

FORESHORE MANAGEMENT PLAN MINDARIE – QUINNS ROCKS

CITY OF WANNEROO

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1.0 Introduction

Foreshore Management Plan: Mindarie – Quinns Rocks

1.1 Overview

The Quinns Rocks – Mindarie coastal foreshore is located 35 km north of Perth. It is an area of rapid population growth with Quinns Beach having the potential to form an important regional beach for the City of Wanneroo. The Quinns Rocks foreshore has become badly eroded due to recent heavy winter storms. Expert advice has concluded that the preferred option for addressing this problem is the construction of three groynes at Quinns Beach. Two of these were constructed in December 2002 and the third in December 2003. Approval for the construction of the groynes has been granted by the Western Australian Planning Commission (WAPC) subject to the preparation of a foreshore management plan for the area. The City of Wanneroo is taking this opportunity to extend the study area and develop a comprehensive foreshore management plan for the entire Quinns Rocks coastal area including foreshore areas associated with Quinns Beach North and South and North Mindarie Beach.

1.2 Purpose and Objectives

1.2.1 Purpose

The purpose of the management plan is to:

- provide recommendations and a framework for foreshore management according to best practice principles;
- review existing infrastructure (including leisure and recreational facilities) and the need or otherwise for removal of existing facilities and new or upgraded facilities;
- provide a mechanism for prioritisation and allocation of funding; and
- satisfy the condition imposed by the WAPC.

1.2.2 Objectives

The objectives of the management plan are to:

- prepare a comprehensive management plan for the Mindarie-Quinns Rocks area (including Kinsale Reserve);
- identify the natural resources (including bushland) and processes as well as the necessary management measures for preserving and enhancing the conservation values of the area;
- identify ecotourism, recreation and leisure resources and provide for public use of the area where appropriate while maintaining natural ecosystem processes;
- investigate the potential and opportunity for development of recreational and interpretational amenities consistent with the values of the area, including bushland conservation;
- identify weed control methods and priorities and rehabilitation methods and priorities; and
- differentiate coastal areas into management zones based upon its attributes.

1.3 Study Area

The study area is located 35 km north of the Perth CBD and is approximately 4.6 km north to south. A Map of the Study area is shown in Figure 1.1. For reference, the study area has been divided into four contiguous sectors for descriptive purposes. Management Zones have been defined by purpose and are outlined in Chapter 6 of this report. Sectors and their boundaries are described from north to south and are outlined as follows.

1.3.1 North Mindarie Beach

The southern extent of the study area is in line with the housing at the end of Long Beach Promenade. This sector covers all foreshore and vegetation bordered by Alexandria View to the north, and Anchorage Drive and Long Beach Promenade to the east. It has an area of 37.9 ha and extends 0.8 km S-N.

This sector is typified by dunes and beaches, two car parks and a large reserve (part Bush Forever Site 322). This locality is typified by varied topography, beaches and remnant vegetation.

1.3.2 Mindarie Keys to Quinns Beach

This sector is bordered by Mindarie Keys Marina to the south and Quinns Rocks Caravan Park to the north. Also included in this locality is Kinsale Park, located behind the foreshore area on Kinsale Drive. It has an area of 26.3 ha and extends 1.1 km S-N.

This sector is typified by the presence of a limestone cliff running the length of the foreshore. The foreshore is therefore relatively stable and includes a car park, access tracks, a dual use pathway (DUP), and lookouts. There are substantial areas of remnant vegetation including Kinsale Park which was completely burnt in 2002.

1.3.3 Quinns Beach South

This sector is typified by beach and foredunes along the foreshore. The Quinns Beach South sector extends from Quinns Rocks Caravan Park in the south to the cusp and artificial headland on the beach between Pearce Street and Hall Road in the north. Ocean Drive borders the foreshore for the length of the sector. It has an area of 17.5 ha and extends 0.8 km S-N.

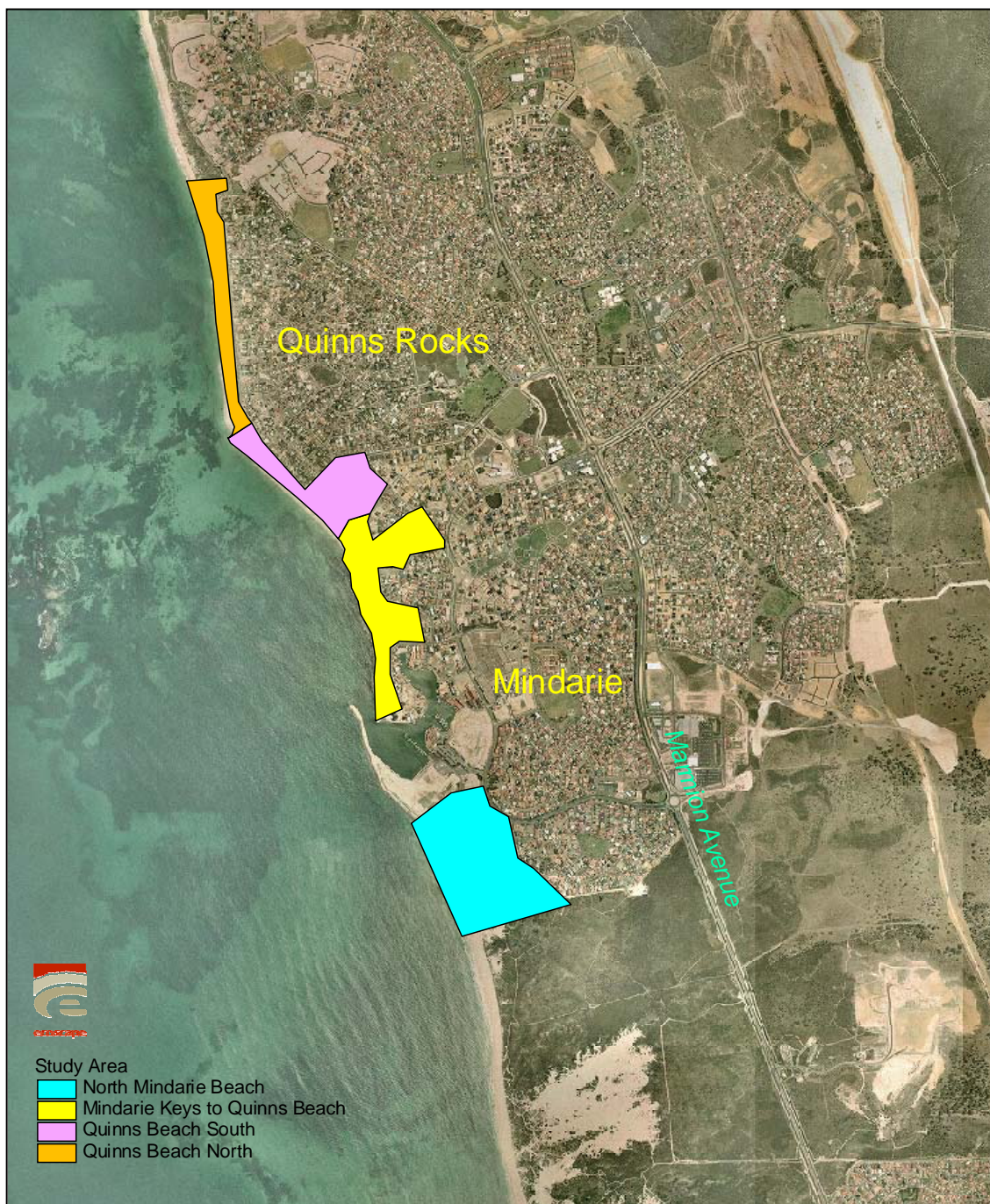
This narrow area consists of the beach with adjoining dunes, remnant vegetation and a number of beach access tracks. A car park is located on the southern border adjacent to the Quinns Rock Caravan Park. This part of the beach has not been subject to high levels of erosion. A community facility development has been approved for this area consisting of a surf-lifesaving club, café community facility and car park.

1.3.4 Quinns Beach North

This sector is also typified by beach and foredunes and stretches from the cusp of the beach in the south to Camira Way in the north, and is bordered by Ocean Drive to the east. It has an area of 13.8 ha and is 1.4 km in length.

Quinns Beach North has been subject to severe erosion. Construction of three groynes and sand nourishment is being undertaken to prevent further erosion to this area. Recreation infrastructure and amenities located in this area include the existing surf lifesaving club, toilets, car parks and access tracks. Most of the access tracks in this area have been severely impacted by erosion and are closed.

Figure 1.1 Study Area Showing Reference Sectors



1.4 Surrounding Areas

The foreshore areas of Quinns Rocks and Mindarie have a long history of public use dating back to the early 1900's (see Section 3.1.2). It is only relatively recently however that Quinns Rocks has grown from a relatively isolated holiday town to a modern suburb of Perth.

Suburbs surrounding the study area are generally experiencing rapid growth which has implications for management of the foreshore in terms of providing adequate recreational facilities and protecting the natural environment. The suburbs of Quinns Rocks and Mindarie are situated adjacent to the study area and are currently well established. The surrounding suburbs of Clarkson, Merriwa, Butler and Jindalee are all experiencing rapid development, particularly in the newly created coastal suburb of Jindalee.

2.0 Biophysical Environment

Foreshore Management Plan: Mindarie – Quinns Rocks

2.1 Climate

The climate of the Mindarie – Quinns Rocks foreshore is typical of coastal areas near Perth (Figure 2.1). The dominant winds affecting coastal processes are winter depressions moving eastwards generating moderate to strong north-east to north-west winds and strong sea breezes during spring through to autumn. Winds are an important factor in coastal processes as they affect wave climate and sediment movement along the shoreline. The strong south-westerly winds that occur in summer are the dominant dune building and eroding force.

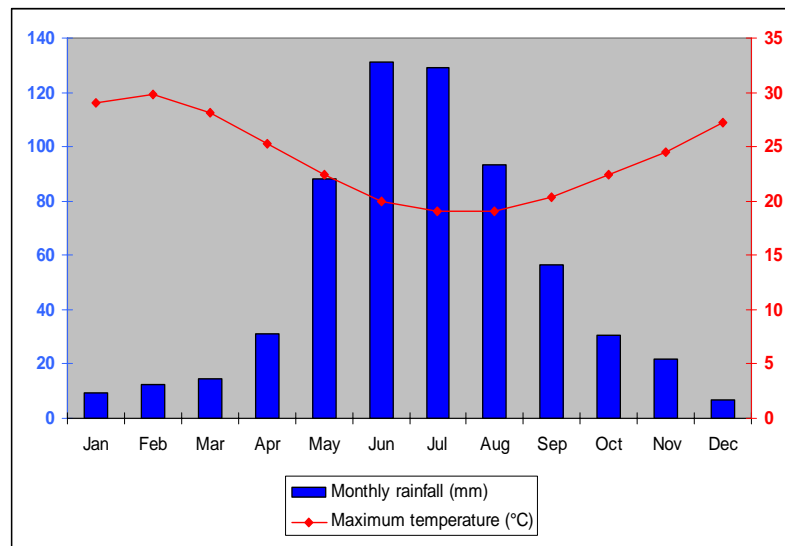


Figure 2.1 Monthly Climatic Averages at Lancelin (1965 – 2001)

2.2 Climate Change

Global climate change has possible implications for the coastal areas in terms of sea level fluctuations, changes in storm frequency and changes in synoptic features resulting in changed wave climate.

While global climate change is a controversial issue, there have been no studies undertaken to assess its effects on the WA coastline. This lack of relevant data makes it difficult to predict the extent of changes as a result of climate change. The Intergovernmental Panel on Climate Change IPCC (1995 in MP Rogers and Associates, 1999) estimates global sea level rises to be in the range of 0.03 metres to 0.23 metres by 2030 and nearly double this figure by 2050.

Lack of detailed data on the effects of climate change means that a precautionary principle should be employed when making decisions affecting coastal areas. Reference should be made to the Statement of Planning Policy No. 2.6 (State Coastal Planning Policy) which provides guidance for determining suitable setbacks for coastal developments.

2.3 Sediment Transport

2.3.1 Introduction

Three fundamental mechanisms move sand around the Quinns Rocks coastline. These are longshore or littoral drift, cross-shore transport and wind blowing beach sand inland.

Long periods of large amounts of sand being blown inland is evident from the presence of transgressive dunes although the amount of the sand moved by wind is now limited to areas where dune vegetation is degraded (MP Rogers and Associates, 1999).

Wind significantly influences sand movement at Quinns Rocks through its influence on nearshore currents. Littoral and cross-shore transport are both determined by nearshore currents driven by waves or tides. Effects of tides are not expected to be significant near Quinns Rocks given the small tidal range and wind is therefore the dominant influence on currents and therefore sand movement.

2.3.2 Wind Regimes

At the synoptic scale, the wind regime is largely determined by the seasonal position of the Subtropical High Pressure Belt. During summer the Belt is centred between 35 and 40 degrees south (i.e. south of the study area). During this season the Quinns Rocks region experiences winds largely from the southwest and east as a result of winds rotating anticlockwise around high pressure cells (MP Rogers and Associates, 1999).

During winter the Subtropical High Pressure Belt is situated between 25 and 30 degrees south (i.e. north of the study area). This produces storm force winds from the northwest, west and southwest under the influence of low pressure cells (MP Rogers and Associates, 1999).

At the meso-scale the differential heating and cooling of sea and land typically results in morning breezes from the east and afternoon breezes from the west. Autumn, summer and spring winds are in the order of 10 to 30 km/hr in the mornings and 40 to 50 km/hr in the afternoons. In winter the wind is more variable, with speeds usually ranging from 10 to 40 km/hr, but reaching 50 km/hr during storms (MP Rogers and Associates, 1999).

2.3.3 Nearshore Currents

During spring and summer, when the winds consistently blow waves from an east to south-easterly direction in the mornings and east to north-easterly in the afternoon, nearshore currents could be expected to be in the order of 0.2 to 0.3 m/s. During winter and autumn the wind direction and strength is more variable but currents remain in the order of 0.1 to 0.3 m/s (MP Rogers and Associates, 1999). During winter the currents vary with wind changes in 3-4 day cycles (DEP, 1996).

The force of the waves reaching the coast in the Quinns Rocks region is diminished and the direction of the waves is modified by:

- reflection off Quinns Rock and submerged reef faces;
- depth limited breaking on reefs and in shallow areas;
- diffraction through gaps in the reefs;
- attenuation due to turbulence induced by the reefs and shallow sand; and
- refraction and shoaling (MP Rogers and Associates, 1999).

Waves arriving at an angle to the shore generate a longshore current in the surf zone within the study area (Woods, 1984). Sediment is suspended and transported in this zone, giving rise to "littoral drift" of sediment along the coast. The direction of the longshore current is generally northwards in summer and southwards during winter, due to changes in the directions of prevailing winds between the seasons (Woods, 1984).

Superimposed on this littoral movement of sand is the east-west (cross-shore) movement of sand that occurs under the influence of seasonal wave characteristics and ocean levels. During winter storms, sand is eroded from beaches and dunes and is deposited as offshore bars. The beaches at Quinns Rocks are partially protected from this winter erosion by offshore reefs that dissipate some of the wave energy prior to it reaching the beach. Erosion can occur rapidly however, and sand that has taken months to accumulate can be moved offshore in a matter of hours. A typical beach sand cycle is apparent on most sandy beaches in the area, where winter storms move sand from the beach to an offshore sand bar, and summer swell patterns re-deposit it on the beach (City of Wanneroo, 1991).

2.4 Shoreline Stability

The construction of the artificial headland in 1977 at the cusp where Quinns Beach naturally deviates northwards has influenced sediment movement and shoreline stability. Therefore trends before this date are not indicative of current processes (MP Rogers and Associates, 1999).

MP Rogers and Associates (1999) made the following conclusions on the basis of a number of studies on the coastal processes to the north of the Mindarie Keys Marina:

1. From 1977 until 1997 the beach north of the headland receded by about 20 metres, with the net loss of approximately 170,000 m³. Without management the Northern Car Park and Ocean Drive are at risk, and this is the basis of the proposed construction of three groynes in this area;
2. From 1977 until the early 1980's, the beach south of the headland receded. From that point it accreted. A net accretion from 1977 until 1997 of approximately 80 000 m³ resulted;
3. Little or no sediment enters the study area from south of Mindarie Keys Marina;
4. There is minimal movement of sediment between the Quinns Rocks coastline and offshore, although the offshore region has accreted by about 70 000 m³ between 1977 and 1997;
5. During summer the net movement of sand is onshore and northwards; and
6. During winter there is a net movement of sediment offshore and southwards.

The area south of Quinns Beach and immediately north of Mindarie Keys Marina consists of stable limestone cliffs, and the area south of Mindarie Keys Marina has remained relatively stable since 1941 due to sediment transport rates being relatively low. Any net movement of sediment will be northwards and therefore gradual accretion on the southern edge of the Mindarie Keys breakwater could be expected (Hames Sharley, 1992). This is also the only area where sand is being transported inland by wind, which occurs where dune vegetation has been degraded.

2.5 Groyne Construction

A report by MP Rogers and Associates (2002) suggested three options to alleviate the problem of persistent erosion of Quinns Beach North. Of these options, a groyne field and initial beach renourishment scheme was recommended and is being undertaken by the City of Wanneroo.

