbils, which could scatter into the weeded zone.
- Where native plants are regenerating among dense weeds, clear some growing space for them but do not create large openings.

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\* It is not within the scope of this Management Plan to make specific Occupation Health, Safety and Welfare recommendations. When undertaking works outlined in this Plan, ensure that all Occupational, Safety and Welfare requirements are met.

## Appendix 7: Coastal Indigenous Species

Information from:

Bonney, N., (2003)

Ralph, M., (2003)

Urban Forest Biodiversity Program Staff

### ***Acacia cupularis* - Cup Wattle**



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

#### **Family**

Leguminosae.

#### **Description**

A bushy shrub to 2m high by 4-6m wide. Phyllodes are narrow to 7cm in length.

#### **Distribution**

Coastal areas within South Australia. Also grows in Victoria and Western Australia.

#### **Location in the Dune System**

Grows in protected swales and hind dune areas.

#### **Flowers, Fruit and Seed**

Flowers deep yellow, globular, several on each peduncle.

#### **Seed Collection Techniques**

Use gloves, run hands through branchlets, to remove dry pods. Alternatively, place sheet under bush, shake branchlets to dislodge seeds and pods. Trample over collected material and sieve out clean seed.

#### **Propagation Techniques**

Pour very hot water (just off the boil) over seeds, allow to cool and soak overnight, strain off water. Seeds which are swollen are mostly viable, discard seeds which float. Sow seed 3-5mm under soil. Keep moist until germination. Can be used in direct sowing projects.

#### **Habitat and Ecology**

Secretes nectar from glands on the phyllode edge. This attracts ants which prey on gall producing wasps and flies. Birds are also attracted to the nectar. The bright red arils attract birds which eat the seeds. Ants transport seed to their nests to eat the arils.

#### **Uses in Landscape**

Screening plant. Large garden beds. Full sun.

#### **Similar Species**

*Acacia ligulata* (Umbrella Bush), seed is near double the size, and found more inland.

## *Acacia longifolia* var. *sophorae* - Coastal Wattle



Photo: Ron Sandercock

Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Leguminosae.

### Description

Large spreading shrub to 3m high by 5m wide. Leaves (phyllodes) obovate to 10cm in length by 3-4cm wide.

### Distribution

Mostly found on calcareous soils and coastal dunes. Also found in Queensland, New South Wales, Victoria and Tasmania.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Flowers yellow, rod shaped, 2-4cm long on short peduncles.

### Seed Collection Techniques

Use gloves, run hands through branchlets, to remove dry pods. Alternatively, place sheet under bush, shake branchlets to dislodge seeds and pods. Trample over collected material and sieve out clean seed. Heat of the day is best time to collect seed.

### Propagation Techniques

Pour very hot water (just off the boil) over seeds, allow to cool and soak overnight, strain off water. Seeds which are swollen are mostly viable, discard seeds which float. Sow seed 5mm under soil. Keep moist until germination. Can be used in direct sowing projects.

### Habitat and Ecology

Seed is sought after by emus, pigeons and other birds. Wattlebirds, silvereyes, honeyeaters and ants are active with seed dispersal. Very good habitat species for larger mammals and birds.

### Uses in Landscape

Screening plant. Large backdrop species. Large garden beds. Full sun.

### Similar Species

Similar to the weed *Acacia cyclops*, which has phyllodes shorter in length, flowers in globular heads, bright red arils around seeds. *Acacia cyclops* seed pods are curled

## *Acacia nematophylla* - Coast Wallowa



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Leguminosae.

### Description

Bushy shrub to 2.5m high by 3m wide. Phyllodes cylindrical to flat and narrowly linear, straight to shallowly curved, 2-4cm long by 0.7-1.5mm wide, grey-green.

### Distribution

Occurs on coastal dunes. Also occurs on Eyre Peninsula, southern Yorke and Fleurieu Peninsulas.

### Location in the Dune System

Found mostly in rear protected swales.

### Flowers, Fruit and Seed

Flowers, globular and in singles.

### Seed Collection Techniques

Use gloves, run hands through branchlets, to remove dry pods. Alternatively, place sheet under bush, shake branchlets to dislodge seeds and pods. Trample over collected material and sieve out clean seed. Heat of the day is best time to collect seed.

### Propagation Techniques

Pour very hot water over seeds, allow to cool overnight, strain off water. Seeds which are swollen are mostly viable, discard seeds which float. Sow seed 5mm under soil. Keep moist until germination.

### Habitat and Ecology

Ants transport seed to their nests where they eat the protein rich arils. Useful habitat plant.

### Uses in Landscape

Attractive screening plant. Large garden beds. Full sun.

### Similar Species

*Acacia calamifolia* which occurs inland.

## ***Adriana klotzschii* - Coast Bitter-bush**



Photo: Ron Sandercock

Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### **Family**

Euphorbiaceae.

### **Description**

Medium spreading shrub to 1-2m high by 1-2m wide. Leaves opposite, ovate to lanceolate in shape, up to 9cm in length, dark green and glossy above, white beneath, leaf margins are toothed.

### **Distribution**

Found in many regions and associated with limestone and calcareous soils.

### **Location in the Dune System**

Grows in protected swales and hind dune areas.