This scheme involves the construction of three, 25 metre long groynes spaced at 460 metre intervals between the artificial headland at the cusp of Quinns Beach and Tapping Way to the north. As well, 180 000m³ of sand was included to saturate the groyne field (MP Rogers and Associates, 2002).

The works are to be staged over a four-year period from November 2002 to November 2006. By December 2003, all three groynes had been constructed.

2.6 Geomorphology and Soils

The study area occurs on two of the three major relict sand dune formations of the Swan Coastal Plain. The majority of the study area consists of the Quindalup Dune system, the youngest of the three systems. The Quindalup Dunes are composed of calcareous sands known as the Safety Bay Sands, which are generally well sorted and comprise white, medium grained, rounded quartz and shell debris. The Quindalup Dunes occur as beach ridges, parallel dunes and parabolic dunes (Churchward and McArthur, 1980).

The skeleton of the coastal zone comprises four to five parallel limestone ridges, the two largest lying to the east. The western ridge forms the mainland coast, with a chain of islands and reefs offshore (Woods, 1984). Superimposed on this limestone basement are a number of landforms associated with the younger sandy deposits. These include submarine banks, transgressive dunes, beach ridges, beach ridge plains, marine basins, wave cut platforms and cliffs, and beaches.

South of Quinns Road, the Spearwood Dune system occurs adjacent to the coast and consists of a core of Tamala limestone overlain by yellow sands. Within the study area, high wind erosion over a long period of time has resulted in the Cottesloe formation, consisting of shallow yellow-brown sand and exposed Tamala limestone characterised by the cliffs that occur along the coast between Quinns Road and Mindarie Keys.

The central portion of the study area consists of Cottesloe Soils and the northern and southern extremities lies within the Quindalup Soils. The Cottesloe Soils form low hills with shallow brown soils over limestone, which is often exposed. The Quindalup Soils form dunes and beach ridges composed of calcareous sands (Churchward and McArthur, 1978).

The soils within the study area directly reflect the geomorphic units they lie within. The central portion consists of Coastal Limestone, with the southern and northern extremities consisting of Safety Bay Sand.

Soils and Landforms found in the study area are included in Figure 2.2.

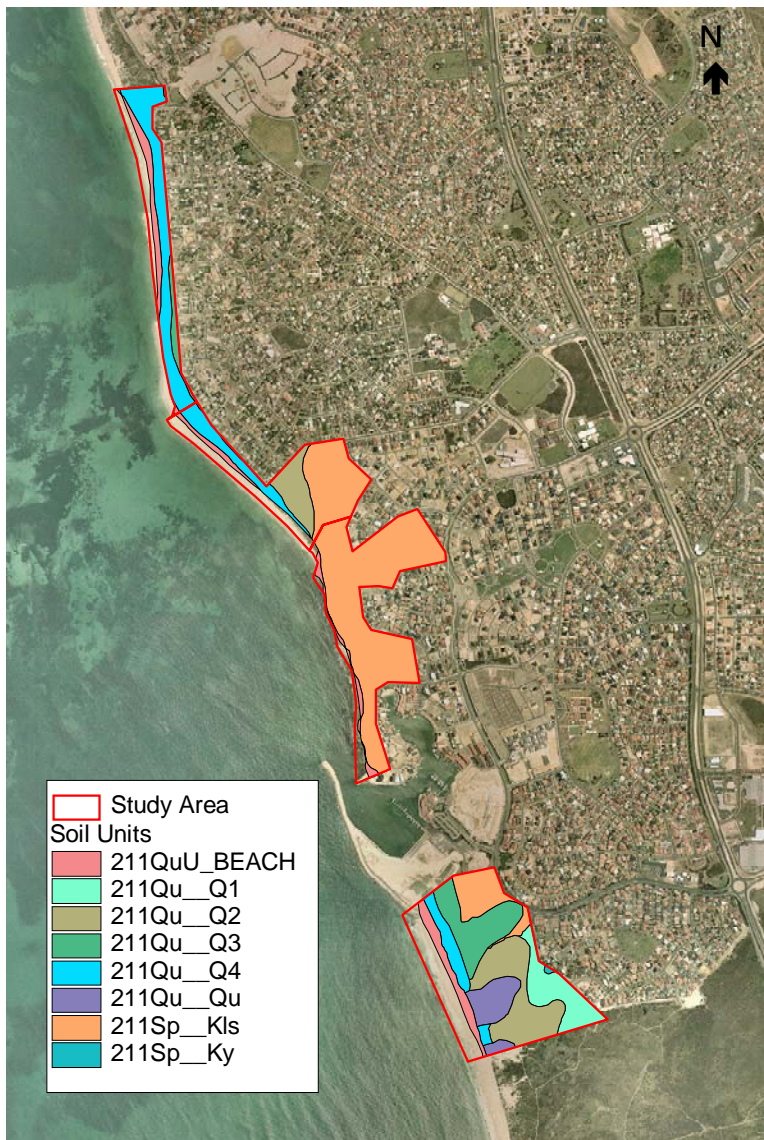
2.7 Landforms and Topography

The coastal environment of south west Australia can be divided into discrete sectors, each with unique characteristics. The Mindarie - Quinns Rocks study area is located in the Whitfords to Lancelin Sector, which is characterised by a series of four main limestone shore parallel ridges that form the basis of the bathymetry and onshore geomorphology of this sector (Hames Sharley, 1992).

One ridge forms the basic architecture of the shoreline, and together with less continuous ridges to landward, forms a topographic barrier between the Swan Coastal Plain hinterland and the coast. Portions of the ridge are exposed along the shore as diffuse rocky headlands with 2 to 5m high seacliffs and intervening pocket beaches. Unconsolidated dune sands mantle portions of the seaward face of the ridge forming sandy beach shores. Locally these sandy portions of the coast project up to 800m seawards to form discrete cusped promontories (Hames Sharley, 1992). The cusps are topped by linear primary dunes and beach ridges variably modified by the prevailing winds into transgressive dune fields.

A typical transect through the study area from the coast to the easternmost extent of the coastal dunes includes low foredunes, gradually rising to higher, primary and secondary dunes away from the coast. The coastline within the study area continues to undergo change related to long-term changes in sea level and the shape of sandy parts of the coast continue to change in response to changes in sand supply and wave direction (Woods, 1984).

Soils and Landforms found in the study area are included in Figure 2.2.



Soil Unit	Description
211Qu__Q1	The oldest Quindalup phase. Dunes or remnants with low relief. Calcareous sands have organic staining to about 30 cm, overlying pale brown sand with definite cementation below 1 m.
211Qu__Q2	The second Quindalup phase. A complex pattern of dunes with moderate relief. Calcareous sands have organic staining to about 20 cm, passing into pale brown sand; some cementation below 1 m.
211Qu__Q3	The third Quindalup phase. Irregular dunes with high relief and slopes up to 20%. Loose calcareous sand with little surface organic staining and incipient cementation at depth.
211Qu__Q4	The youngest Quindalup phase. Irregular dunes with slopes up to 20%. Loose pale brown calcareous sand with no soil profile development.
211Qu__Qu	Presently unstable sand.
211QuU_BEACH	Beach.
211Sp__Kls	Low hills and ridges of the Spearwood system. Bare limestone or shallow siliceous or calcareous sand over limestone.
211Sp__Ky	Low hilly to gently undulating terrain. Yellow Spearwood sand over limestone at 1-2 m.

Figure 2.2 Soils and Landforms within the Study Area

2.8 Flora and Vegetation

Flora and Vegetation was determined from two flora and vegetation surveys. A survey of part of Bush Forever Site 322 by BBG (2003) that included the Mindarie Beach portion of the study area undertaken in November and December, 2002, and the area from Mindarie Keys Marina to Tapping Way was surveyed by Ecoscape in August, 2003. The methods used for this survey are described in Appendix 1.

Bush Forever

Most of the study area forms part of Bush Forever Sites 322 and 397. The Bush Forever policy is outlined in Section 4.2.2.

Bush Forever Site 322

Bush Forever Site 322 is referred to as Burns Beach Bushland, and is 407.9ha in area (Government of Western Australia, 2000). It encompasses both Spearwood Dunes with associated Central/South Cottesloe vegetation complex and Quindalup Dunes with Safety Bay sands and associated Quindalup vegetation complex. More than 70% of the Site is in Excellent to Pristine condition.

Vegetation types within the Site include:

- *Banksia attenuata* or *B. attenuata* – *Eucalyptus* woodlands;
- *Acacia rostellifera* – *Melaleuca systema* shrublands;
- *Olearia axillaris* – *Scaevola crassifolia* shrublands; and
- *Spinifex longifolius* grasslands and low shrubland.

Bush Forever Site 397

Bush Forever Site 397 is referred to as the Coastal Strip from Wilbinga to Mindarie, and is 404.7ha in area. Floristically it is similar to Burns Beach Bushland, consisting of Spearwood Dunes with Tamala Limestone sands under Cottesloe Central and South vegetation complex, and Quindalup Dunes with Safety Bay sand under the Quindalup vegetation complex. There is a sumpland within the Site that is the only one in the Quindalup Dunes north of Perth in the Perth Metropolitan Region.

Vegetation types within the Site include *Acacia rostellifera* – *Melaleuca systema* shrublands; *Olearia axillaris* – *Scaevola crassifolia* shrublands; and *Spinifex longifolius* grasslands and low shrubland. The seasonal wetland is defined by *Frankenia pauciflora* low shrubland on Tamala Limestone Cliffs. The condition of the vegetation within the Site ranges from near Pristine, to Degraded, with areas of severe localised disturbance.

2.8.1 Flora

Native Flora

A total of 85 taxa comprising 37 plant families and 68 genera were found within the study area during the 2003 survey, which is estimated to be approximately 60% of the expected flora for the survey area (flora survey methods are described in Appendix One). Species representation was greatest amongst the Proteaceae, Mimosaceae, Myrtaceae and Papilionaceae families, a composition fairly typical of coastal vegetation. Some 112 species were recorded in the 2002 survey (BBG, 2003) of Part Bush Forever Site 322. A list of plant species occurring within the study area is shown in Appendix Three.

Significant Flora

No Declared Rare Flora species, pursuant to Subsection 2 of Section 23F of the *Wildlife Conservation Act 1950* and listed by CALM were identified during the survey.

Two Priority Three Flora species, *Astroloma microcalyx*, and *Lasiopetalum membranaceum* were identified during the Ecoscape (2003) survey within the same plant communities. No endangered or vulnerable species, pursuant to s178 of the *EPBC Act 1999* were located.

In addition to the above, a third Priority Three species *Stylidium maritimum* was found in one location of the Mindarie foreshore as part of the BBG (2003) survey.

A number of other plant species which may be limited to a particular soil or landform, are rare, poorly known, or have some other feature of particular interest, were recorded within the survey area, including:

- *Melaleuca cardiophylla*;
- *Lechenaultia linarioides*;
- *Grevillea preissii*; and
- *Trymalium ledifolia* subsp. *ledifolium*.

Weeds

Eighteen of the species recorded during the 2003 survey were introduced (weed) species, mainly Poaceae (grasses), which indicates the degraded condition of some parts of the survey area. Thirty-five weed species were found in Part Bush Forever Site 322 during the survey undertaken by BBG in 2003. Weed species from these surveys are listed in Table 2.1, with their priority for control determined from the Environmental Weed Strategy for Western Australia (Department of Conservation and Land Management, 1999).

Some weed species are aggressive colonisers of disturbed areas and were recorded within almost every vegetation community and include Sea spinach **Tetragonia decumbens*, Rose Pelargonium **Pelargonium capitatum*, Geraldton Carnation Weed **Euphorbia terracina* and Gazania **Gazania linearis*. The timing of the survey precluded the identification of a range of grassy weeds and may have limited the recording of some bulbous weeds.

Rehabilitation and weed control methods for the study area is detailed in Sections 6.2 and 6.3.

Table 2.1 Weed Species and their Priority according to the Environmental Weed Strategy for Western Australia.

Weed Species	Eco	BBG	EWSWA	Weed Species	Eco	BBG	EWSWA
<i>Agave americana</i>	x		Low	<i>Gladiolus caryophyllaceus</i>	x		Moderate
<i>Ammophila arenaria</i>		x	Low	<i>Lactuca saligna</i>		x	Low
<i>Anagallis arvensis</i>	x	x	Unrated (L)	<i>Lactuca serriola</i>		x	Moderate
<i>Arctotheca calendula</i>		x	Moderate	<i>Lagurus ovatus</i>	x	x	High
<i>Arctotis stoechadifolia</i>		x	Low	<i>Leptospermum laevigatum</i>		x	High
<i>Avena barbata</i>		x	Moderate	<i>Mellilotus indicus</i>		x	Low
<i>Brassica tournefortii</i>		x	High	<i>Nothoscordum gracile</i>		x	Low
<i>Bromus diandrus</i>		x	High	<i>Oenothera drummondii</i>		x	Moderate
<i>Carduus pycnocephalus</i>		x	Moderate	<i>Oxalis sp.</i>	x		Mild
<i>Carpobrotus edulis</i>	x	x	Moderate	<i>Pelargonium capitatum</i>	x	x	High
<i>Crassula glomerata</i>		x	Moderate	<i>Pennisetum clandestinum</i>		x	Moderate
<i>Cynodon dactylon</i>	x	x	Moderate	<i>Ricinus communis</i>	x		Low
<i>Dimorphotheca ecklonis</i>	x		Low	<i>Romulea rosea</i>	x	x	High
<i>Dischisma arenarium</i>		x	Unrated (L)	<i>Schinus terebinthifolius</i>			Moderate
<i>Echium plantagineum</i>		x	Unrated (M)	<i>Solanum nigrum</i>	x	x	Moderate
<i>Ehrharta longiflora</i>	x	x	Moderate	<i>Sonchus oleraceus</i>	x	x	Moderate
<i>Euphorbia terracina</i>	x	x	High	<i>Stenotaphrum secundatum</i>		x	Moderate
<i>Foeniculum vulgare</i>	x	x	Unrated (L)	<i>Tetragonia decumbens</i>	x	x	Moderate
<i>Galenia pubescens</i>		x	Low	<i>Thinopyrum distichum</i>		x	Moderate
<i>Gazania linearis</i>	x	x	Low	<i>Trachyandra divaricata</i>		x	Mild

2.8.2 Vegetation

Eighteen vegetation communities were observed and recorded for the survey area during the 2003 survey. The location and extent of vegetation communities are shown in Map 1 and are described in Appendix Two. A species list and species by site matrix table is presented in Appendix 3. The vegetation communities are typical coastal areas, which may appear fairly homogenous at a broad scale but on closer inspection, vary considerably depending on the age of the dune, underlying limestone or deep sand, dune stability and external influences from disturbance, weeds, fire, etc.

The vegetation generally varies from shrubland to heath with a mix of dominants generally consisting of Coastal Daisybush *Olearia axillaris*, Basket Bush *Spyridium globulosum*, *Scaevola crassifolia*, *Acacia cyclops*, *Rhagodia baccata* subsp. *dioica*, *Myoporum insulare* and *Melaleuca huegelii* var. *huegelii* with the exception of *Melaleuca lanceolata* and *Acacia cyclops* Low Closed Forest, *Acacia cyclops* Closed Tall Scrub and the *Frankenia pauciflora*, **Tetragonia decumbens* and *Threlkeldia diffusa* Open Low Heath.

Vegetation Condition

Vegetation condition was mapped based on the vegetation condition scale by Kaesehagen (1995) (Appendix Seven). Most of the communities were in 'Good' or 'Very Good' condition with degraded areas occurring near tracks and in areas adjacent to housing or the caravan park with a number of garden escapes colonising bare and disturbed areas. Bushland Condition is shown in Map 2. The areas of each Bushland Condition category within the study area are shown below in Table 2.2. Methods of weed control and rehabilitation based on bushland condition mapping are detailed in Section 6.2 and 6.3.

Table 2.2 Areas of Bushland Condition within the Study Area

Bushland Condition	Area
Very Good – Excellent	11.7 ha
Fair to Good	8.6 ha
Poor	5.9 ha
Very Poor	3.1 ha

Floristic Community Types

The following Floristic Community Types (FCT) as defined by Gibson *et al.* (1994) were inferred from the vegetation survey data:

- **FCT 16** Highly saline seasonal wetlands (*Frankenia pauciflora* Low Shrubland on Tamala Limestone Cliffs)
- **FCT 26a** *Melaleuca huegelii* – *M. systema* shrublands of limestone ridges
- **FCT 29a** Coastal shrublands on shallow sands
- **FCT 29b** *Acacia* shrublands on taller dunes
- **FCT S13** Northern *Olearia axillaris*-*Scaevola crassifolia* Shrublands
- **FCT 30a** *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands
- **FCT 30c** Other mallees or scrubs (*Spyridium globulosum*, *Acacia lasiocarpa*, *Dryandra sessilis*, *Olearia axillaris*, *Templetonia retusa* listed as components).

Inferred Floristic Community Types for each vegetation community are included in Appendix Two.

Threatened Ecological Communities

Two of the Community Types inferred are listed as Threatened Ecological Communities (TECs). **FCT 26a** is a State listed Endangered Community Type and **FCT 30a** is State listed as Vulnerable. Neither community has been listed under the Federal *EPBC Act 1999*. Vegetation communities inferred as TECs are shown below in Table 2.3.

Table 2.3 Inferred Threatened Ecological Communities

No.	Vegetation Community Description	Inferred TEC	Reserve Status	Conservation Status
5	<i>Melaleuca lanceolata</i> and <i>Acacia cyclops</i> Low Closed Forest	30a	Poorly reserved	Vulnerable
7	<i>Olearia axillaris</i> , <i>Melaleuca huegelii</i> var. <i>huegelii</i> and <i>Spyridium globulosum</i> Closed Low Heath	26a	Unreserved	Susceptible
12	<i>Acacia cyclops</i> Closed Tall Scrub	?26a	Unreserved	Susceptible
13	<i>Acacia truncata</i> , <i>Melaleuca huegelii</i> var. <i>huegelii</i> and <i>Scaevola anchusifolia</i> Open Low Heath	26a	Unreserved	Susceptible

No Threatened Ecological Communities were inferred during the BBG (2003) survey however reference was made to FCT 29a and FCT 29b. These community types were inferred to be present in the Mindarie portion of the study area and are significant as they are both poorly reserved and susceptible and have been proposed for listing as a Threatened Ecological Community.

Further investigation is required to determine the status of the potential TECs in the Study Area. This is explored in more detail in Section 6.1.1.

2.8.3 Plant Disease

Dieback

The study area occurs mostly on the Spearwood and Quindalup Dunes. The soils of these two dune systems tend to be well-drained and highly calcareous. Therefore the expression and impact of *Phytophthora* is generally limited. However, if development is to occur within the study area in the future, it is important to practice soil hygiene; for example, ensuring that any soil brought in during construction or landscaping is not from an infected area.

Phytophthora species are soil-borne water moulds that kill a wide selection of plant species of the south west of Western Australia. The life cycle of *Phytophthora* requires moist, non-alkaline conditions that favour survival, sporulation and dispersal. As *Phytophthora* is a parasite, it requires a living host on which to feed and extracts its food by a mass of thread-like mycelium, which forms the body of the organism. *Phytophthora* is a water mould that kills its host by girdling the base of the stem, destroying the roots and depriving the plant access to nutrients and water.

Human activity is perhaps the biggest factor contributing to the spread of the disease. Infected soil can be moved around the forest on vehicles or bikes, footwear, animal movements, road construction and earth moving equipment.

There is no evidence of *Phytophthora* in the study area, however steps should be taken to ensure that infection does not occur, particularly during rehabilitation activities. Dieback management is detailed in Section 6.5.

Armillaria luteobalbina

Armillaria luteobalbina (also known as honey fungus), is a toadstool-producing fungus that is native to Western Australia and commonly occurs in the south-west of the state. Unlike *Phytophthora cinnamomi*, *A. luteobalbina* is not restricted to certain soil types and may occur within the study area.

Armillaria luteobalbina appears as a golden yellow fruiting body at the base of tree stumps around June or July. The infection is caused by the aerial dispersion of spores, or through mycelium in root systems. Infection entry points for the spores may be provided by wounds caused by fire, broken limbs and insect damage. *A. luteobalbina* can kill many coastal species and in severe cases can cause sand dunes to erode.

There is no evidence of *Armillaria* being present in the study area however steps should be taken to ensure that infection does not occur, particularly during rehabilitation activities. Management strategies for *Armillaria* are detailed in Section 6.5.

Aerial Canker

Most living trees have numerous small fungal infections and recently a new fungal threat has emerged in Western Australia. Air-dispersed fungi, known as Aerial Canker, have infested many native plant communities, especially in areas along the south coast. Species from the Myrtaceae and Proteaceae families appear to be particularly susceptible.

Aerial canker kills twigs in the lower crown and causes lesions called cankers in the bark of the main stem and roots. Severe cankers can cause death in parts of the plants above the canker. The fungus usually enters the plant through an existing wound (insect attack or wind damage). Healthy trees not subject to stress are unlikely to be severely affected.

There have been no reports of aerial canker from the City of Wanneroo however steps should be taken to ensure that infection does not occur, particularly during rehabilitation activities. Management strategies for *Aerial Canker* are detailed in Section 6.5.

2.9 Fauna and Fauna Habitat

2.9.1 Fauna Habitat

Some fauna studies have been completed that encompass parts of the study area and/or are relevant to the study area. These include a survey of the birds of the City of Wanneroo by Jones and Gole (2003); a study of the fauna of the northern Swan Coastal Plain by the Western Australian Museum in 1978; studies compiled in preparation of the Bush Forever series (Government of Western Australia, 2000) and a study of the vertebrate fauna in the Shire of Capel with a similar coastal habitat as the study area (Alan Tingay and Associates, 1998).

The vegetation in the study area is a complex mosaic of communities depending on exposure, topography, geomorphology, soil depth and extent of disturbance. As a result, fauna habitats are diverse and it can be expected that an array of fauna types will be observed in the study area.

2.9.2 Reptiles

A study undertaken by the Western Australian Museum in 1978 of the fauna of the Swan Coastal Plain recorded a variety of reptilian species in the dunal zones of the study area. Particularly well represented were the legless lizards (Pygopodidae), skinks, and elapid snakes. Turtles that may be observed in surface water and damp areas are *Chelodina oblonga* and *Pseudomydura umbrina*. The dunal zone, due to the presence of limestone, is twice as rich as other areas of the Swan Coastal Plain in geckos.

31 species of reptiles were recorded in the two Bush Forever Sites, partly within the study area (Government of Western Australia, 2000), while Alan Tingay and Associates (1998) recorded five species of reptiles in Quindalup coastal heath: Burton's Legless Lizard *Lialis burtonis*; Western Bearded Dragon *Pogona minor*; West Coast Ctenotus *Ctenotus fallens*; Gould's Snake *Rhinoplocephalus gouldii*; and the Western Pale Flecked Morethia *Morethia lineocellata*.

2.9.3 Amphibians

The Western Australian Museum study of 1978 recorded amphibian species in the dunal zone of the metropolitan area. Species observed include the frogs *Myobatrachus gouldii*, *Vermicella calonotos*, and *Vermicella semifasciata*. Due to the lack of unpolluted, consistent areas of fresh surface water in the dunes, amphibians are not prolific in the study area (Western Australian Museum, 1978). One amphibian species was recorded in Burns Beach Bushland Bush Forever Site (Government of Western Australia, 2000). A study of Quindalup coastal heath undertaken by Alan Tingay and Associates (1998) found the species Moaning Frog *Heleporus eyrie* and Pobblebonk *Lymnodynastes dorsalis*.

2.9.4 Mammals

Only 12 native mammal species have been recorded from the northern section of the Swan Coastal Plain, which includes the study area (Western Australian Museum, 1978). In the two Bush Forever sites in the study area, four native mammal species were recorded, with two significant species, known to be poorly represented, observed in the Burns Beach Bushland. These are the Western Brush Wallaby *Macropus irma* and the Honey Possum *Tarsipes rostratus*.

2.9.5 Birds

A survey undertaken by Jones and Gole (2003) recorded a comprehensive list of bird species found in parks and reserves in the City of Wanneroo including the study area. The full list is shown in Appendix Four.

The survey found that the coastal strip from Wilbinga to Mindarie (represented by Bush Forever Site 397) consists of several major habitats. The heathland nearest the coast is the habitat of 26 bird species including some now extinct at most metropolitan coastal areas. Significant species recorded in the coastal area of Wanneroo included the White-Winged Fairy Wren, White-Browed Scrubwren, White-Breasted Robin, New Holland Honeyeater and Carnaby's Black Cockatoo.

Five bird species recorded by Jones and Gole (2003) in the City of Wanneroo and potentially within the study area are protected under the JAMBA Agreement, an agreement made between the governments of Australia and Japan to protect important bird species that migrate annually between the two countries (Department of Foreign Affairs, 1995). These species are Cattle Egret (*Bubulcus ibis*); Red-Necked Stint (*Calidris ruficollis*); Long-Toed Stint (*Calidris minutilla*); Common Sandpiper (*Tringa hypoleucos*); and Fork-Tailed Swift (*Apus pacificus*).

LeProvost (1990, in Government of Western Australia, 2000) undertook a limited survey of Bush Forever Site 397 and observed 30 bird species, with 16 of these considered significant species. Bush Forever Site 322 was surveyed by Kinhill Stearns (1983 in Government of Western Australia, 2000) during which 54 bird species were observed, with Scarlet Robin (*Petroica multicolor*) listed as the only significant species found.

2.9.6 Threatened and Priority Fauna

The *Western Australian Wildlife Conservation Act, 1950* and the *Commonwealth Environmental Protection and Biodiversity Conservation Act, 1999* (EPBC Act) categories for threatened fauna defined by the IUCN are outlined in Appendix 7.

The *WA Wildlife Conservation Act* also has an additional category for “Other Specially Protected Fauna”. In addition, CALM also has four Priority categories for fauna species that are not considered Threatened under the IUCN categories, but for which there is cause for concern. These categories are also defined in Appendix 7.

Kinhill Stearns (1983) (cited in Government of Western Australia, 2000) observed two significant fauna species, with few populations on the Swan Coastal Plain, in Bush Forever Site 322: the Western Brush Wallaby *Macropus irma* and the Honey Possum *Tarsipes rostratus*.

2.9.7 Feral Animals

There are several species of feral animal within the study area, including domestic cats and dogs. Known vertebrate feral animal species are: Cat *Felis catus*; European Red Fox *Vulpes vulpes*; Rabbit *Oryctolagus cuniculus*; Domestic Dog *Canis familiaris*; House Mouse *Mus musculus*; Black Rat *Rattus rattus*; Laughing Turtle Dove *Streptopelia senegalensis*; Galah *Cacatua rosecapilla*; and Rainbow Lorikeet *Trichoglossus haematodus*.

The feral rodents, the House Mouse and Black Rat, are a ubiquitous species commonly associated with human settlement. Feral cats and foxes are predators of a wide range of small native animals, including birds, mammals, frogs and reptiles. The European Rabbit presents a significant threat to the germination of seedlings, particularly after a wildfire event.

Management Strategies for the control of feral and domestic animals are detailed in Section 6.6.

3.0 Social Environment

Foreshore Management Plan: Mindarie – Quinns Rocks

3.1 Cultural Heritage

3.1.1 Aboriginal Heritage

A search of the Register of Aboriginal Sites (Department of Indigenous Affairs, 2003) did not reveal any registered Aboriginal sites, although a recent site visit confirmed specific mythological connections at two places within the study area. Aboriginal Sites, regardless of whether they are they are registered or not, are protected under the Aboriginal Heritage Act, 1972. If works may impact on a known site, then a determination as to whether the works are within the scope of any prior Ministerial consent issued under Section 18 of the Act should be made. If the works are assessed to be beyond the scope of previous consent then fresh consent will be required to permit the works to proceed. If no consent has been previously issued, permission will need to be sought and obtained under Section 18 prior to any works proceeding.

It is courteous to consult with the Aboriginal community prior to works proceeding in any case. Aboriginal people often buried their dead in sand dunes and it is possible to uncover remains during excavation. In this event, unless a Section 18 has already been granted, works must stop immediately until a Section 18 is applied for and granted. If this is not granted, works can be postponed indefinitely. It may therefore be a good idea to apply for Section 18 clearance prior to works, such as the proposed development of Lot 211, proceeding even though no evidence of Aboriginal heritage has previously been found.

3.1.2 Non-indigenous Cultural Heritage

European History of Quinns Rocks – Mindarie

The first records of the area were made by Robert Quin, Government surveyor in 1866. Quinns Rocks was first settled by the Clarkson's in the 1890's who had two pastoral leases totalling 13,000 acres in the area. These coastal leases were known as the Mindarie Pastoral Company (Palassis Architects, 1997).

Quinns Rocks was named after one of the Clarkson's shepherds, Mick Quinn (Arthur and Hunt-Smith, undated). The shepherds lived in shacks near reliable water sources and tended the Clarkson's Merino sheep. During the 1930's and 1940's amateur fishermen began using the area and constructed shacks near the beach. More shacks were to follow and the area became a popular holiday location for amateur fishermen and their families.

The increasing number of beach shacks in the area became a concern for the government due to poor hygiene standards. There were no septic tanks and sewage was emptied into a large hole. There are stories of people falling into this hole during some of the parties held on the beach (Arthur and Hunt-Smith, undated). In 1959 the shack owners were told to remove the fishing shacks or face prosecution by the National Parks Board. A subdivision

was approved at around the same time and shack owners were given first offer of the blocks for sale.

While there are no listed heritage sites within the study site, much of the area has a high community attachment focussing on traditional beach houses and the natural topography that still remains in some areas.

Development of Quinns Rocks

Quinns Rocks has experienced relatively rapid development. Prior to 1959 the area was an isolated and relatively inaccessible squatter shack settlement. In 1959 titles became available for surveyed lots in the Quinns Rocks area, and permanent dwellings, many of them shacks relocated from the beach, were constructed. In that year all beach shacks from Quinns Rocks were removed or relocated (K.A. Adam and Associates, 2003). Since that time there has been a steady evolution of the settlements from isolated weekend / holiday places to outer metropolitan suburbs.

A major part of the evolution of the area is the change in housing style and construction. Previously, all houses built in the area were built on stumps or with footings set into natural ground, with a minimum of cut and fill and retaining walls. This practice limited the extent of modification to the natural topography of the area. Most houses recently constructed use cut & fill levelling of building sites to enable slab-on-ground construction. This type of construction has a greater impact on dune topography.

It has been recommended that a survey of traditional holiday houses and other objects and places be undertaken for possible inclusion in the Municipal Heritage Inventory, as part of the upcoming review of the MHI (KA Adam and Associates, 2003).

Lime Kilns

One of the few remnants of the European History in the Quinns Rocks – Mindarie area are the lime kilns located just outside the study area on Lot 963 Anchorage Drive. The kilns were established in c. 1932 by the Cooper family and operated for about 10 years and employed up to 12 people who lived in shacks or tents nearby (Palassis Architects, 1997). The kilns produced high grade lime which was exported to the goldfields for use in the gold extraction process. Lower grade lime was used in agriculture.

3.2 Population Growth

The City of Wanneroo is one of the fastest growing local government areas in the Perth Metropolitan Area, and the districts of Mindarie and Quinns Rocks are rapidly evolving into modern, highly populated suburbs of Perth. An increase in resident population and tourist numbers will have implications on the management of the foreshore areas. Most obviously, there will be an increase in pressure on the recreational infrastructure and amenities. Existing levels of recreational facilities are unlikely to cope with higher pressures brought about by population expansion and if not improved will have implications for public safety and recreation.

With a larger number of people wishing to utilise the foreshore area, there will also be a greater potential for conflicts between different recreational user groups. This must be anticipated and incorporated into future management of the area.

Increased population may also impact the natural environment, both directly and indirectly. Native vegetation can be directly affected by the unregulated pedestrian and vehicular movement across the dunes as more people desire access to beaches, lookouts and tracks. Indirectly, the natural environment may also be compromised due to increased littering, possible disease, weed introduction, and pollution.

Some problems in the area may be reduced due to an increased population. Antisocial behaviour may decrease as the population density increases. As more residents utilise the foreshore area at different times of the day and night, exercising, walking dogs and so on, the opportunities for observing graffiti, vandalism, theft and other illegal activities increase.

3.3 Planned Future Developments

3.3.1 Groyne Construction

Three groynes have been constructed on the northern end of Quinns Beach to halt the high levels of erosion in this area. The last was completed in December, 2003. Groyne construction will have implications for the recreational use of the area. While they are not excessively large, they may provide more sheltered areas for swimming.

3.3.2 Lot 211 Ocean Drive, Mindarie

A proposal for a new Essential Services (surf lifesaving) Building, Community Facility and car parking for 212 vehicles has been approved by the Western Australian Planning Commission (WAPC). This site is adjacent to the existing Quinns Rocks Caravan Park and access to the Park will be from a new access road off McPharlin Avenue. A plan of the proposed development is shown in Figure 3.1 and the estimated location and extent of the development in relation to the vegetation mapping conducted by Ecoscape in 2003 is shown in Figure 3.2.

The car park is likely to be completed first and earthworks on this stage have started. A drainage swale is to be dug between the two car parks (separated by a limestone retaining wall) and to the immediate east of the existing car park to cater for 1 in 100 year storm events. A roundabout will also be constructed at the intersection of Quinns Road and McPharlin Avenue.

Two buildings are to be constructed: An Essential Services building (Surf Lifesaving) to the south west of the main car park. This building will be designed so that a Community Facility can be built on top at a later date. A café – restaurant will also be built in the area to the immediate north of the Essential Services building. The developer of the café – restaurant will also be responsible for the provision of toilets and change rooms in this area.

Once the new car park and toilets – change rooms have been constructed, the existing car park and toilet block will be removed and the area landscaped. A main pedestrian access way with wide steps to the beach will then be constructed. A ramp to launch surf-lifesaving vessels from the bitumen area and provide emergency vehicular beach access will also be constructed.