### **Flowers, Fruit and Seed**

Red tinge. Female flowers mainly consist of three sets of forked red threads.

### **Seed Collection Techniques**

Cut off mature fruits, place in sunny position to fully dry. Valves will open to release seeds. Sieve to clean. Seed is often not viable.

### **Propagation Techniques**

No treatment necessary. Sow seed directly into containers. Place seed 5mm under propagating mix. Keep moist. Mostly grown from cuttings.

### **Habitat and Ecology**

Coloniser, grows rapidly in disturbed areas. Host plant for the Bitter-bush Blue Butterfly (*Theclinesthes albocincta*)

### **Uses in Landscape**

Low screening plant. Unusual attractive flowers. Large garden beds. Full sun to semi-shade.

## *Alyxia buxifolia* - Sea Box



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Apocynaceae.

### Description

Woody medium shrub to 2m high by 3m wide. Leaves paired, thick, dark green and shiny on top.

### Distribution

Found mostly along the coast or inland in mallee. Remnants exist at Tennyson and Minda dunes.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Flowers in groups. Petals have a lopsided 'windmill' appearance, waxy white. Fruit a swollen red or orange berry 6-10mm long, becoming black with age.

### Seed Collection Techniques

Use gloves, pick off mature fruits. Skin is very firm when ripe. Alternatively, place sheet under bush and shake branches to dislodge fruit. Store away in dry area until sowing.

### Propagation Techniques

Sow fresh seed. Fruit skin can be peeled off before sowing. Sow seed 5mm beneath propagating mix. Keep moist and out in open position. Various acids, including Gibberellic and Hydrochloric have been used as a pre-treatment to help induce germination. Germination may take several months. Can also be grown from cuttings, but is slow.

### Habitat and Ecology

Long lived plant, useful for revegetation projects. Seeds are dispersed by birds such as silvereyes (*Zosterops* spp.)

### Uses in Landscape

Screening plant. Large garden beds. Full sun to semi-shade.

### Similar Species

The native *Beyeria lechenaultii* (Pale Turpentine Bush) has similar but thicker. Shrub is smaller, lacks the colourful fruit.

## *Carpobrotus rossii* - Native Pigface



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Aizoaceae.

### Description

Thick fleshy succulent ground-running plant. Leaves triangular in cross section.

### Distribution

Grows along the coast.

### Location in the Dune System

Highly adaptable plant and will grow in most areas from rear of foredune to the protected hind dunes and swales.

### Flowers, Fruit and Seed

Flowers have hundreds of pink 'petals' that are white at the base. Flower support is globe shaped. Fruit a grey capsule, seed within are tiny red-brown.

### Seed Collection Techniques

Cut off mature capsules with secateurs. To determine ripeness, squeeze capsules upside-down over your hand and the tiny seeds should release if mature. To extract seed, soak capsules in warm water which causes seed to be released or manually by squeezing capsules. Can harvest seeds when still wet.

### Propagation Techniques

Sprinkle seed over propagating trays and prick out into tubes once germinated or sow direct to tubes. Cover very lightly and keep moist in a warm sunny position. Seed has good results over three months. Grown easily from cuttings.

### Habitat and Ecology

Fruits are edible. Flowers provide nectar for a range of insects. Soil stabiliser.

### Uses in Landscape

Attractive groundcover. Small to large gardens. Full sun.

### Similar Species

The weed *Carpobrotus edulis* (Hottentot Fig), is very similar but with yellow 'petals'.

## *Dianella brevicaulis* - Short-stem Flax-lily



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Division	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Liliaceae.

### Description

Small clumping plant to shin high with blue-green, stiff, strap-like leaves.

### Distribution

Mostly found on calcareous soils and coastal dunes. Also found in Queensland, New South Wales, Victoria and Tasmania.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Flowers on wiry branched stalks within foliage line. Petals blue, upturned. Stamens dark purple with orange base.

### Seed Collection Techniques

Collect fruits that are losing their colour or drying off. Place in warm dry place. Once dry, rub firmly to dislodge shiny black seeds. Store in cool dry place until ready to use.

### Propagation Techniques

Propagating from seed can have erratic results and take up to 4-5 months for germination. Smoke treatment can improve results. Other treatments that have been reported to improve results include peeling (after soaking in water for 24 hours), nicking the seed coat or rubbing lightly with fine sandpaper. Soaking seed in soapy water prior to sowing (velvet soap is recommended) may also be helpful. Stratification can also be helpful in breaking seed dormancy. Use fresh seed.

### Habitat and Ecology

Flowers are insect pollinated. Fruits are taken by various honeyeaters and silvereyes. Sleepy Lizards and Blue Tongue Lizards have been known to eat ripe fruits. Edible fruits.

### Uses in Landscape

Attractive for borders, mass planting, small groups, pots, indoor, small to large gardens. Full sun to shade.

### Similar Species

The indigenous *Dianella revoluta* carries its flowers above the foliage.

***Disphyma crassifolium* var. *clavellatum* - Round-leaf Pigface**



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

**Family**

Aizoaceae.

**Description**

Fleshy ground-hugging plant. Leaves round if cut across.