The facility is likely to substantially increase recreational use of the immediate and surrounding areas, which will put increased pressure on surrounding recreational facilities and natural bushland. The site lies within Bush Forever Site 397 and therefore conditions have been placed on the development to ensure the preservation of existing native vegetation within the site. The Environmental Management Plan for Lot 211 Ocean Drive (City of Wanneroo, 2002) states that the development must be “...of the environmental standard in order to protect and enhance the integrity of the existing site, Council’s network of open spaces and the integrity of the area in which this site lies”.

Protection of natural values should be undertaken through the following considerations:

- chain mesh fencing should be erected on the eastern edge of the car park;
- post, rail and ringlock fencing should be erected around the perimeter of the conservation area;
- track/pathway fencing should be erected along paths within conservation areas;
- informative and regulatory signage should be placed in appropriate areas such as (see also Section 6.8):
 - interpretive and informative signage at the entrances to paths and tracks entering conservation areas
 - regulatory signage on dune surfaces to discourage inappropriate access
 - waymarker signs which direct people along tracks and to other public facilities;
- landscaped areas within the development should be local provenance and contribute to fauna movements through the development (See Section 6.6); and
- rehabilitation of degraded sites (shown in pink in Figure 3.2) should be undertaken to improve bushland condition within Bush Forever Site 397 and provide a buffer between the development in Lot 211 and the intact bushland in BF Site 397.

As well as the protection of natural values, the requirements of recreational users and visitors to the area need to be considered during the planning stage of the development. The plan outlined in Figure 3.3 gives the location and type of infrastructure including paths, buildings and services. Other infrastructure needed to facilitate passive recreation is as follows:

- The provision of grassed areas, picnic tables and barbecues within the landscaped areas on the foreshore;
- Upgrading and connecting the existing dual use path up to the development area at the site of the existing car-park. Bicycle racks should be provided in this area. It is also recommended that riding of bicycles within the area be prohibited as it is likely to be used by a large number of pedestrians



Figure 3.2 Estimated Location and Extent of Proposed Lot 211 Community Facility Development in relation to Vegetation Mapping.

The Draft Structure Plan and Environmental Management Plan for Lot 211 provides an overview of planning and management considerations for the proposed development. These are summarised in Section 4.2.3. The development of Lot 211 is also further explored in Sections 6.8 and 6.9.

3.3.3 Ocean Drive Upgrade

A draft concept design for the proposed upgrade of the Ocean Drive road reserve and carpark facilities from Camira Way to Quinns Road has been prepared by Technical Services. The draft design includes road realignment (with median treatment subject to the constraints of the road reserve), stormwater drainage utilising water sensitive design principles, street lighting to Australian standards, parking embayments on the western side of the road reserve, and footpath/dual use path provision. The project is currently on hold, with further action involving public consultation to be progressed subject to project funding (in the 2004/2005 Capital Works Budget) being approved by Council.

It is noted that it is proposed to upgrade the existing footpath on the eastern side of the road reserve to 1.5m wide, and provide a new 2.1m wide shared path (formally known as a dual use path) on the western side. Provision of the dual use path on the western side will be consistent with other coastal paths, will allow safer utilisation by all users, and will avoid conflict with numerous crossovers to private property located on the eastern side. The shared path as proposed will also improve and provide for safer access to the beach at the various controlled access points. A pedestrian crosswalk constructed adjacent to the Surf

Lifesaving Club and Car Park will also be required, as there is a kiosk located on the eastern side of the road.

Ocean Drive is adjacent to the dune areas of Bush Forever Site 397, and the stability of these dunes is of concern. While the groynes appear to be working in the short term, reliable, long-term data has yet to be acquired. The potential risks associated with development should be taken into account during the planning stage, as widening into the dunes and the removal of native vegetation may accelerate wind erosion. Design must account for and ensure the integrity of the dunes and associated vegetation to the west of the road reserve.

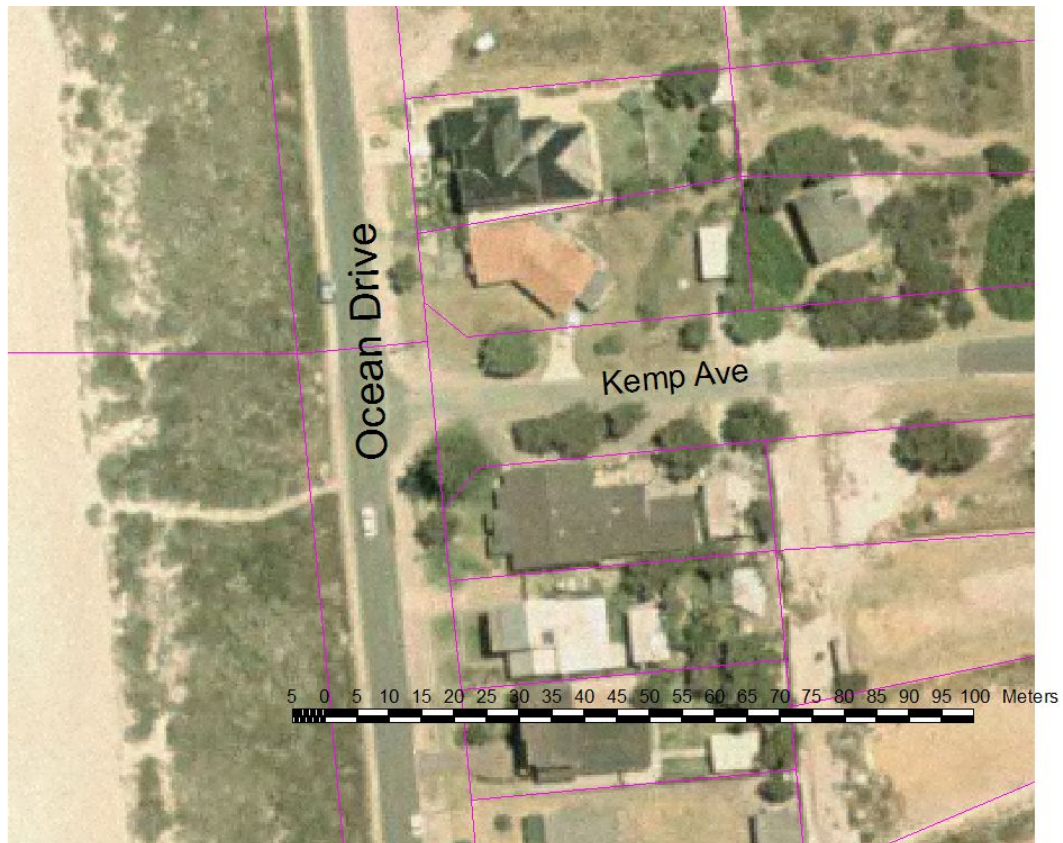


Figure 3.3 Example of Road Reserve Width on Ocean Drive.

3.4 Access

Access in the study area is generally by tracks leading to the coastline from car parks or roads running parallel to the coast. Formal access points appear to have been developed from informal tracks. Attempts have been made to block unsafe or inappropriate tracks however this has had limited success.

The main access points to **North Mindarie Beach** are via a staircase at the northern end of the beach from the car park at Alexandria View, and from a road and car park off Long Beach Promenade. The road and car park have been closed due to high levels of anti-social behaviour since its construction. Several informal paths lead from the car-park including a path directly to the beach. Another formal limestone path leads from Long Beach Promenade to Tuart Grove Picnic area and on to the car park.

The northern end of the beach accessed from the car park on Alexandria View is mainly used by surfers and leads directly to a permanent rip at the base of the headland. This area is unsuitable for general swimming for this reason.

Mindarie Keys to Quinns Beach has a sealed dual use pathway (DUP) with formal access paths, lookout areas and outdoor seatings. Access to the limestone cliff faces and small beaches from the DUP have mostly been closed or converted to lookouts. The shoreline of this area is extremely hazardous and access should be prevented.

Access to **Quinns Beach North and South** is by multiple formal tracks, some leading from established car parks. However, due to high levels of erosion at the northern section of the beach, many of these tracks are unsafe and have been temporarily closed. It is interesting to note that the path and steps leading from the car park at Quinns Rocks Caravan Park are partially covered by sand accretion.



Examples of Erosion and Accretion of Access Tracks on Quinns Beach

See Section 6.8 for information on access management

3.5 Recreation

3.5.1 Recreation Activities

The coastline of the City of Wanneroo is approximately 32 km. Much of the coast is still in a good or excellent condition and this needs to be protected as development and associated demand for coastal recreation increases. The dunes, beaches and marine areas of the City of Wanneroo foreshore are used for a number of recreational pursuits, particularly walking, jogging, cycling, animal exercising, swimming, diving, surfing, windsurfing, fishing and boating.

Recreation activities need to be managed so that:

- activities can be carried out in a safe environment;
- disturbance to the natural environment is minimised; and
- conflicts between incompatible recreational uses are minimised.

The main recreation activities at **North Mindarie Beach** are swimming, surfing, body boarding, walking and fishing. The northern end of the beach is used primarily by surfers (Armstrong *et al* 1999), as there is a strong permanent rip at this area of the beach. **Mindarie Keys to Quinns Beach South**, has negligible opportunities for aquatic-based

recreational activities due to the hazardous nature of the limestone cliffs in this area (see Map 5), however large areas of remnant vegetation, walking tracks and a DUP provide opportunities for walking, cycling and jogging. **Quinns Beach North and South** supports a wide range of aquatic and beach-based activities, including swimming, walking, jogging and fishing. A dog beach at Tapping Way also allows dog exercising.

The condition of recreational facilities is generally poor and inadequate for the amount of use it will receive based on current and projected population growth. Considerable work will need to be undertaken in order to provide an appropriate and safe level of facilities. Work in this area is already being undertaken through the development of Lot 211 and upgrades to Ocean Drive however there is a need for existing infrastructure to be upgraded and the provision of additional infrastructure to satisfy recreational needs. These requirements are explored in more detail in Section 6.8 and 6.9.

4.0 Management Framework

Foreshore Management Plan: Mindarie – Quinns Rocks

4.1 Management Services

Relevant management services for the foreshore area are as follows:

4.1.1 Infrastructure Services

Infrastructure Services provide for the creation, maintenance and refurbishment of the community's physical infrastructure, establish standards and guide and influence development projects in terms of infrastructure requirements (City of Wanneroo, 2003)

Infrastructure Services is a multi-disciplined team that develops and manages the community's infrastructure assets. Relevant services within infrastructure services are:

Engineering Construction Services

In-house components of Engineering Construction Services are provided by a day labour workforce of three construction teams. Two of these teams specialise in major road and drainage construction. The other team specialises in general construction including carparks and traffic management schemes.

Relevant activities undertaken by the ECS include:

- survey services
- road construction
- drainage construction including traffic management devices
- carpark construction
- footpath and dual use path construction
- construction of bicycle facilities.
- provision of streetlighting, carpark and court lighting
- road marking and signing

Engineering Maintenance Services

Engineering Maintenance Services is responsible for maintaining 771 kilometres of road in the City of Wanneroo.

The unit also maintains the following:

- Road verges;
- pathways;
- drainage systems;
- car parks;
- tennis courts and netball courts;
- coastal management and foreshore maintenance; and
- road markings and street furniture (eg. signs, street lighting, etc).

Building Design Services

Building Design Services are responsible for development of initial concepts promoted by Council through design and construction of public buildings.

Landscape Services

Landscape Services are responsible for the development of parks and recreational reserves in conjunction with subdivision works, existing infrastructure enhancement and new roading development promoted by Council.

Project Design Services

Project Design Services are responsible for the design of new roads and drainage assets, and the provision of traffic management services.

4.1.2 Operations

The Operations Unit manages civil construction projects and maintenance of infrastructure assets such as roads, car parks, drainage systems, pedestrian and bicycle facilities, foreshore reserve improvements, parks and street trees (City of Wanneroo, 2003).

Relevant Services within the Operations Unit include the following:

Parks Maintenance

The Parks Maintenance team manages the ongoing grounds maintenance requirements of all the City's parks, reserves, conservation areas and foreshore vegetation areas. All vegetation along verges and medians, including street trees on all road reserves, are maintained on a cyclic basis, and works are undertaken to provide an aesthetically pleasing and safe environment for all residents and visitors.

Revegetation projects are undertaken to maintain or restore damaged and disturbed areas, and ensure that facilities meet the users' needs and expectations. Regular maintenance activities include mowing, turf care, tree pruning, irrigation, rubbish removal, tree planting, weed control and play equipment.

The main areas of maintenance responsibility are:

- parks / reserves / playing fields;
- conservation areas;
- vegetation in / along verges and medians;
- car parks;
- roundabouts;
- sumps; and
- pathways.

4.1.3 Planning Services

The Planning Services Unit oversees a wide range of Council's town planning related responsibilities. These vary from legislative requirements for the co-ordination of Town Planning Scheme amendments and the provision of advice to State planning authorities as part of the land development processes, to strategic objectives such as facilitating Council's environmental objectives and preparation of planning strategies.

The key areas of responsibility are (City of Wanneroo, 2003) :

- the co-ordination of amendments to the City's Town Planning Scheme and assessment of amendments to the Metropolitan Region Scheme;
- undertaking strategic planning studies related to the preparation of planning strategies and policies (eg; Councils Rural Strategy and Commercial Centres Policy);
- the assessment of structure plans and urban design proposals;
- provision of advice to Council on a range of environmental matters and the preparation and assessment of management plans for coastal and wetland areas;
- provision of advice to the Western Australian Planning Commission (WAPC) for subdivision applications and the co-ordination of clearances for subdivisional development;
- preparation of schemes and other mechanisms to assist in managing and co-ordinating development of new areas; and
- management of road reserves, pedestrian access ways and reserved land matters.

4.1.4 Ranger Services

Ranger Services enforce all relevant statutes of the City of Wanneroo. Ranger Services' role is also to educate the community in relation to their legal responsibilities and provide fire management in conjunction with the Wanneroo Volunteer Bush Fire Brigade. Community security is currently in the developmental stages, and the new security working group established by Council will work closely with the community to develop a security model for the City of Wanneroo.

The Ranger Services unit is responsible for investigating customer referrals relating to:

- street and verge parking;
- off-road vehicles;
- littering and dumping;
- vandalism and theft to municipal property;
- dog registrations;
- stray and nuisance animals;
- beach matters;
- speargun control;
- abandoned vehicles; and
- patrols of Council parks and reserves.

4.1.5 Community Development Directorate

The Community Development Directorate contributes to the vision for the City of Wanneroo by:

- facilitating community growth and development;
- planning for future community infrastructure and facilities based on community needs Providing spaces, places and services to enhance lifestyle options;
- protecting, enhancing and celebrating heritage and culture;
- supporting the community's safety and security needs; and
- ensuring compliance with statutory requirements for the benefit of the wider community.

Leisure & Library Services Business Unit

The Leisure & Library Services Business Unit have specific roles on Mindarie – Quinns Rocks foreshore including:

- facilitating the safe access and use of the City's foreshore areas;
- ensuring a range of facilities and programs are available through the management of community buildings;
- managing the use of ovals and parks;
- managing the negotiation and operation of community facility leases;
- providing a range of programs to cater for the leisure needs of the community;
- providing support and advice to community, sporting & recreational groups;
- developing appropriate draft policies to facilitate the equitable management of leisure activities;
- collection, display and interpretation of cultural heritage; and
- ensuring the preservation of heritage buildings and sites controlled by the City of Wanneroo.

4.2 Policy Context

In recognition of the increasing pressures being placed on Western Australia's coastal environment, the Western Australian government over the past two decades has sought to improve and strengthen coastal planning and management systems (Government of Western Australia, 2003). Consequently, a number of coastal planning and management policy documents have been prepared for the West Australian coast based on local and overseas experience. These included:

- Coastal Planning and Management in Western Australia: A Government Position Paper (1983);
- Country Coastal Planning Policy (1987);
- Draft Perth Metropolitan Region Coastal Development Policy (1988);
- Draft Coastal Planning and Management in Western Australia: Towards a Policy Framework (1996); and
- State Coastal Statement of Planning Policy (2003).

More recent documents, such as the State Planning Strategy (1997) and the Coastal Zone Management Policy for Western Australia (2001), as well as the development of the Coastal Planning Policy (WAPC, 2003), provide the most recent Government directions of use and management of coastal resources. Until recently, and despite earlier policy documents, there has been little strategic planning for coastal management in the metropolitan area, with a greater emphasis placed on localised planning within the boundaries of management responsibility (DPI, 2001). DPI (2001) point out that many of these foreshore management plans have been prepared and implemented by developers as part of the development approval process. However, as developments have matured, the pressures on coastal areas have altered, along with patterns of use. The City of Wanneroo has experienced considerable development pressure over the past two decades, which has in turn placed pressure on coastal resources.

The following describes key policy at a Commonwealth (4.2.1), State (4.2.2) and Local (4.2.3) level.