**Distribution**

Grows mainly on or near the coast, especially near edges of saltmarshes and clifftops

**Location in the Dune System**

Grows in protected swales and hind dune areas. Prefers heavier soils.

**Flowers, Fruit and Seed**

Flowers bright pink, held on stalks above the foliage.

**Seed Collection Techniques**

Cut off mature capsules with secateurs. To determine ripeness, squeeze capsules upside-down over your hand and the tiny seeds should release if mature. To extract seed, soak capsules in warm water which causes seed to be released or manually by squeezing capsules.

**Propagation Techniques**

Remove the fleshy fruit before sowing. Good viability. Easily grown from cuttings.

**Habitat and Ecology**

Fruits are edible. Flowers provide nectar for a range of insects. Soil stabiliser.

**Uses in Landscape**

Attractive small groundcover, pots, hanging baskets, small to large gardens. Full sun.

**Similar Species**

May be confused with the native *Carpobrotus rossii* (which has larger flowers and leaves which are triangular in cross section) and with several succulent weed species such as *Carpobrotus edulis* and *Drosanthemum candens* (see Appendix 3 for species details)

## *Enchylaena tomentosa* - Ruby Saltbush



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Chenopodiaceae.

### Description

Low shrub to less than 1m high by 1.5m wide. Leaves blue-green, small, fleshy, cylindrical, to 2cm long with a covering of fine hairs.

### Distribution

Widespread along Australian coast and inland where slightly saline conditions exist or on calcareous soils. All states except Tasmania.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Fruit is succulent, berry-like to 5mm in diameter, depressed – globular, flat to sunken in the centre. Variable colours, mostly red, orange or yellow.

### Seed Collection Techniques

Pick berries by hand or shake branchlets to dislodge fruit onto a small sheet. Fully dry in warm position. Flesh withers away to leave mostly the seed. Can extract seed from moist berry. Store in cool, dry area.

### Propagation Techniques

Propagated from seed. Usually good results in 2-3 weeks. Use fresh seed. Cover seed to approximately 5mm and keep moist. May benefit from using smoked water. Adding a small amount of salt or sand from collection site to the propagating mix may also be beneficial to germination.

### Habitat and Ecology

Offers food for most of the year. Many bird species are attracted to the berries. Ants and lizards are also attracted to the berries. Berries are also suitable for human consumption and plants were used as a food source by indigenous people.

### Uses in Landscape

Ground cover, small shrub. Full sun to semi-shade.

### Similar Species

Similar to the natives *Threlkeldia diffusa* (Coastal Bonefruit), *Maireana enchylaenoides* (Wingless Fissure-plant) *Suaeda australis* (Austral Seablite)

## *Isolepis nodosa* - Knobby Club Rush



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Division	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Cyperaceae.

### Description

Perennial rush growing up to 50-150cm high, from a creeping woody rhizome.

### Distribution

Coastal situations and on saline soils inland, prefers seasonally wet sites.

### Location in the Dune System

Grows throughout the dunes to the rear of the foredune. Prefers the moister swales.

### Flowers, Fruit and Seed

Shiny brown seeds, 1mm long.

### Seed Collection Techniques

Cut seed heads with secateurs, rub together to dislodge seed. Store in a cool dry area.

### Propagation Techniques

Sprinkle seeds into tubes or trays. Lightly cover with sand or gravel. Keep moist - the bog method is recommended. Division to be carried out in autumn and spring. Take part of plant with juvenile root growth.

### Habitat and Ecology

Adapted to saline situations. Very important for sand stability. Tussock beds provide good habitat for birds.

### Uses in Landscape

Useful accent plant, group plantings, pots, birdbaths. Full sun to semi shade.

### Similar Species

May be confused with the serious weed *Juncus acutus* (Spiny Rush) which has extremely sharp leaf tips and the seed heads are attached to one side of the stem and are not spherical.

## *Kunzea pomifera* - Muntries



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Myrtaceae.

### Description

A prostrate shrub, with spreading branches over several metres. Bright green leaves.

### Distribution

Grows along sandy coasts.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Flowers white, fluffy are borne in terminal clusters. Fruit is an edible purple berry.

### Seed Collection Techniques

Collect drying berries and place on material to further dry out. As fruit shrinks seeds fall out from base. Pass through fine sieve to clean.

### Propagation Techniques

Cuttings are the preferred method of propagation. Sprinkle seed over propagating mix and cover with fine gravel. Keep moist in a warm area. *Kunzea pomifera* is usually difficult to propagate by seed.

### Habitat and Ecology

Fruits are edible and were a food source for indigenous people. Fruits are attractive for birds and lizards. Small insects and ants attend to the flowers. May provide habitat for *Teliqua rugosus* ssp. *asper* (Sleepy Lizard).

### Uses in Landscape

Ground cover. Pots, hanging baskets. Full sun to semi-shade.

## *Lepidosperma gladiatum* - Coastal Sword Sedge



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Division	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Cyperaceae.

### Description

Rigid stems up to 1m high by 2cm wide. Sharp edges.

### Distribution

Widespread in South Australian coastal regions. All states except Northern Territory and Queensland.