4.2.1 Commonwealth Policy

Living on the Coast: The Commonwealth Coastal Policy (Government of Australia, 1995)

The Commonwealth Coastal Policy (Government of Australia, 1995) produced as part of the Intergovernmental Agreement on the Environment, recognises the importance of the coastal zone for much of Australia's economic, social, tourism and recreational activity. The underlying goal of the policy is ecologically sustainable use of the coastal zone. While the policy is primarily directed at Commonwealth actions and developments in the coastal zone, using the policy as an overall guide for development and management of the City of Wanneroo's coastal zone will facilitate co-operation between the City, the State and Commonwealth governments as well as achieving best practice sustainable management.

The Commonwealth's objectives for coastal management are:

1. Sustainable resource use:

- To ensure that coastal zone resources are available for fair and equitable public and commercial use, so that their use optimises the long-term benefits derived by the community;
- To ensure that consequences arising from the dynamic nature of coastal environments are recognised. This includes taking into account natural fluctuations in sea level and climate, climate change, impacts associated with storm events, changes in shoreline position, and species mobility within coastal ecosystems; and
- To maintain adequate and appropriate public access to the coast, so that it is possible to enjoy a range of recreational opportunities that are consistent with these objectives. Where appropriate, public access should be managed to protect coastal resources and public safety.

2. Resource conservation:

- To conserve and manage areas and features of significant ecological, physical, cultural, historic, landscape and scientific importance, so that their values are maintained;
- To maintain the biological diversity and productivity of marine and terrestrial ecosystems and natural processes within the coastal zone for present and future generations. Where environmental qualities have been degraded remedial action should be taken to restore them; and
- To maintain or restore the quality of coastal waters, so that there is no significant detrimental impact on the integrity of coastal ecosystems and their ability to support a range of beneficial uses.

3. Public participation:

- To ensure that there is informed public participation in open, consultative processes dealing with planning and management of coastal resources; and
- To recognise the interests in the coastal zone of Australia's indigenous peoples and incorporate these interests in management arrangements.

4. Knowledge and understanding:

- To enhance and incorporate in decision making an understanding of coastal zone ecosystems and natural processes and the effects on them of human activities. This enhanced understanding should also be reflected in the skills of managers with responsibilities in the coastal zone; and
- To encourage and support relevant decision making organisations in the preparation of management guidelines and codes of practice to deal with specific coastal management issues.

4.2.2 State Policy

State Planning Strategy (WAPC, 1997)

The State Planning Strategy provides a strategic guide for land use planning in Western Australia through to 2029 with the aim of achieving a number of goals, including generating wealth, conserving and enhancing the environment, and building vibrant and safe communities (WAPC, 1997). The Strategy established the following principles:

1. Environment: to protect and enhance the key natural and cultural assets of the State and deliver to all Western Australians a high quality of life which is based on sound environmentally sustainable principles.
2. Community: to respond to social changes and facilitate the creation of vibrant, accessible, safe and self-reliant communities.
3. Economic: to actively assist in the creation of regional wealth, support the development of new industries and encourage economic activity in accordance with sustainable development principles.
4. Infrastructure: to facilitate strategic development by ensuring land use, transport and public utilities are mutually supportive.
5. Regional: to assist the development of regional Western Australia by taking account of the region's special assets and accommodating the individual requirements of each region.

The Strategy provides a number of actions for achieving these principles, which are designed to be guide planning for all levels of government. The Strategy indicates the actions that are desirable in each of Western Australia's 10 regions.

Draft Coastal Zone Management Policy for Western Australia (Government of Western Australia, 2001)

The Draft Coastal Zone Management Policy for Western Australia (Government of Western Australia, 2001) sets out the Western Australia government's position on coastal planning, management and protection. The government's vision for coastal management is that it is ecologically sustainable, co-ordinated across all levels of government and will engender international respect. The Coastal Zone Management Policy sets out the following comprehensive objectives:

1. Environmental objectives:

- Protection and conservation of areas of environmental and cultural significant through appropriate means, including a comprehensive, adequate and representative system of conservation reserves;
- Avoidance or mitigation of adverse impacts of natural hazards or human activities;
- Protection and enhancement of aesthetic qualities;
- Maintenance of physical and biological processes;
- Maintenance and improvement of water quality (marine, estuarine, surface and groundwater) in accordance with national and State water quality management strategies;
- Restoration of degraded environments to agreed standards; and
- Integration of coastal zone management with catchment, estuarine and offshore management programs.

2. Community objectives:

- Fair and equitable public and commercial use of coastal resources;
- Retention of the widest possible range of options for future generations;
- Appropriate recreational and tourism use and enjoyment of the coast, with due regard for public safety;
- Protection and improvement of the visual amenity of the coast;
- Public access to the coast consistent with public safety needs and the maintenance of natural values and processes;
- Protection for areas valued by the community for their natural and cultural heritage; and
- Public awareness of and involvement in coastal zone management.

3. Economic objectives:

- Long-term economic benefits based on the ecologically sustainable use of coastal resources;
- Optimal and effective expenditure by Commonwealth, State and local government and the private sector on coastal zone management;
- Conservative and sustainable resource use to avoid compromising the options for future generations;
- Appropriate application of the user-pays principle;

- Provision for balanced multiple use of coastal zone resources, consistent with the specified purpose for reservation of particular lands under law;
- Minimisation of resource use conflicts;
- Recognition of the economic and commercial value of coastal land and the legal rights of landowners; and
- Efficiency and accountability in coastal zone management.

4. Infrastructure objectives:

- Recognition of the dynamic nature of coastal environments and the consequences for coastal development and use;
- Avoidance or mitigation of the impacts of natural hazards through intelligent siting and design of infrastructure, based on ongoing scientific research;
- Development of ports, industry, residential areas, tourism and other commercial needs in appropriate locations, based on planned allocation of suitable sites;
- Minimisation or avoidance of adverse environmental impacts of new infrastructure through adoption of mechanisms such as strict control measures (including zero discharge requirements wherever practicable);
- Location of new industrial and other infrastructure away from the coastal zone and concentration in existing nodes, wherever practicable;
- Minimisation or avoidance of adverse visual impacts of new infrastructure through designs which harmonise with coastal landforms; and
- Equitable cost-sharing arrangements for the construction and maintenance of public infrastructure between State and local governments.

5. Regional Development objectives:

- Retention of as much as possible of Western Australia's regional coastline as possible in a natural and healthy condition;
- Ecological sustainability for all new regional development;
- Equitable sharing of coastal management resources across all regions;
- Full coverage of coastal regions with coastal management plans;
- Good coastal management practice for all regional coastal areas, based on appropriate levels of access to coastal management knowledge and skills;
- Recognition of the needs of regional areas for an economic resource base, including the need for new port facilities and carefully planned residential, industrial and tourism development;
- Recognition of the limited financial resources of many regional local governments with primary responsibility for coastal management; and
- Recognition of the different needs and pressures operating in metropolitan and country areas.

The Review of the Structural Arrangements for Coastal Planning and Management in Western Australia (WAPC, 2002)

The structural arrangements for coastal planning and management in Western Australia were reviewed by a Ministerial Taskforce in 2002 (WAPC, 2002).

Within this framework of management:

- The Minister for Lands is the owner of most coastal foreshores by virtue of it being Crown (Government) Land. This land is managed on his behalf by government authorities and departments or leased to enterprises such as pastoralists and indigenous groups.
- Significant portions of the West Australian coastline are managed by the Department of Conservation and Land Management (CALM) for the purpose of recreation and conservation, and the Department of Land Administration manages the unallocated Crown Land.
- The Environmental Protection Authority undertakes assessment of changes in coastal land use.

The Review of the Structural Arrangements for Coastal Planning and Management in Western Australia (WAPC, 2002) identified a hierarchy of 4 levels of plans. These are:

- **Strategic Plans** provide a broad strategic framework, identifying long-term opportunities with an emphasis on the range of options available;
- **Structure Plans** interpret and apply the goals and objectives identified in the strategic plans through a more detailed arrangement of land uses;
- **Coastal Management Plans** aim to build a framework for management of districts or whole or significant parts of local government authorities. They may include more detailed rehabilitation and management plans for key nodes; and
- **Foreshore Management Plans** provide detailed guidelines for particular beaches, inlets or sections of foreshore.

This plan is consistent with the above definition for a Foreshore Management Plan.

State Coastal Statement of Planning Policy (WAPC, 2003a)

In recognition of the demands and pressures on the coast and the need for coordinated decision-making, the Western Australian Planning Commission (WAPC, 2003a) developed this policy under section 5AA of the *Town Planning and Development Act*. The policy seeks to ensure that coastal issues are appropriately considered in planning decisions and actions.

The policy:

- describe how coastal issues are considered within the planning system;
- addresses planning issues associated with protection and management of the coast; and
- recommends provisions to accommodate them into regional and local strategies, schemes and plans.

It also includes policy objectives, measures, and requirements for the preparation of coastal planning and management studies. The policy requires setbacks for coastal processes and coastal foreshore reserves, and provides guidance for their determination. Local governments and State agencies should take this policy into account in developing local strategic plans, conservation and management plans, as well as day to day processes of decision making on zoning, subdivisions and development applications to ensure integrated decision-making.

Environment and Natural Resources Policy (WAPC, 2003b)

The Environment and Natural Resources Policy (WAPC 2003b) sets out the broad environment and resource management policies for sustainability, including measures to:

- safeguard and enhance areas of environmental significance on the coast including the marine environment;
- ensure use and development on or adjacent to the coast is compatible with its future sustainable use for conservation, recreation and tourism in appropriate areas.
- take into account the potential for impacts from changes in climate and weather on human activities and cultural heritage including coastal and urban communities, natural systems and water resources.

Under the Environment and Natural Resources Policy planning strategies, schemes and decision-making will identify and, where appropriate, include provisions for the sustainable use of the coast.

Bush Forever (Government of Western Australia, 2000)

The Bush Forever document was prepared with the co-operation of the Ministry for Planning, the Department of Environmental Protection, the Department of Conservation and Land Management and the Water and Rivers Commission. Bush Forever (Government of Western Australia, 2000) applies specifically to bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region and is based on the System 6 recommendations (Department of Conservation and Environment, 1983). It identifies 51,200 hectares of regionally significant bushland in the Perth Metropolitan area for protection, covering 26 vegetation complexes. This amounts to about 18% of the original vegetation on the Swan Coastal Plain portion of the Metropolitan Region. Areas selected as Bush Forever Sites, which are representative of regional ecosystems and habitats, play a central role in the conservation of Perth's biodiversity.

As part of the Bush Forever process, specific criteria were developed to select coastal areas in the metropolitan region suitable for conservation areas. The six criteria relate to:

- Inclusion of a succession of different Quindalup dune types;
- The requirement for the site to be of sufficient size that natural processes such as dune formation can continue;
- Inclusion of sandy and/or rocky shorelines;
- Linkage to other bushland or coastal areas;
- Possession of a variety of vegetation types; and
- Possession of a variety of adjacent habitats to provide for the diverse reptilian and bird fauna of the coastal dunes.

Sections of two Bush Forever Sites are found within the study area: Bush Forever Site 322 – Burns Beach Bushland; and Bush Forever Site 397 – Coastal Strip from Wilbinga to Mindarie, and as such the entire study area lies within the boundaries of Bush forever Site 322 and 397. This has implications for planning and management within the study area. The natural vegetation in the area has been identified as regionally significant. Developments in this area must have conservation as a high priority with minimal clearing of natural vegetation. Possible environmental impacts of proposals on the surrounding bushland must also be minimised. Bush Forever boundaries are shown in Map 3.

State Sustainability Strategy

The State Sustainability Strategy is the first attempt in this State to meet the needs of current and future generations through integrating environmental protection, social advancement and economic prosperity. The purpose of the State Sustainability Strategy is to illustrate how the State government will respond to the sustainability agenda by adopting the sustainability framework and highlighting actions across government that give meaning to the framework.

The six goals of the sustainability strategy are as follows:

1. Ensure that the way we govern is driving the transition to a sustainable future;
2. Play our part in solving the global challenges of sustainability;
3. Value and protect our environment and ensure the sustainable management and use of natural resources;
4. Assist business to benefit from and contribute to sustainability;
5. Plan and provide settlements that reduce the ecological footprint and enhance our quality of life; and
6. Support communities to fully participate in achieving a sustainable future.

4.2.3 Local Policies and Management Plans

This section provides a brief overview of local policies and management plans for the City of Wanneroo. Relevant recommendations made in these documents and their current status is listed in Appendix 5.

City of Wanneroo Strategic Plan (City of Wanneroo, 2002b)

The vision statement for the City of Wanneroo Strategic Plan (City of Wanneroo, 2002b) states *“By the year 2007, the City of Wanneroo will be a vibrant centre of creative growth known for the quality of lifestyle choices and development patterns which will enhance sustainability.”*

The goals of the Strategic Plan are:

1. Environmental Sustainability – *“To value, protect and enhance our natural environment in harmony with the growth and progress of our city”*
2. Healthy Communities – *“To foster an identity that promotes lifestyle choice and provision of quality services and infrastructure”*
3. Economic Development – *“To maximise opportunities for balanced economic development within the City”*

4. Corporate Management and Development – “To create a culture that is committed to corporate learning, evolution and proper management of our natural, financial and human resources”

Coastal Planning Study –Burns Beach to Jindalee (Hames Sharley, 1992)

The Coastal Planning Study divided the 11 km stretch of coast from Burns Beach to Jindalee into 8 management sectors. This includes the entire study area, which it delineated from north to south as Sectors 5, 6 and 7.

It concluded that:

- Sector 5 (Quinns Rocks) was developed and foreshore management was adequate;
- Sector 6 (Mindarie Keys) was being developed, and had a plan that was largely implemented though there were some concerns regarding species used in plantings. It noted that there was potential for an additional drainage outflow from the breakwater; and
- Sector 7 (Tamala Park) was undeveloped and the bushland was of regional significance.

Mindarie Beach Foreshore Reserve Management Plan (James, 1994)

The Foreshore Reserve Plan considered the portion of the study area south of Mindarie Keys, and established a framework within which the development of recreational facilities and rehabilitation works may proceed. It recommended the development of lookouts, carparks, and a picnic area at Tuart Grove.

Assessment of the Conservation Values of Remnant Vegetation in the City of Wanneroo (Trudgen, 1996)

The purpose of the Trudgen (1996) report was to prepare an assessment of the conservation values of the major vegetation types in the City of Wanneroo, and from this, to make recommendations from a biological point of view for appropriate reserves in the City. The remnant vegetation mapping of the City of Wanneroo was updated to provide for this. Recommendations made to the City of Wanneroo from this report included the following:

- the City should redirect development away from areas with native vegetation in good condition;
- speed up the implementation of outstanding System 6 recommendations by the Department of Conservation and Environment (1983);
- incorporate sustainability principles to ensure economic development can proceed and natural systems can continue to operate; and
- seek funds to carry out flora surveys to locate populations of rare and priority flora within the City.

Draft Local Structure Plan Lot 211 Ocean Drive Mindarie (City of Wanneroo, 2002c)

This report was prepared by the City of Wanneroo to guide future land use and development on Lot 211 Ocean Drive, the site of the proposed new Community Facility, Café and Surf Life Saving Club. The site was divided into four precincts: conservation, community, tourist, and coastal recreation. The provisions for each of these precincts are defined by objectives and key criteria, which are:

Conservation Precinct

Objective: *"...to protect and enhance the natural qualities of the bushland and maintain biodiversity"*

Key Criteria: Fulfilment of management recommendations

Community Precinct

Objective: *"...to provide a community node with community buildings, café/restaurant, children's playground, picnic/barbecue areas and access to the beach:*

Key Criteria: All buildings set back behind the Alignment of Ocean Drive (in consideration of recommendations of M.P Rogers and Associates, 1999) and development should aim to minimise disruption to the existing land qualities such as topography and vegetation.

Tourist Precinct

Objective *"...to develop a multi-use tourist facility with a range of accommodation types including a caravan park, tourist chalets and camping grounds*

Key Criteria: As for Community Precinct with addition of limitation of buildings to two storeys

Coastal Recreation Precinct

Objective: *"...to provide public access and passive recreation opportunities associated with the coastal location"*

Key Criteria: Consideration of recommendations of M.P Rogers and Associates (1999)

The Environmental Management Plan, contained in the document as Appendix 1, discusses the current situation of the site, who should manage the site, how it is to be managed and when particular management activities should occur. It is realised that as the site comprises Bush Forever Site 397, development and management of the site should be of the highest environmental standard to protect and enhance its natural qualities.

Foreshore Vegetation Survey and Management Recommendations Mindarie, Yanchep and Two Rocks (BBG, 2003)

This study comprises a flora and vegetation survey of the foreshore area including the North Mindarie Beach portion of the study area. It provided recommendations for rehabilitation of the area as well as additional management recommendations for bushland management. Recommendations made include:

- entire beach areas and dune faces be replanted using native species;
- construction of concrete paths and fencing between beach areas and residential areas to prevent damage to dunes through trampling; and
- replanting of native species should occur concurrently with weed removal to prevent erosion risks and maintain soil holding capacity.

Old Quinns Rocks Residential Planning Study (K.A. Adams and Associates, 2003)

This study was commissioned by the City of Wanneroo and was designed to provide a strategy and guidelines for the future development of the townsite. A community consultation programme was undertaken in parallel with a series of technical investigations, ranging from an historic overview of the evolution of Old Quinns Rocks to an examination of infrastructure to its development potential. Recommendations were made in areas such as heritage conservation, streetscape works, and residential design guidelines.

This document is at the Draft for Public Comment Stage (as of January, 2004) and has yet to be adopted by council. The following summarises the overall objectives for Old Quinns Rocks, the specific objectives for the beachside Locality (adjacent to the Quinns Rocks North and Quinns Rocks South sectors of the study area) and the policies and actions for this locality.

Objectives for Old Quinns Rocks

- To maintain its separate and evolving identity as a settlement or “village”, not merely a part of seamless suburban Perth
- to maintain its strong sense of the natural coastal and bushland environment, especially in relation to its beachfront, natural vegetation, and the coastal dune topography
- to maintain its informal and varied styles, materials and general character of housing
- to retain significant elements of its heritage in a context that respects that heritage and tells a story
- to provide for its community to continue living in Old Quinns Rocks in suitable housing as members of the community age and their needs change
- to recognise and provide for the need for beachfront facilities for both residents and visitors
- to protect the amenity and environment of the beachfront
- to encourage walking and cycling as a means of transport
- to maintain the low-key and informal character of the streets
- to maximise access to views of the ocean, consistent with equitable principles
- to provide and maintain public infrastructure that supports these objectives

Specific Objectives for Beachside Locality

- allow for a moderate level of redevelopment consistent with overall objectives to occur, but at densities not significantly higher than at present, recognising that much redevelopment will be in the form of replacement of one single house by another, larger single house
- ensure that the development of the beachfront reserve and of the beachside locality occur in a well integrated way
- encourage the retention, in an appropriate context, of original shacks and traditional cottages
- encourage the provision of holiday accommodation in close proximity to the beachfront, perhaps in association with a beachfront centre
- encourage the development of a beachfront centre on Ocean Drive, to serve both residents and visitors to the beach, providing for local daily needs, with facilities for

relaxed snacks, eating and drinking, with service access from the rear and compatible with both adjoining residential development and other beachside development

- encourage the provision of off-street parking behind the beachfront line of buildings, suitably screened, to serve beachfront users
- provide attractive and appropriate landscaping and street treatment to Ocean Drive, with appropriate measures to ensure pedestrian safety, car parking and access to the beachfront
- provide for a purpose – designed aged persons' development
- encourage optimal and equitable access to views of the ocean
- maintain a moderate height of buildings

Policies and Actions

(1) Amend DPS2 to provide for the locality to be coded R20-R30, whereby the basic density code is R20 with qualifications. On corner sites, where all new dwellings would have direct frontage to the street, the relevant Code is R30.

(2) Prepare or commission, in conjunction with the proposed foreshore management plan, an urban design study, covering the whole of the beachfront reserve together with Locality 1, to include consideration of the following:-

- maximising recreational use of the foreshore reserve
- minimising alienation of the foreshore reserve for car parking
- exploring opportunities for providing car parking in well screened locations behind the line of foreshore facing development, including in conjunction with the beachfront centre
- possible relocation of one or more original shacks or traditional holiday houses onto the foreshore reserve, sited in a heritage – appropriate way (i.e. to tell the Old Quinns Rocks story), possibly with the windmill or traditional water tank, and adapted for community use, a café or the like
- a detailed streetscape design for Ocean Drive

(3) Negotiate with the owners of the Ocean Drive commercial site and adjoining sites, including those to the rear, with the aim of achieving an integrated plan for future development of a beachfront centre. This should encompass local daily shopping needs, together with facilities for a restaurant, café or the like, kiosk to serve beach users, other facilities that may be appropriate, and including, at an upper level, allowance for holiday apartments. Rear service access and parking, with no vehicle access from Ocean Drive, should be an essential component of the plan. Shared parking, available also to beach users, should be considered

(4) Negotiate with the owner(s) of the vacant commercially zoned site in Beverly Crescent, with a view to re-subdivision of the site and adjoining road reserve to create a viable site for an Aged Persons' Development, at R30 density, including the density bonus provided for in the R-Codes.

Trails Master Plan Stage 1 (Ecoscape, 2003)

This study provides a framework to direct the planning and implementation of trails in the City of Wanneroo. Community consultation was undertaken to provide a direction for the Master Plan development. Three distinct themes evolved from the analysis and consultation process that were related to landscape character, land use, historical values and environmental aspects. The Trails Master Plan is included in Appendix 9.

Of relevance to this Management Plan is the potential for a dual-use (pedestrian / bicycle) foreshore trail (DUP) as part of the Sunset Coast Trail. Maximum visual amenity for this trail will be achieved if it can be situated close to the coastline; however erosion and conservation issues also need to be taken into account. Ocean Drive, running alongside the Quinns Rocks foreshore, is to be shortly upgraded and it is understood that a DUP is to be included in the designs running along the western edge of the road. This will link with the existing DUP at the Lot 211 development. Management of pedestrians and cyclists is explored in Section 6.8.

Coastal Safety Audit (Armstrong et al., 1999)

The aim of the Coastal Safety Audit was to identify aspects of the City of Wanneroo's policy, procedures, resources and facilities that do not comply with proscribed standards. The audit addressed the dynamic surf environment, the resident and tourist population as well as incident histories. It was revealed that there were several aspects of the coastal and foreshore infrastructure that needed to be improved in order to comply with recognised and legislated standards – in particular, signage and foreshore access.

Quinns Beach Coastal Protection Works Stage 1 Report (M.P. Rogers and Associates, 1999)

This report was commissioned by the Shire of Wanneroo to provide a comprehensive evaluation of the coastal protection options available for Quinns Beach in the face of ongoing coastal erosion. The report outlined the alternative management options to be considered including: doing nothing; sand renourishment; or low strength seawall construction. The Quinns Beach North management options included: doing nothing; regular sand renourishment; seawall construction; or groyne/headland construction.

Quinns Beach – Erosion Risk Management Study Report (M.P. Rogers and Associates, 2001)

The Risk Management Study of Quinns Beach outlined critical weather and ocean combinations that will cause erosion as well as emergency action plans to combat these events should they arise.

Quinns Beach Erosion and Coastal Protection (M.P. Rogers and Associates, 2002)

This report also discussed options for protecting Quinns Beach from future erosion. The Net Present Value (NPV) and other implications were examined for three main options: groyne and initial renourishment; headlands and initial renourishment; and seawall and ongoing renourishment. After examining all factors, this report concluded that Option 1, groyne and

initial renourishment, was the best option for Quinns Beach as it: was the most cost-effective; provided a practical scheme staged over a 3 or 4 year period.

Purpose and Vesting

The Purpose and Vesting of parcels within the study area are shown in Map 3 and described in Table 4.1 below. Vesting and Management Orders for the lots are generally suitable given the purpose of the area. Vesting for reserve 25997 however should be transferred to the City of Wanneroo to enable consistent management of the area.

Table 4.1 Purpose and Vesting of Land Parcels within the Study Area

	Name	Parcel ID	Reserve	Vesting	Owner	Purpose
1	Quinns Rocks Caravan Park	LOT 211 D 27023 Vol 485 Fol 181A	N/A	Freehold	City of Wanneroo (CoW)	Freehold – leased
2	Nth Mindarie Reserve	SWAN LOC14135; 11186; 12037	35890	Crown Reserve vested in LGA	Crown Land – CoW Management Order	Public Recreation
3	Kinsale Park	SWAN LOC 11936; 12202	42931	Crown Reserve vested in LGA	Crown Land – CoW Management Order	Public Recreation
4	Sth Mindarie Foreshore	SWAN LOC Pt9917; 12295	35890	Crown Reserve vested in LGA	Crown Land – CoW Management Order	Public Recreation
5	Mindarie Foreshore	LOT 11918 DP 240397 Vol 3126 Fol 655	20561	Crown Reserve vested in LGA	Crown Land – CoW Management Order	Recreation & Incidental
6	Nth Breakwater Reserve	SWAN LOC 14438	46863	Crown Reserve vested in LGA	Crown Land – CoW Management Order	Recreation & Ancillary
7	Long Beach Park	SWAN LOC 12405	35890	Crown Reserve vested in LGA	Crown Land – CoW Management Order	Public Recreation
8	Quinns Rocks Foreshore	SWAN LOC 7019	25997	Unvested	Crown Land	N/A
9	Quinns Rocks Foreshore	LOT 11918 DP 240397 Vol 3126 Fol 655	20561	Crown Reserve vested in LGA	Crown Land – CoW Management Order	Recreation & Incidental
10	Frederick Stubbs Memorial Grove	CROWN RESERVE 22915	22915	Crown Reserve vested in LGA	Crown Land vested in CoW	Recreation & Parking
11	Nth Quinns Rocks Foreshore	SWAN LOC Pt9917; 13294	35890	Crown Reserve vested in LGA	Crown Land – CoW Management Order	Public Recreation

5.0 Stakeholder Consultation

Foreshore Management Plan: Mindarie – Quinns Rocks

Various community groups and members of the public with key interests in the Mindarie – Quinns Rocks areas were consulted to obtain opinions on issues of current and future management of the foreshore. Formal consultation took place with stakeholders when the Draft for Public Comment was released between the 8th of March till the 19th April 2004 (refer to Appendix 10, Submissions Summary) and a public Information session was held at Gumblossom Community Centre on 31 March 2004. Information gained from the consultation process was used during the formulation of the Plan for Management.

5.1 Quinns Rocks Environmental Group Inc.

5.1.1 Organisation Profile

The Quinns Rocks Environmental Group Inc. (QREG) is a local community group promoting conservation. Formed in 1985, they have worked to raise awareness, take practical action and act on local environmental issues (City of Joondalup and City of Wanneroo, 2002). Activities they have been involved in include:

- a campaign to save bushland north of Burns Beach and protect Neerabup National Park;
- comments on planning proposals and promoted sustainable development;
- held workshops and published a book on managing urban bushland;
- prepared a guide to growing locally indigenous plants for local residents, to conserve biodiversity and water;
- held clean up days and bush regeneration days; and
- surveyed local flora and fauna in local bushland and held bush and beach walks.

QREG focus on the area in and around Quinns Rocks from Burns Beach to Eglinton and also network with others groups and organisations, including the Conservation Council and Urban Bushland Council. QREG currently comprises 40 members and committee of 5 people. A questionnaire was forwarded to the Group committee by email. The major concerns and comments from this are summarised below.

5.1.2 Major Concerns and Comments

Weed control

Weed control activities have been undertaken in the following areas:

Lot 211

- Part of Lot 211 and adjoining reserve on a QREG workday in 2002 which included the removal of Pepper Trees. Poisoned and cut.
- Removal of Pepper Tree and Victorian Tea Tree by Work for the Dole team 2003. No idea if poisoned when cut. There was a problem in that many smaller Pepper Trees were missed and material from both species with seed was left where cut and not removed.

- QREG undertook hand-removal of Pelargonium on part of Lot 211 from areas of good bushland and then on margins on number of occasions as part of *Bushcare by the Beach*. Geraldton Carnation Weed and isolated patches of Fennel and Castor Oil Plants were also removed
- Large area of couch removed on southern boundary of caravan park.
- QREG is unaware of any works by City of Wanneroo in this area except pepper tree removal.

Kinsale Park

- QREG Hand removed various weeds including Pelargonium, Pink Gladiolus etc as part of *Bushcare by the Beach*.
- City of Wanneroo has two year contract for weed control in whole reserve.

Coastal foreshore area in front of Kinsale Park

- Hand removal of Pelargonium by Work for the Dole team along walkway where revegetation has been done north and south of path intersection.
- QREG hand removal of weeds around plantings as part of Bushcare by the Beach activities.

Specific Comments on weed control are:

1. Much of the foreshore area from Quinns Road to Dog Beach is very degraded. Weed control and revegetation plan is needed in this area
2. City of Wanneroo weed control has been very limited, adhoc and has not been followed up. There was a problem in the area that resident was controlling chemical control of weeds because of serious allergies. This has been overcome by the Weed Management Policy.
3. There has definitely been no monitoring or evaluation of works done to date.

Revegetation

Revegetation activities have been undertaken in the following areas:

Kinsale Park

- Small section of revegetation with local species following removal of *Eucalyptus* trees planted by developer. Planted 2003 as part of City of Wanneroo demonstration site.

Coastal foreshore area in front of Kinsale Park.

- Two areas revegetated with local species in Sept 2002 and Aug 2003. Funds for this project came from Coast Care grant to Mindarie Coast Care. Seed did not come from the reserve.

Specific Comments on revegetation are:

4. Suggest restricting revegetation to very degraded areas where regeneration potential is very limited.

Recreation facilities

5. Rationalisation of tracks through bushland areas.
6. Limit footprint of paths/buildings/carparks to retain remnant vegetation.
7. Extension of north-south dual use path has been suggested between dog beach and Quinns Road. This should be on eastern side of Ocean Drive and within the existing road reserve. The coastal reserve is too narrow and in places very steep so construction on beach side would encroach on remnant vegetation or require substantial earthworks.

Other facilities

8. Stormwater drain outfall into foreshore reserve just north of Caldera Close. Bad erosion right down to path and weed infestation especially fennel and many annual weeds.

Access

9. Repair existing paths/steps affected by erosion.
10. Fencing needs to manage public access in bushland areas eg Lot 211

Antisocial activities

11. Rubbish dumping is problem in places along Ocean Drive, Kinsale Park and Seaham Way including lawn clippings, rubble, soil and newspapers.
12. Community education through leaflet drop and signage is needed. Local residents need to be encouraged to report dumping and ensure it is follow up by council staff.

Future growth

13. Future growth makes protection of remnant bushland critical. Management efforts needed to enhance and maintain integrity of coastal vegetation.

Erosion

14. Effects of erosion control measures on sediment transport need to be monitored (potential to push erosion problem to another part of the coast)

Development of Lot 211

15. QREG submission was made on Lot 211 structure plan. QREG are concerned that locally significant bushland will be lost including Quindalup and Spearwood transition zone and development will increase recreational pressure on bushland.
16. Management needed includes fencing, signage, weed control and appropriate landscaping of developed areas with locally occurring species.

Bushland area south of Mindarie Keys.

17. Management will need to be integrated with the greater Burns Beach Bushland reserve.
18. Picnic area under Tuart trees great amenity for local residents.

5.2 Quinns Rocks Fishing Club

5.2.1 Organisation Profile

The Quinns Rocks Fishing Club aims to promote and encourage the sport of angling. The Club is a family orientated, social club with club premises currently adjacent to Mindarie boat ramp. The Club encourages junior participation and promotes conservation and protection of fish stocks (K. Tasker, pers. comm., 2003).

The Club has members that are primarily interested in offshore fishing. A member of the Club was of the opinion that the groyne recently placed along the beach to prevent erosion appear to be working, despite some late winter storms that appear to have removed some of the renourished sand.

5.2.2 Major Concerns and Comments

Issues raised by the Fishing Club include the following:

1. The boat ramp at the existing Surf Life Saving Club should be repaired and reopened. It is believed the presence of the groynes will offer substantial protection if the new ramp is constructed with suitable materials. The only other boat ramp in the area is at Mindarie Keys Marina, which is privately owned and does not accommodate existing public demand. There is currently regular conflict as a result of overcrowding and inadequate parking. The future of access by the general public to this boat ramp is also uncertain.
2. The current Club premises at Mindarie Keys Marina are too small to accommodate club functions and fund raisers, and its future availability is uncertain. It is expected that a new premises will be made available at the proposed Community Facility.

5.3 Quinns Rocks Community and Recreation Association

5.3.1 Organisation Profile

The Recreation Association produces the "Rocks News", a newsletter that goes out to local members and affiliates of the Association. Articles in the Rocks News are based on information received from sources such as the Quinns Mindarie Surf Lifesaving Club, the media, the local environmental groups and the Mayor.

The Association is based on an unbiased, apolitical foundation and as such, chooses not to become involved in decisions involving the local area.

5.3.2 Major Concerns and Comments

Issues surrounding the management of the City of Wanneroo Foreshore are of concern to this local organisation but do not elicit an opinion.

5.4 Quinns/Mindarie Surf Life Saving Club

5.4.1 Organisation Profile

The Surf Life Saving Club premises are at risk from high levels of erosion. It is expected that these will be moved to the proposed Community Facility adjacent to the Quinns Caravan Park. The Club is happy with the way the City of Wanneroo is handling the move and most needs and requests of the Club have been met. From the completion of the move and the start of the new life saving season (generally October), two patrols will be undertaken by the Club; one at the beach of the existing location of the Club, and a second patrol at the new location.

When questioned regarding the forecast of future development further north and south of the Quinns Rocks / Mindarie region, it was predicted that North Mindarie beach would not have a major development growth in the near future due to the inaccessible nature of the foreshore and the lack of infrastructure. The surf at this beach is bigger than at the currently patrolled beaches at Quinns Rocks; therefore if development were to occur in the future then patrols

would definitely need to be implemented. The next area of growth predicted by the Surf Life Saving Club is Jindalee, to the north of the study area.

5.4.2 Major Concerns and Comments

In general, the Club is content with the way that the City of Wanneroo currently manages and maintains the foreshore areas.