### Location in the Dune System

Grows in protected swales and hind dune areas. One small patch of possible remnant plants exist in the rear dune between the Torrens Outlet and the Henley Sailing Club.

### Flowers, Fruit and Seed

Spikelet, pale brown to 15cm. Nut ovate, seed within, 2mm long by 1mm wide, brown.

### Seed Collection Techniques

Cut off fruiting spikes. Use strong gloves as foliage is extremely sharp. Remove seeds by firmly smacking fruiting spike against a flat surface, many seeds will easily dislodge.

### Propagation Techniques

Propagation by seed has proved to be very difficult. Trials using heat, smoke, older seed, and various combinations of these have all returned erratic results (Ralph, 2003), but may be worth further trials. Division in winter months has proved to be the most reliable, but plants often die back and are slow to recover. May need to trim back the foliage when dividing.

### Habitat and Ecology

An important plant in sand dune ecology. Established clumps form good habitat for small native animals. Birds, including finches are known to eat the seeds.

### Uses in Landscape

Good accent plant. Foliage contrast. Borders. Pots.

## *Leucopogon parviflorus* - Coast Beard-heath



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Epacridaceae.

### Description

Densely foliated shrub to 2m high, upright branches, leaves oblong to 3cm tapering to a pointed tip. New growth bright green.

### Distribution

Widespread in coastal regions. Also found in Queensland, New South Wales, Victoria and Tasmania.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Flowers, white, tubular with flared hairy tips, arranged in spikes at ends of branches. Berries white, often conspicuous. One seed per fruit, hard stone-like, cream in colour, 2.5mm long by 1.5mm wide.

### Seed Collection Techniques

Seeds are ready to pick when fruit is bright white and easily falls off branches. Collect and fully dry out. Clean and store in cool, dark, dry area.

### Propagation Techniques

Important to sow fresh seed direct into tubes. Place seed onto propagation mix and under approximately 4mm of soil gathered from under parent plants. Place in cool, partial shade and keep moist. Allow 3-12 months for germination. Stratification of seed may be useful for breaking seed dormancy.

### Habitat and Ecology

Ripe fruits are eagerly sought after by various native birds, lizards and meat ants. Provides habitat for small birds.

### Uses in Landscape

Medium shrub, screen, bird attracting. Full sun.

## **Lotus australis - Australian Trefoil**



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### **Family**

Leguminosae.

### **Description**

A perennial herb to 30cm with stiff hollow stems, either upright or along the ground and erect at the ends. Leaves of five similar leaflets, two of which are at the junction of leaf and stem.

### **Distribution**

Found on coastal calcareous sands, dry hills and grasslands. Most states except central Australia.

### **Location in the Dune System**

Grows in protected swales and hind dune areas.

### **Flowers, Fruit and Seed**

Flowers rosy pink to white, pea flowers, in clusters of 3-8 on stalks longer than the leaves with three leaflets just under the flowers. Seed pods terate in shape 50mm long by 4mm wide. Seed round in shape 2mm in size, dark brown in colour. Up to 15 seeds per pod.

### **Seed Collection Techniques**

Pods can be picked when matured to a brown colour. Place in paper bag in a warm area to finish drying. Seed pods are explosive, therefore be careful when collecting and drying out.

### **Propagation Techniques**

Place seed in potting soil and cover lightly with fine gravel, keep moist, place in open sunny position.

### **Habitat and Ecology**

Plant offers a source of nectar and pollen to insects and birds. Parts of the seed are used as a food source by ants, which, in turn, are an important disperser of the seed. Weevil type beetles use the seed to lay eggs on, which, once hatched, drill into the seed to seek out the protein.

### **Uses in Landscape**

One of the more colourful local plants, cottage garden effect, pots, hanging baskets. Full sun to semi-shade.

## *Muehlenbeckia gunnii* - Coastal Climbing Lignum



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Polygonaceae.

### Description

Climbing plant, twining onto nearby shrubs or trees. Leaves round to egg-shaped with crisped edge.

### Distribution

Grows along the coast, in the foothills and in the mallee.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Flowers waxy, yellow-green, five petals, small to about 5mm diameter. Fruit yellow, nut is black.

### Seed Collection Techniques

Collect ripe fruits, squeeze off flesh and dry in warm place.

### Propagation Techniques

Sow as normal, not very reliable.

### Habitat and Ecology

The fruit is a source of food for lizards and birds. Its scrambling nature over other plants provides valuable habitat.

### Uses in Landscape

Twiner, pots. Full sun to semi-shade.

## ***Myoporum insulare* - Common Boobialla**



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### **Family**

Myoporaceae.

### **Description**

Large shrub to small tree up to 5m. Leaves thick and fleshy to 7cm, light-green, sparsely toothed.

### **Distribution**

Common on damp sandy soils along the coast. Also found in Western Australia, New South Wales and Victoria.

### **Location in the Dune System**

Grows in protected swales and hind dune areas.

### **Flowers, Fruit and Seed**

Flowers have five petals white with purple spots. Fruit is a drupe, succulent, ripening to a bluish-purple at maturity, round in shape to 6mm in diameter. Fruits dry with a blackish dry skin over a woody stone-like cover with rarely more than one seed fully developing.

### **Seed Collection Techniques**

Dislodge ripe fruits into a bucket or container. Place fruits in dry sunny position to completely dry. This may take several weeks. Once dry store in cool, dark, dry area until time for sowing.

### **Propagation Techniques**

Soak seeds in warm water overnight before sowing. Sow into sandy compost propagating mix 2-3mm deep. Cover over surface with fine gravel to 4mm thick. Keep moist. Place out in open. Provide fifty percent shade on hot days. Easily grown from cuttings.

### **Habitat and Ecology**

Many different bird species are attracted to the fruit as a food source, which help disperse the seed. Provides habitat for small birds and ground dwelling mammals.

### **Uses in Landscape**

Large shrub to small tree, screening plant. Full sun.

## *Nitraria billardierei* - Nitre Bush



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Zygophyllaceae.

### Description

Medium to large dense and spreading shrub up to 3m high, sometimes spiny. Leaves flat, glaucous and somewhat succulent.

### Distribution

Widespread where saline flats occur. Also occurs near coastal dunes.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Flowers have five petals, white to 4mm in length. Fruits are a drupe near 1.5cm in diameter. Green, ripening through to red or purple. Seed (endocarp) is a hard woody pip 5-7mm in length, pale brown in colour, surface pitted, pale 'lemon' seed within.

### Seed Collection Techniques

Pick fruits by hand. Squeeze off fruit straight away, then dry seeds. Dry in warm area.

### Propagation Techniques

The hard woody pip, (endocarp) can be gently cracked with a nut cracker. The seed can then be carefully removed, so as not to damage it. Sow carefully into propagating mix. Cover lightly, keep moist, place in sunny open position. Woody pips have been sown into soils after fermenting in a plastic bag with wet soil for two months prior to sowing. Sow when daily temperatures are warm. Often grown from cuttings.

### Habitat and Ecology

Ripe fruits are consumed by a wide variety of birds. Can tolerate high salinity. An important habitat plant for birds. Fruit is edible but can be salty.

### Uses in Landscape

Large gardens, bird attracting. Full sun.

### Similar Species

Can be confused with the weed *Lycium ferocissimum* (Boxthorn), and the natives *Lycium australe* (Australian Boxthorn) and *Bursaria spinosa* (Sweet Bursaria). Refer to Appendix 3 for comparisons.

## *Olearia axillaris* - Coastal Daisy-bush



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Compositae.

### Description

Medium to tall shrub to 3m. Many branches, stems white when young. Leaves dark-green or bluish above, white underneath.

### Distribution

Grows along coastal dunes and nearby scrub. Also found in Western Australia, New South Wales and Victoria.

### Location in the Dune System

Grows in protected swales and hind dune areas. Can grow to the rear of the foredune.

### Flowers, Fruit and Seed

Flowers daisy-like, crowded along stems in the axils, whitish to dull. Seed (achenes) small to 1mm in length. Pale brown attached to a pappus with many bristles to 3mm in length, off white in colour.

### Seed Collection Techniques

Rub gloved hands through branches to dislodge seed or bend branch over into container. Shake branch and ripe seeds will fall out. Be careful in windy conditions. Store in a cool, dry, dark position.

### Propagation Techniques

Use fresh seed. Sprinkle over propagating mix. Cover seed just enough to anchor. Keep moist, leave in open position as light enhances germination. Also grown from cuttings.

### Habitat and Ecology

A primary coloniser and key habitat plant in the dune environment. Seed is eaten by several bird and insect species.

### Uses in Landscape

Rounded shrub will cope with clipping. Medium to large gardens, screen plant, foliage contrast. Full sun to semi-shade.

### Similar Species

The indigenous *Olearia ramulosa* (Twiggy Daisy-bush) has leaves half the length of *Olearia axillaris*.

## *Pelargonium australe* - Native Pelargonium



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Geraniaceae.

### Description

Perennial herb to 50cm high. Stems and leaves velvety with soft hairs. Leaves ovate to obicular to 9cm in length. Leaf edges wrinkled.

### Distribution

Found on poor calcareous sands and granite outcrops.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Pale pink with purple stripes. Flowers in closely clustered group of about ten.

### Seed Collection Techniques

Collect by pinching off ripe heads, place into a container. Gently rub seed from the fluff. Storing in cool, dry and dark area.

### Propagation Techniques

Sprinkle seed over trays or direct to tubes. Lightly cover to anchor seed, keep moist, sow from autumn.

### Habitat and Ecology

Birds often eat the seed. Ants carry seed away to consume in their nests. Seeds that are not eaten germinate away from the parent plant. Seed dispersal is also via wind. Flowers are insect pollinated.

### Uses in Landscape

One of the more colourful local plants, cottage garden effect, pots. Full sun to semi-shade.

## *Rhagodia candolleana* ssp. *candolleana* - Sea-berry Saltbush



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Chenopodiaceae.

### Description

Sprawling shrub approximately 1m high to several metres wide. Leaves alternate, dull green above, white below, somewhat fleshy.

### Distribution

Often found on poor soils along the South Australian coast. Also found in Western Australia, New South Australia, Victoria, and Tasmania.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Flowers, small, whitish, clustered in branched spray. Fruits pale green, ripening through to deep red in late summer to autumn, succulent, translucent, globular, depressed, to 4mm in diameter. Seed is black and 1.5-2.5mm in diameter.