5.5 Quinns Rocks Senior Citizens Club

5.5.1 Organisation Profile

The Quinns Rocks Senior Citizens Club meets regularly and is made up of 278 members.

5.5.2 Major Concerns and Comments

The main issues raised by the representative include the following:

1. Steps and access paths to the beach were eroded and dangerous
2. Swimming was often hazardous
3. The facilities at the site of the existing surf-lifesaving club should remain and be upgraded rather than just being moved.

5.6 Mindarie Ratepayers and Residents Association

5.6.1 Organisation Profile

Mindarie Ratepayers and Residents Association (Inc) was formed, as a non-profit organisation, in 2002. MIRRA came from the merger of two existing groups; the Mindarie Community Group (MCG) and Mindarie Activities Social Team (MAST). MIRRA feel responsible to assist in the future planning of our suburb and wish to increase their involvement with the City of Wanneroo in the first instance – and the City of Joondalup in respect to our southern foreshore areas.

MIRRA is a non-partisan organisation and have representation from all quadrants of the suburb of Mindarie. Consultation of residents and ratepayers was extensive and a questionnaire was circulated through the community by email. A report was then compiled and submitted to Ecoscape after circulation to interested members and the MIRRA management committee prior to forwarding.

5.6.2 Major Concerns and Comments

Summarised responses are as follows:

Extent of Foreshore Management

1. The extent of the foreshore management plan should not be restricted to North Mindarie and Quinns Beach. A composite plan needs be developed for the whole coastline line area from the Whitford nodes the area north of Two Rocks.
2. All three tiers of government, local, state and federal, must act in a unified and structured way to accomplish the most benefit for all at the least cost.

3. Some important works from Mullaloo to Burns Beach were achieved before Joondalup and Wanneroo were separated. There does not now appear to be co-operation and joint planning between the now separated authorities.
4. There need to be more communication and consultation from local government authorities towards community groups

Usage of Foreshore Areas

5. Dual-use pathways should be constructed close to, and with a view of the ocean, Ideally traversing the coastline from Whitford to north of Two Rocks. This should be financed by developers as part of the approvals process.
6. Development of residential and commercial buildings needs to be curtailed and Bush Forever areas protected.
7. The coastal buffer zone of 100 metres should be increased to a minimum of 500 metres, with development prohibited inside the zone from Quinns Rocks North to Two Rocks.

Native Vegetation

8. Monitoring and patrols of the dune areas should be undertaken to stop unauthorised vehicular traffic in natural areas to increase public safety and prevent denigration of natural environment. Combined efforts between cities are necessary and the legislation effectively enforced
9. Revegetation needs to be ongoing and publicised and should involve groups such as MIRRA. Blowout areas seem to be common and are not being rehabilitated.
10. Exotic plants and weeds are increasing and existing programs to eradicate weeds and introduced species (eg Japanese Peppers) needs to be expanded before they get out of hand. Native species should be the obligatory choices of developers in their part in the greening and provision of shade and visual amenity.
11. The Bush Forever plan needs to encompass the current and proposed developments, a considerable amount of which are controlled by the joint local government councils (e.g. Tamala Park). These government agencies need to take their eye off the “cash cow of development” and focus on the need to maintain pristine ecological environments for future generations.

Access

12. Controlled public access is a necessity if the coastal area is going to be managed in an effective way. There should be two public access areas between Burns and Claytons Beaches which necessarily means the creation of vehicle parking areas with defined access tracks. The vehicle parking should be separated from the beachfronts and no vehicle access should be allowed onto the beaches. The car park at Tuart Grove should therefore be reopened with measures implemented to restrict vehicles accessing the surrounding natural areas
13. There is concern with the reduction of available parking for vehicles and boat trailers utilising the boat ramp at Mindarie Keys Marina. It appears this is designed to discourage people from outside Mindarie using these facilities.
14. There is currently only one small boat ramp between Ocean Reef and Yanchep which is privately owned. In summer this boat-ramp at Mindarie is inadequate as there is only one ramp, is poorly signed and lacks supervision, administration or enforcement of regulations. Further boat ramp facilities need to be constructed at

appropriate distances along the coastline. This would enhance the current facilities; remove the pressures caused by overuse and congestion, and enable ocean pursuits to be conducted in a structured safe manner.

15. Although the marina area was not especially included in this study, it must be said that the access, parking and entry/egress aspects, as well as a friendly and safe environment, should be kept in mind, particularly with regard to increased congestion on access to Marmion Avenue.

Recreation

16. The area from Quinns Rocks Caravan Park north to the southern end of the new Quinns Beach development needs to be developed similar to Mullaloo and City Beaches with lawn areas enhanced by shady trees, picnic pergolas and easy access points for families, elderly and disabled persons.
17. Given that the construction of the groynes will ensure ongoing beach stabilisation for the whole area, the time is now ripe for innovation in design and construction of public facilities to provide for future generations. This area has the potential to be “the beach” for most of the residents of the City of Wanneroo.

Antisocial Behaviour

18. An effective visual police presence and a “zero tolerance” policy to antisocial behaviour should be implemented
19. The use of unlicensed and off road vehicles in the whole of the Mindarie/Quinns area is at epidemic proportions. At least on several occasions on each day persons can be seen riding unlicensed trail bikes on the bitumen surfaces along public roadways putting themselves and other members of the public at risk. Four wheel drives and other off road vehicles consistently enter beach bushland areas and destroy vegetation. An effective policing program by state and local government authorities will curtail most of these activities.
20. Graffiti (in Mindarie suburb only) is well controlled at the moment, as there is a community fund, which is used to privately remove any defacement almost immediately. When this fund is used up we will be faced with the same problems as other suburbs – exacerbated by the beachfront proximity and its associated attractiveness for antisocial behaviour.
21. Dog control and rubbish are two other issues that are commonly brought up by residents. Adequate enforcement needs to occur with regards to dog control, faeces and littering.
22. More bins are needed at beaches access points, walkways, boat ramps and other strategic locations (eg fishing platform).

Community Facility

23. The re-location of the Quinns Mindarie Surf Lifesaving Club to Lot 211 Ocean Drive is long overdue as their current facilities are highly inadequate;
24. While some believe the proposed Community Facility will not significantly assist the people of Mindarie to have its own community centre, there is some practicality in siting the facility on Lot 211, as it will encourage community groups to utilise the facilities and it is the most cost effective location. It may be also attract tourists and visitors to the area. The proposed parking areas are also adequate for community events and do not detract from the normal peaceful neighbourhood.

25. A general and sporting focussed facility should also be developed at Abbeville Park to cater to the needs of junior sports such as soccer, football, cricket, etc similar to Anthony Waring Park in Clarkson.

5.7 Local Residents

5.7.1 Organisation Profile

Three local residents were opportunistically interviewed by Ecoscape during field surveys along the foreshore. All were residents of Quinns Rocks or Mindarie.

5.7.2 Major Concerns and Comments

One resident of Quinns Rocks is concerned about the proposed Community Facility development adjacent to the Caravan Park. It was felt that although Quinns Rocks will be affected by this development, there has been little consultation with residents of Quinns Rocks. The Facility will not necessarily be consistent with the image of Quinns Rocks that many residents wish to maintain. The area will become much busier, which is not only a concern for the safety and wellbeing of the local residents, but also for the Bush Forever Site that is directly behind the new development. The resident believed that the bushland will be adversely affected by the development and that this has not been sufficiently considered.

Another resident spoken to by Ecoscape would like to see the area adjacent to the existing Surf Life Saving Club developed into an area more suitable for the public to picnic and relax by the beach. This could include landscaping, upgrading the existing playground at Frederick Stubbs Memorial Park, a gazebo and grassed areas to accommodate Quinns Rocks residents near the area. This resident also notes that Ocean Drive can become very dangerous during busy periods, such as weekends and public holidays. The road has a long straight stretch and as a result motorists tend to go very quickly, risking children and pedestrians who frequent the sides of the road during the day and recommended traffic calming measures or a dual use pathway along Ocean Drive.

A third resident was of the opinion that a dual use pathway would need to be constructed on the eastern side of Ocean Drive due to the ongoing risk of erosion to the road. Public safety was identified as a concern due to high levels of erosion and the very steep dune slopes. The resident was particularly concerned that a number of people were continuing to use the beach access tracks that had been closed. Dune protection measures were regarded as being necessary for the wellbeing of the public and the integrity of the dunes themselves.

5.8 Department of Conservation and Land Management – WA Threatened Species and Communities Unit (WATSCU)

The Department of Conservation and Land Management's Threatened Species and Communities unit were consulted with regard to inferred Threatened Ecological Communities (TEC), particularly with regard to the proposed development of Lot 211. , WATSCU stated that there are no direct obligations of the developers or the City of Wanneroo, however as an

inferred TEC is close to the proposed development, the EPA may recommend that the TEC be confirmed as part of its approvals process.

Regardless of whether it is confirmed, appropriate management for conservation of the TEC must be undertaken, including weed control; appropriate fencing; adequate vegetation buffers; and activity and development restrictions.

5.9 Environment and Natural Resource Management Planning Directorate (Bush Forever Office)

The Bush Forever office of the Department for Planning and Infrastructure (DPI) also recommends confirming the presence of inferred Threatened Ecological Communities and that the fencing between the construction site at Lot 211 and the intact native vegetation needs to be adequate (e.g. high mesh fencing) to prevent vehicular and personnel movement through the vegetation. It was also recommended that during construction, personnel be briefed on the significance of the area and encouraged not to dump rubbish, spoils or topsoil outside the construction area. The Department also has a policy to encourage the use of hard edges against conservation zones, such as pathways, roads and car parks to help prevent weed migration.

6.0 Plan for Management

Foreshore Management Plan: Mindarie – Quinns Rocks

6.1 Management Zones

Management zones have been developed in order to direct appropriate management to different areas. Management zones have been determined based on the current and projected future levels of recreational use as well as identified conservation values that need to be protected within the study area. Nodes are focal points for activity and are always located within High or Medium Intensity passive recreation zones.

Four management zones have been determined for the study area in order to guide management and maintenance priorities (see Map 4). These zones are:

- Conservation;
- Low Intensity Recreation;
- Medium Intensity Recreation; and
- High Intensity Recreation.

Areas proposed for conservation were determined based on the bushland condition, current and projected land uses. The three recreation zones were determined based on the existing and projected levels of public use and facilities, as well as the sustainability of each level of use relative to the landform and ecology of each area. The area of each management zone is shown below in Table 6.1.

Table 6.1 Management Zone Areas

Management Zone	Hectares
Conservation	54.4
Low Intensity Passive Recreation	11.2
Medium Intensity Passive Recreation	5.1
High Intensity Passive Recreation	5.5

Areas of high, medium and low levels of public recreational use were identified from:

- the results of a 1999 survey of beach use (CoastWise (1999) and other relevant reports);
- the level of access determined by car parks, roads and dual use paths;
- proximity to recreational facilities and residential areas; and
- observations during field assessments.

The results of the CoastWise survey are shown in Figure 6.1. This shows the highest level of use at the existing Surf Lifesaving Club (Quinns Mindarie SLSC). The proposed development of the Quinns Mindarie Facility adjacent to Quinns Rocks Caravan Park, is likely to significantly increase visitor numbers in this area and may reduce the level of use at the existing SLSC.

Map 4 shows the location of Management Zones for the Quinns Rocks – Mindarie Foreshore.

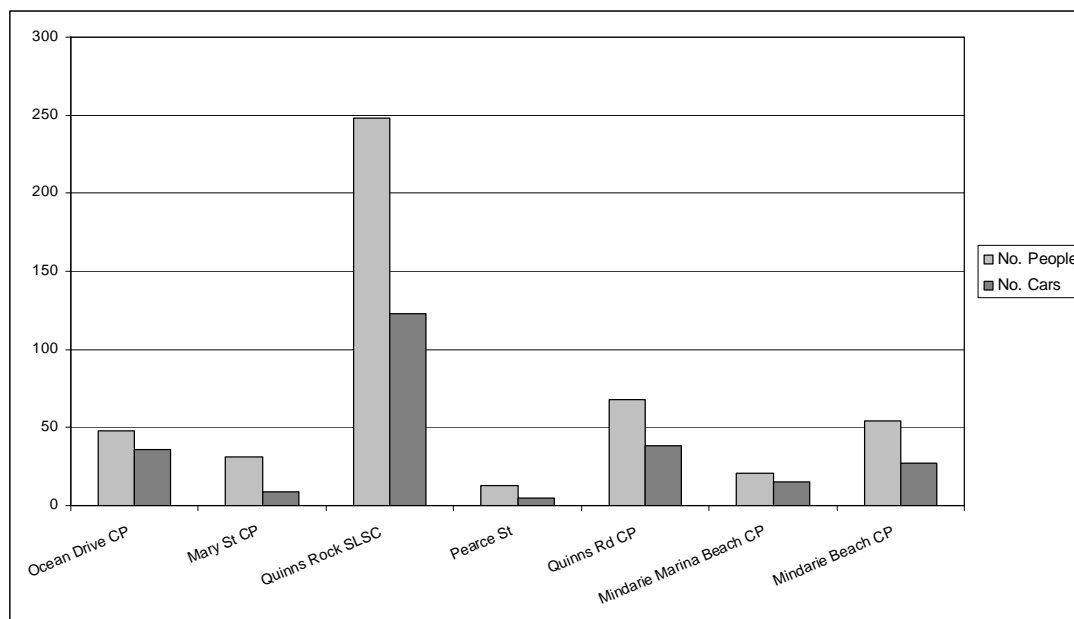


Figure 6.1 Results of CoastWise 1999 Beach User Survey

6.1.1 Conservation Zone

The primary objective of this zone is to provide for the protection of the environment including: landforms; significant fauna habitat and important vegetation communities. Areas zoned for conservation are managed solely for the protection of the natural environment and access by the public restricted.

Although access to the conservation zone is restricted, there remains the potential for significant environmental degradation if the area is not carefully managed. The conservation zone contains low coastal heath which is easily damaged by trampling, and sand dunes that can be easily eroded if the vegetation cover is damaged or removed. There are a number of degraded and eroded areas within the conservation zone that require ongoing weed control and revegetation.

The presence of the Threatened Ecological Communities 30a and 26a was inferred from the flora and vegetation survey and are shown in Map 1. This should be verified by surveying 10 m x 10 m quadrats in each of the vegetation type and analysing this with the original data from Gibson *et al.* (1994). This should be done in conjunction with the WATSCU (the Department of Conservation and Land Management's Threatened Species and Communities Unit). If these are verified TECs, a conservation plan for these areas should be undertaken in association with the Department of Conservation and Land Management.

Management guidelines for the Conservation Zone are:

1. Exclusion of people and vehicles in this zone through appropriate barriers (e.g. fencing) and alternative routes.
2. Signage should be limited, unobtrusive and related to rehabilitation activities
3. Rehabilitation, erosion mitigation and weed control should be undertaken where required.

4. Recreational facilities should not be provided in this zone.

6.1.2 Low Intensity Passive Recreation Zone

The objective for this zone is to provide facilities to cater for low levels of public use and passive recreation, whilst maintaining any conservation values in the area. Low intensity passive recreation occurs in areas where:

- access is almost entirely by pedestrians along pathways or beach front remote from car parks and other facilities;
- recreational activities are passive and consist chiefly of walking, jogging, swimming and fishing;
- recreational activities are generally not concentrated at nodes, but rather are spread relatively evenly at low density along linear, accessible stretches; and
- vehicular access is not permitted except by authorised vehicles.

Management Guidelines for this zone are:

1. Provision and maintenance of suitable paths, steps, regulatory signage and some seating.
2. Additional recreational amenities such as bins and toilets should not be provided in these zones

6.1.3 Medium Intensity Passive Recreation Zone

The objective for this zone is to provide facilities to cater for medium levels of public use and recreation, whilst maintaining the integrity of the vegetation and landforms of the area. This is generally those areas where:

- access is largely by pedestrians or cyclists, along pathways or beach front more than a short walk (ie at least a few minutes) from large car parks and other major recreational infrastructure, or a short walk from small car parks;
- there is a moderate demand for access to the area;
- there is a higher density of recreational users than in the Low Intensity Passive Recreation Zone.
- existing recreational activities include passive recreation and some more specialised activities, including cycling, fishing, animal exercising, surfing and windsurfing; and

The medium intensity zones along beaches are assumed to extend 50 metres on either side of Medium Intensity category access points.

Management Guidelines for this zone are:

1. Provision of recreational facilities should follow the Low-intensity Passive Recreation Zone with the inclusion of additional facilities and infrastructure such as:
 - bins (at car parks)
 - composting toilets (where there is a demonstrated need)
 - bicycle racks (where accessible by bicycle)
 - interpretive and regulatory signage
2. Where the Medium intensity passive recreation zone is adjacent to the conservation zone, appropriate fencing should be installed

3. Tracks should be hard-paved.

6.1.4 High Intensity Passive Recreation Zone

The objective of the high intensity passive recreation zone is to provide facilities and management for high levels of passive recreational activities, while implementing measures that will reduce the impact of these activities on the surrounding biophysical environment. High Intensity Passive Recreation Zones are generally those areas where:

- popular swimming beaches are located (such as Quinns Beach), which are patrolled by surf lifesavers and have associated infrastructure, such as large car parks, grassed areas, buildings, toilet and shower blocks and a high number of access ways to the beach;
- a high proportion of visitors arrive by car and walk a short distance from relatively large car parks to zone;
- there is a high demand for access to the area;
- high intensity use is often concentrated in time and space, with peak usage during summer, and at nodes surrounding swimming beaches and associated infrastructure; and
- existing recreational activities are generally passive and include swimming, walking, jogging and cycling. Other uses in this zone may require specialist infrastructure, such as boat launching ramps.