### Seed Collection Techniques

Collect when fruits have reached a deep maroon colour. Cut off terminal fruiting spikes. Can squeeze off flesh when moist. Place in warm dry area to dry. Once dry, the seeds are easily observable. Sieve to give final clean.

### Propagation Techniques

Seeds propagate easily without treatment. Use fresh seed under 12 months old. Sow into tray and prick out or sprinkle direct into tubes. Cover with layer of fine gravel; keep moist in an open position.

### Habitat and Ecology

Important plant in coastal ecology. Fruits are sought after by a wide range of honeyeaters and other birds. Lizards also eat the fruits, aiding in seed dispersal. Provides habitat for a range of native birds and lizards.

### Uses in Landscape

Sprawling groundcover for medium to large gardens. Full sun to semi-shade.

## *Scaevola crassifolia* - Cushion Fanflower



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Goodeniaceae.

### Description

Spreading robust shrub up to 1.5m high by 2m wide. Leaves broadly ovate to orbicular with slightly serrated edges. Leaves to 4cm long by 1cm wide.

### Distribution

Found along coast on limestone and calcareous soils and sands. Also found in Western Australia.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Bright blue, fan shaped. Fruit globose to 3mm, seed within a dry, thin covering called a mesocarp. Seed to 1.5mm in size.

### Seed Collection Techniques

Cut off drying flowering stems (not the branches), lay out in a dry warm area to fully dry. Place contents over fine screen and rub hands over foliage to dislodge seed. Seed is fine and small.

### Propagation Techniques

Sprinkle over propagating mix, cover lightly and keep moist. Seed can take several months to germinate. Smoke treatment may improve germination rates. Often grown from cuttings.

### Habitat and Ecology

Flowers attract butterflies. Flowers are pollinated by insects. Provides habitat for lizards and small mammals.

### Uses in Landscape

Large groundcover or sprawling shrub, attractive flowers. Full sun.

## Senecio lautus - Variable Groundsel



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Compositae.

### Description

Branched herb to 80cm high by 75cm wide. Leaves bright-green, divided into lobes, usually fleshy but sometimes almost flat.

### Distribution

Widespread from uplands to the coast.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Flowers bright yellow, composite (daisy), usually about 25mm in diameter.

### Seed Collection Techniques

Seed heads become fluffy and seeds come away from the plant very easily when mature.

### Propagation Techniques

Mostly grown from cuttings which strike easily if taken in the winter months. Erratic results from seed. Sprinkle seed into trays and prick out into tubes or sprinkle seed direct into tubes. Surface sow and cover with propagating mix just enough to anchor as light may enhance germination. Keep moist in an open sunny aspect.

### Habitat and Ecology

Pioneering plant, readily germinates in dunes.

### Uses in Landscape

One of the more colourful native plants, cottage gardens, pots, small gardens. Full sun to semi shade.

### Similar Species

Do not confuse with the weeds *Chrysanthemoides monilifera* (Boneseed), *Sonchus* spp. (Sow Thistles) or *Reichardia tingitana* (False Sow-thistle).

## *Spinifex sericeus* - Rolling Spinifex



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Poaceae.

### Description

Robust, large perennial, with creeping, stout, branched stems. Leaves very hairy; leaf sheaths swollen at the base.

### Distribution

Coastal sand dunes and beaches above high tide. Widespread throughout Australia and Asia in coastal areas.

### Location in the Dune System

Grows along the foredune and to the rear dune in places.

### Flowers, Fruit and Seed

Plants produce both male and female spikelets.

### Seed Collection Techniques

Seed along the Adelaide Metropolitan coastline is affected by a fungal rust and is not generally collected.

### Propagation Techniques

Mainly propagated by cuttings as *Spinifex sericeus* along the Adelaide metropolitan coastline are affected by a fungal rust which renders the seed infertile.

### Habitat and Ecology

Primary dune forming plant and sand binder. Will tolerate mobile sand.

### Uses in Landscape

Ground cover in coastal gardens. Full sun.

## *Tetragonia implexicoma* - Bower Spinach



Photo: Ron Sandercock

Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

### Family

Aizoaceae.

### Description

Large untidy plant, scrambling onto nearby shrubs or rocks. Leaves large, fleshy, and thick.

### Distribution

Grows along most of the South Australian coast. Also found in Western Australia, Victoria and Tasmania.

### Location in the Dune System

Grows in protected swales and hind dune areas.

### Flowers, Fruit and Seed

Flowers are small, to about 1cm, white, with four petals. Fruit is a red to blackish berry.

### Seed Collection Techniques

Pick fruits by hand. Squeeze off fruit straight away, then dry seeds. Dry in warm area.

### Propagation Techniques

Use fresh seed. Remove the flesh before sowing as it may contain chemical inhibitors. Mostly grown from cuttings.

### Habitat and Ecology

The fruit is a source of food for lizards and birds. Its scrambling nature over other plants provides valuable habitat.

### Uses in Landscape

Groundcover or scrambling plant.

### Similar Species

Do not confuse with the weed *Tetragonia decumbens* Refer to Appendix 3 for a description of this weed species.

### ***Threlkeldia diffusa* - Coast Bonefruit**



Flowering	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Collect Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Seed	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Propagate Cuttings	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec

#### **Family**

Chenopodiaceae.

#### **Description**

Small shrub to 20cm high. Leaves club-shaped, fleshy, often with a purple tinge.

#### **Distribution**

Grows along most of the South Australian coast. Also found in Western Australia, Victoria and Tasmania.

#### **Location in the Dune System**

Grows in protected swales and hind dune areas.

#### **Flowers, Fruit and Seed**

Flowers are insignificant. Fruit reddish or purple, fleshy, an oval berry shape with a large, hard bony centre.

#### **Seed Collection Techniques**

Pick off individual ripe fruits or shake branch over a plate or bowl. Dry in a warm position.

#### **Propagation Techniques**

Sow as normal. Cover seed with thin layer of gravel. Keep moist in a warm open position. Can be unreliable. Take cuttings in late winter to early spring.

#### **Habitat and Ecology**

Many bird species are attracted to the berries. Ants and lizards are also attracted to the berries.

#### **Uses in Landscape**

Small groundcover. Full sun.

#### **Similar Species**

Similar to the native *Enchylaena tomentosa* (Ruby Saltbush). See descriptions detailed in this appendix for further information on differences between the species.



## Appendix 8 Seed Collection and Propagation\*

Information from:

Bonney (1994)

Australian Government, DEH, (2004) <http://www.deh.gov.au/land/vegetation/reveg.html>;

Ralph (2003)

### Collection of Native Plant Materials

Native seed and cuttings from remnant species along Adelaide's metropolitan coastline are an extremely precious resource. Corporately and individually we have a responsibility to foster a culture of conservation and respect toward the environment in general and in this case, dwindling remnant vegetation.

It is not within the scope of this Management Plan to give detailed information on various propagation techniques, however, the publications mentioned above are highly recommended for reading prior to undertaking any propagation of native species. Before carrying out any collection of native materials, there are several principles and guidelines important to be aware of. These are detailed below.

#### **Native seed management principles appropriate for coastal dune situations:**

- Adhere to legislative and regulatory requirements when collecting and planting native seed.
  - The collection of native plant materials is controlled under Section 49, *National Parks and Wildlife Act, 1972*.
  - A permit from the Minister for Environment and Conservation is required to collect native plant materials from Forest Reserves, National Parks and Wildlife Reserves, Crown Land and any other land reserved for, or dedicated to public purposes, such as roadsides and local council reserves. Written approval from the management authority responsible for the land must also be obtained prior to collection of native plant materials. Applications are available at:  
[http://www.environment.sa.gov.au/biodiversity/pdfs/seed\\_collect.pdf](http://www.environment.sa.gov.au/biodiversity/pdfs/seed_collect.pdf)
- Collect native seed and cuttings sustainably – to ensure native vegetation continues to regenerate and provide valuable food sources for local fauna:
  - Collect only what you need (i.e. less than 10% of the available seed);
  - Collect from as many different plants of the same species in one given area (provenance) as possible;
  - Collect seed and cuttings from all parts of the plant, not just the easily accessible areas;
  - Avoid altogether collecting seed from shrubs and trees which only have a few plants left in a particular area.
  - Reduce seed wastage. Match seed requirements to the biological and functional needs and objectives of the revegetation project.
  - Use valuable local provenance seed to enhance remnant vegetation.
  - Improve efficiency of native seed collection by better forecasting revegetation needs and improving the skill level of seed collectors.

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\* It is not within the scope of this Management Plan to make specific Occupation Health, Safety and Welfare recommendations. When undertaking works outlined in this Plan, ensure that all Occupational, Safety and Welfare requirements are met.



- Encourage participation of commercial native seed suppliers in seed management. Ensure they are aware of needs well in advance, and whether they can supply local seed species and particular genetic provenances if required.
- Increase the diversity of local species used in revegetation projects (particularly understorey species), to improve biodiversity benefits.
- Use quality assurance systems to ensure that the highest quality seed (physical and genetic) is used for revegetation activities.
- Promote research into native seed, e.g. plant propagation, sustainable seed harvesting and methods of maintaining genetic and species diversity.
- Refer to relevant guidelines, including the FloraBank Model Code of Practice for community-based collectors and suppliers of native plant seed and the FloraBank

These guidelines are available at:

<http://www.florabank.org.au/support/guidelines/MCOPWeb%20version.pdf>



## Appendix 9: Revegetation Methods\*

### Revegetation Objectives

The New South Wales Department for Land and Water Conservation (2001) outlines the two major objectives for revegetating degraded dune systems:

1. *To restore and maintain biodiversity through establishing native coastal vegetation appropriate to its geographical area and its position within the dune system – vegetation that is self sustaining with minimal maintenance required once fully established.*

A healthy dune ecosystem will feature a variety of plant communities and locally native species that reflect the geographical distribution of species along the coast, zonation within the dune system (refer to Figure 23) and the age of the dunes. These communities provide habitats and resources such as food, nesting sites and protection from predators, for a diverse range of native fauna, including birds, reptiles and insects.

2. *To provide sufficient plant cover to protect fragile dunes against wind erosion. Species that are native to coastal dunes are adapted to survive the hostile environment of drifting sand, strong winds, salt spray and infertile soils. They provide long-term stability.*

Revegetation projects in environmentally sensitive areas must be of the highest ecological standard (Smith, 2002) and the ultimate goal must be to restore the original or pre-European vegetation cover.

When attempting to re-establish a range of locally indigenous plants within the dune environment, there are a number of methods to consider. *Natural regeneration* and *assisted regeneration* are the two major methods and are described as follows by the NSW Department for Land and water Conservation (2001):

1. *Natural Regeneration: Remnant native plants already in the system can usually regenerate after the removal of weeds that compete for light, water and nutrients.*

The aim of this approach is to restore and maintain an ecosystem in which natural regeneration can occur.

2. *Assisted Regeneration: On highly disturbed sites, natural regeneration may occur too slowly to prevent erosion, or too few species may be represented. Planting species that are suited to the geographical area and dune zone may speed the regeneration process.*

Many projects utilise a combination of both natural and assisted regeneration.

### Use Locally Indigenous Species

Locally indigenous species are characterised by the slight variations that occur between plants of the same species from area to area. The variations are a response to different local physical conditions to which the plants have adapted. The use of locally indigenous species has many benefits in a revegetation project, including:

- Plants have adapted to local conditions over time and are able to germinate, survive, grow and reproduce more effectively in one area compared to another;

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- They are hardier, more wind-firm, will grow at optimum speed;
- More resistant to local pests, diseases and local climatic extremes;
- Complement other native plants and animals in the area and are thought to promote genetic and ecological sustainability in local vegetation.

It is important to collect seed and other plant material (such as cuttings) from remnant vegetation sites as close to the rehabilitation site as possible.

### What to Plant Where?

When selecting species to plant, it is helpful to examine historical records (written and photographic) to determine which plants were present before degradation. This information will supplement species selection information based on the recognition of geographical areas, zones, and plant succession. Darrell Kraehenbuehl's '*Pre-European Vegetation of Adelaide: A Survey from the Gawler River to Hallett Cove*' provides a good summary of historical records and pre-European vegetation communities present in the Adelaide metropolitan area, including the Port Adelaide Enfield coast.

The various zones of dunes are vegetated by plants that have adapted to the different conditions experienced in these zones. There are generally three zones that grade into one another. These are:

- An unstable incipient foredune zone of colonising herbs and grasses;
- A semi-stable foredune zone of shrubs and associated ground plants;
- A stable hind-dune zone dominated by trees, with an understorey of shrubs and ground plants. (NSW Department for Land and Water Conservation, 2001)

There are distinct combinations of plants and zones that represent the typical assemblages that are encountered. For example, *Spinifex sericeus* (Rolling Spinifex) is characteristic of the foredune, while other plants such as *Myoporum insulare* (Common Boobialla) can generally only establish and grow in the more sheltered area of the middle and hind dunes.

Plant succession occurs when plants change growing conditions over time (such as altering soil composition) and compete with each other for resources. Where topography permits, a tall shrubland may eventually develop to represent a climax community with a complex structure of shrub, climber and ground layer species (NSW Department for Land and Water Conservation). In the case of the foredune, where conditions are very harsh, typically the only surviving species are *Spinifex sericeus* (Rolling Spinifex) \**Cakile maritima* (Sea Rocket) and \**Thinophyrum junceiforme* (Sea Wheat Grass) - these species form the climax community for that site and zone.

Although it is desirable to initially establish a high diversity of species in a dune revegetation project, Smith (2002) suggests to "only plant early successional plants from the vegetation community that once grew on the site." By approaching revegetation in this manner, it assists the natural regeneration process and enables the process of succession to occur.

### Planting Tube Stock

Planting with nursery-raised tubed seedlings is the most common method of establishing plants within dune systems. The optimum time to plant is from May through to August, with autumn plantings being preferred as this provides an opportunity for some growth following planting, followed by settling-in during winter.



When undertaking revegetation works, try to plant species in proportion and position to how they would occur naturally. Do not plant in straight rows, as this does not occur naturally. Dense plantings will increase competition for weed species and suppress regeneration. A good rule of thumb is to 'pull one plant, plant another', i.e. when removing weeds make sure you put an indigenous plant back in its place.

Water seedlings some hours before planting out, ensuring roots are moist. Without damaging native vegetation or moss layer, scrape aside surface litter then dig a hole, creating a large water bowl that will catch any rainfall throughout the following year. If the soil is not moist, fill the hole with water and let it drain.

Remove the plant from its tube and position it so that it is in the centre of the hole. Ensure the plant is not situated higher than the sand. Plants will grow much better when planted in positions that gain maximum sunlight.

Backfill the hole to just over the level of the top of the soil in the tube. A layer of sand will prevent root exposure. Replace any surface organic matter to act as mulch on the surface and carefully water in with a bucket of water.

To aid successful plant establishment it is important that weed species are controlled. It is good practice to brush-cut or spray weeds at recommended rates prior to and after planting to reduce competition from weeds.