Many of the areas of high intensity use consist of a relatively narrow strip of dune vegetation, which is often degraded by significant weed invasion, vegetation disturbance, erosion, and the effects of human traffic across the dune vegetation (rather than using defined access paths). The high intensity zones are extended 100 metres to either side of high use access points and large car parks.

Management Guidelines for this zone are:

- Recreational facilities should be centred in the High Intensity Passive Recreation Zone.
- Car-parks are required in these areas and should be maintained.
- Bicycle racks should be provided and riding of bicycles prohibited in this zone.
- Surf-lifesaving should be provided
- changerooms and toilet facilities should be provided and maintained
- Access to the beach needs to be clearly defined. All tracks and paths hard-paved.
- Playgrounds and picnic areas with barbecues should be provided within an attractively landscaped area. Amenity planting should use local species.

6.1.5 Recommendations

No.	Recommendation	Priority	Responsibility ⁱ	Indicative Cost ⁱⁱ
1	Verify inferred Threatened Ecological Communities (TECs) nearby to the proposed Lot 211 development using the original data from Gibson <i>et al.</i> (1994).	High	Planning Services / State Government	\$2,000
2	Monitor management zones by undertaking surveys of beach use every 3 years and amend accordingly.	Medium	Planning Services	\$1,500
3	Verify other inferred TECs in the study area using the original data from Gibson <i>et al.</i> (1994).	Medium	Planning Services / State Government	\$2,000
4	Undertake a vegetation survey for Kinsale Park by 2006.	Medium	Operations	\$1,000
5	Prepare a Conservation Plan in conjunction with the Department of Conservation and Land Management for any TECs verified.	Medium	CALM / Planning Services	\$5,000
6	Negotiate management responsibilities and vesting of reserves where appropriate with relevant government agencies.	Low	Planning Services	N/A

6.2 Weed Control

6.2.1 Objectives

The objectives for weed control for the Quinns Rocks-Mindarie Foreshore are to:

- identify and control existing weeds with the highest priority for control, and widespread weeds with a moderate priority for control;
- prevent introduction of additional weed species;
- prevent further encroachment of weeds into bushland and coastal areas;
- minimise any detrimental effects of the weed control programme on the native biota; and
- integrate the weed control programme with bushland restoration programmes.

6.2.2 Background

Weed control is an important component of bushland regeneration and without adequate weed control, survivorship and growth of revegetated species is likely to be poor, while undertaking weed control without bushland restoration will result in reinvasion by weed species. Bushland restoration and weed control should therefore always be undertaken together. Bushland regeneration methods are detailed in Section 6.3.

Along many stretches of heavily populated coast, weed species can often outnumber native species, particularly on foredunes and mobile dunes. In these areas, exotic dune binding species, such as Rose Geranium *Pelargonium capitatum* and Sea Spinach *Tetragonia decumbens* can result in extensive degradation to native vegetation, loss of species and reduced biodiversity. Large numbers of annual, grassy weeds can also increase fire hazard, and pose a threat life and property.

There are a number of strategies to reduce the abundance of weeds along the foreshore, whilst retaining the natural integrity of the dunes, encourage natural regeneration and reduce fire hazard. These strategies will be outlined in the following sections.

Impact of Environmental Weeds

Environmental weeds are plants that establish themselves in natural ecosystems and modify natural processes, resulting in the decline of the communities they invade. Impacts on ecosystem function by environmental weeds include:

- resource competition, as weeds often outcompete native species;
- prevention of seedling recruitment of native species;
- alteration to geomorphologic processes, such as increased or decreased erosion;
- changes to soil nutrient status;
- alteration of fire regime, usually through increased fire frequency;
- changes to the abundance of indigenous fauna due to less diverse habitat;
- loss of genetic diversity;
- loss of species diversity; and
- changes to the structure of vegetation communities, often by the removal of the shrub layer or native ground covers.

6.2.3 Strategy

Weed Management Considerations for Coastal Dunes

Particular attention is required for weed control programmes in coastal dune areas. In some areas, priority weeds are the dominant component of the flora and play an important role in preventing dune erosion. *Arctotheca calendula*, *Tetragonia decumbens* and *Trachyandra divaricata* are all *Moderate* rated weeds, except for *Trachyandra divaricata* which has a *Mild* rating, and should only be controlled where there is no danger of a blow-out occurring. *Tetragonia decumbens* should not be confused with native species of *Tetragonia*, such as *T. implexicoma*. *Pelargonium capitatum* is a *High* rated weed and should be controlled, preferably with a herbicide as the dead plant material will help to hold the soil together and reduce the likelihood of erosion. On west-facing dunes (where wind erosion is likely) with a high proportion of these species, it will be prudent to immediately plant native dune-colonising species following the removal of weed species, and to ensure that large bare patches of sand are not created by weeding.

Following weeding and/or replanting of dunes, temporary erosion control measures may be necessary until native plants have grown to a sufficient size. Incremental weed control in these areas will be vital to ensure that erosion does not occur. Placement of brush material on dunes subject to erosion is the preferred erosion control method. Brush allows natural regeneration to occur from wind-blown seed, or seed from brush material, and protects emerging plants from wind. Brush is also less expensive, less intensive to maintain and more effective than other possible methods, such as jute matting. Local indigenous species should be used in brush placement to avoid the germination of alien species and the accidental introduction of plant pathogens.

Weed Control Methods

Control options for environmental weeds include:

- controlling ecosystem degradation processes;
- manual control;
- herbicides; and
- appropriate fire management.

These options are further discussed below.

Controlling Ecosystem Degradation Processes

Controlling degradation processes that increase ecosystem vulnerability to weeds is often the most effective way to control weeds in the long term. The main degrading processes in the study area are caused by unrestricted access into areas of native vegetation. Controlling degrading processes will include restricting access and public education. Other degrading processes include:

- disturbance (trampling, vehicles, etc);
- fire;
- erosion;
- plant pathogens (e.g. *Armillaria luteobalbina*)

Manual Control

Manual control refers to the physical removal of the weed by mechanical or human effort. This includes hand weeding, pulling and digging or grubbing out and relates to small infestations of weeds (Dixon and Keighery, 1995). It is often the most expensive form of weed removal but it is generally the most appropriate method in circumstances where there are small infestations in largely natural bush areas. It is particularly valuable for small infestations, where chemical control is inappropriate and resources available.

Manual control needs to be carefully managed in order to avoid gross soil disturbance which can encourage further weed infestation. When undertaking manual weed control, the Bradley method (Appendix 6) should be used and revegetation or assisted natural regeneration undertaken in conjunction with weed removal. Hand-pulling of weeds can be as time-efficient as spraying where low numbers exist in a localised, well-vegetated area of bush and in these situations should be given priority over herbicide spraying.

Herbicide Control

The application of herbicides is often the most cost-effective method for weed control and a wide range of herbicides are available for different weed species. It is important that herbicides should always be used strictly in accordance with directions on the label and their application must be undertaken by personnel trained and licensed in the use of herbicide chemicals in public open spaces.

Dixon and Keighery (1995) identified three methods of herbicide control:

1. Herbicide Wipe, Stem Injection and Cut Stump Application

- Herbicide Wipe – wipe herbicide onto part of the plant (for example a leaf/leaves) using a weeding wand, wick applicator (rope), waterproof (pesticide resistant) glove or modified hand sprayer;
- Stem Injection – use a small axe to make cuts at 8 cm intervals at a 45° angle and 4-5 cm long to penetrate the sapwood beneath the bark, or drill at 45 ° angle with holes 5 cm apart. If the plant is multi-stemmed, treat all stems at chest height. Use a special injector calibrated to deliver the right amount or use a syringe; and
- Cut Stump Application – when the plant is actively growing, cut the stump almost to ground level and apply the herbicide immediately using a paint brush.

2. Herbicide Spot Spraying

- When spot spraying, avoid spraying non-target species unless using selective herbicides such as Fusilade®. Special shields can be purchased or, if necessary, made for spraying close to non-target species.

3. Herbicide Blanket Spraying

- When blanket spraying, spray over large area using boom spray or similar, when the plant is actively growing (early June to no later than mid-August or when specified).

Two of the major herbicides recommended for use are glyphosate (e.g. Roundup®) and fluazifop (Fusilade®). Glyphosate is a systematic non-selective herbicide, which is useful for controlling most weeds, particularly bulbous species. Glyphosate should not be blanket sprayed in areas containing native species as it will also kill them. Fluazifop is a monocot-selective herbicide that is effective on most grassy weeds and does not affect native dicots. It may however impact on native monocots such as orchids and native grasses, rushes and sedges. A dye should be added to the herbicide to mark areas sprayed. Herbicides should not be sprayed in wetland areas, nor should a wetting agent or surfactant be added to herbicides in these areas. Alternatives to spraying include wick applicators and other methods that target individual plants. A “frog-friendly” version of Roundup® (known as Roundup® Bioactive™) is available for use near wetland areas.

Guiding Principles for Weed Control

When undertaking weed control programmes, the primary guiding principle is to work from areas in the best condition to those in the worst condition, and all works should be undertaken in conjunction with a restoration strategy (Bradley, 1971; Bradley, 1988; Buchanan, 1989). The bushland condition map (Map 2) should be used to determine the strategies for weed control and prioritise areas for weed control as it is based on weed invasion and native vegetation structure.

Using bushland condition to determining weed control priorities ensures that:

- *Very Good - Excellent* condition bushland is maintained;
- *Fair - Good* condition bushland is enhanced, moved closer to being in *Very Good - Excellent* condition, and prevented from deteriorating to *Poor* condition bushland; and
- *Poor* condition bushland is enhanced, moved closer to being in *Fair - Good* or *Very Good - Excellent* condition, and prevented from deteriorating to *Very Poor* condition bushland.

The *Very Poor* condition bushland areas are generally not suitable for targeted weed control in the absence of intensive rehabilitation works. Instead, weeds in these areas should be addressed within the context of a comprehensive restoration plan.

When working in *Very Good - Excellent* and *Fair - Good* condition bushland, the Bradley method of weed control is recommended (Appendix 6). Essentially, this method involves assisted natural regeneration of native plants from seed banks, rather than the use of replanting programmes

Approaches to Weed Control

Approaches to the control of priority weeds can be categorised into:

- Species-led control;
- Site-led control;
- Resource-led control;
- Cause-led control; and
- Threatened species and communities led control (CALM, 1999).

Only the first three approaches to control will be described below. Cause-led control is a preventative measure that aims to reduce the impact of factors that aid the spread and establishment of weeds, and there are no threatened ecological communities identified from the foreshore.

Species-led Control

Species-led control is a proactive strategy to prevent introduction, establishment, survival, reproduction and dispersal of an emerging weed before it becomes a major problem within the study area. Initiatives should be undertaken at a local level to prevent the introduction and spread of weed species through control of degrading processes.

Generally, it is recommended that species-led control be undertaken prior to site-led control. Weed species were placed in this category if they:

- Have small populations;
- Are relatively easy to remove;
- Have a high potential to spread and therefore become a problem in the future; and
- Are located in areas that will not be continually reinfested from the soil weed seed bank or from surrounding areas.

These weed species should be tackled on a weed by weed basis, using the guiding principles described in Section 6.3.4.

Weeds that have a High Environmental Weed Strategy for Western Australia (EWSWA) priority (CALM, 1999) or have a Moderate priority and are widespread are suitable for species-led control and include:

- Rose Pelargonium *Pelargonium capitatum* has extensively invaded bushland areas within the study area and has become the dominant species in many situations;
- Geraldton Carnation Weed *Euphorbia terracina* has become one of the dominant species within many bushland areas. This species has a high potential for spread and has become a serious threat.
- Hare's Tail Grass *Lagurus ovatus* and Great Brome *Bromus diandrus* are two grassy weeds that have established in many areas of disturbed bushland.
- Victorian Tea-tree *Leptospermum laevigatum* has been used as a rehabilitation species near the existing SLSC and along some roadsides. This species is highly invasive and should be removed and the areas rehabilitated with local species.
- Sea Spinach *Tetragonia decumbens* while having a moderate priority, is very extensive within the study area and has invaded many bushland areas.
- Wild Turnip *Brassica tournefortii* is found in small populations in disturbed areas within the study area. This species should be eradicated before it becomes widespread.

Control methods for these and other High and widespread Moderate priority weeds are listed in Table 6.2

Table 6.2 Control methods for weed species in rated as High in EWSWA, and widespread Moderate-rated weed species.

Most of the species listed below have been recorded within the study area. Source: *Environmental Weed Strategy for Western Australia database - weedBase* (CALM, 1999)

Species	Method*				EWSWA Rating	Distribution in Study Area	Herbicide(s) and Application Rates	Timing	Control Notes and General Comments
	1	2	3	4					
<i>Arctotheca calendula</i> Cape Weed	✓	✓	✓		Moderate	Common in highly disturbed areas.	Glyphosate/Roundup knapsack 100 mL in 15L water or stronger solution on large plants. Lontrel 1 in 100 has been used successfully by Mains Road Dept. over 1 year old direct seeded woody seedlings and mature bush. Do not use Lontrel over sensitive plants such as orchids. Seek further advice before using.		Mainly in disturbed areas where extra water/nutrients encourage lush growth. Generally only worth controlling in these areas.
<i>Avena barbata</i> Wild Oats	✓	✓	✓	✓	Moderate	Common in disturbed areas and adjacent to tracks and roads	Use 2L Fusilade per ha for blanket and spot spraying. Easy to control.	No timing given – probably best to spray before flowering to prevent seed set.	
<i>Brassica tournefortii</i>	✓	✓	✓		High	May be sparsely present at North Mindarie Beach.	Glyphosat/Roundup knapsack 75-100 mL in 15L water when actively growing		
<i>Bromus diandrus</i> Great Brome	✓	✓	✓	✓	High	May be present on secondary dunes in North Mindarie	Fusilade or similar herbicide at 2L/ha.	When actively growing	Competes with natives.
<i>Euphorbia terracina</i>	✓	✓	✓		High	Present mainly in the roadside revegetation of Kinsdale Road	Spray seed 200, 10-15ml in 10L water + 0.25% wetter.	Early Winter	Found in highly disturbed areas. Usually a short lived perennial.
*Method 1 - Hand Weeding, Pulling, Digging; Method 2 - Herbicide Wipe, Stem Injection or Cut Stump; Method 3 - Spot Spraying; Method 4 - Blanket Spraying									

Species	Method*				EWSWA Rating	Distribution in Study Area	Herbicide(s) and Application Rates	Timing	Control Notes and General Comments
	1	2	3	4					
<i>Lagurus ovatus</i> Hare's Tail Grass	✓	✓	✓	✓	High	Present throughout site with highest abundance on secondary dunes and near tracks and disturbed areas	Spray with Fusilade or similar herbicide at 2-4L/ha.	Winter.	Competes with native plants
<i>Leptospermum laevigatum</i> Victorian Tea Tree	✓	✓	✓		High	Roadside replantings and near the existing SLSC.	Hand pull small seedlings. Spot spray small plants. Paint cut stump when actively growing. Apply Roundup/Glyph. straight after cutting. Remove tops which may have seeds still attached. Check following years for new seedlings. Can use Garlon, Grazon or Velpar with care. If cut at ground level no need for herbicide.		Replaces native species. Produces large amounts of seed. Killed by fire.
<i>Pelargonium capitatum</i> Rose Pelargonium		✓	✓		High	Very common on coastal dunes – has become dominant in many vegetation types	No specific data for herbicide control. Suggest Ally/Brush-off at 5g/ha. Glyphosate 1 in 100 in early September gave some control, add wetting agent. Try with wick applicator. Repeat applications may be necessary.	Ally/Brush-off: August, September. Glyphosate: June to October	Smothers small native plants. Colonises natural bare sandy areas, therefore destroys natural habitat of burrowing snakes. Difficult to control. Pull plants in autumn/winter when soil is damp. Plant will reshoot if stem is broken at or below ground level. Secondary weeding is important but good control can be achieved.
*Method 1 - Hand Weeding, Pulling, Digging; Method 2 - Herbicide Wipe, Stem Injection or Cut Stump; Method 3 - Spot Spraying; Method 4 - Blanket Spraying									

Species	Method*				EWSWA Rating	Distribution in Study Area	Herbicide(s) and Application Rates	Timing	Control Notes and General Comments
	1	2	3	4					
<i>Romulea rosea</i> Guildford Grass	✓		✓		High	Only found in Vegetation Community 12	Glyphosate 20-40 mL in 10L water + 0.25% wetter or surfactant, e.g. Pulse. Glean, Ally/Brush-off at 5g in 250L water per hectare.	Glyphosate in mid-winter; Ally/Brush-off/Glean no later than early stages of flowering.	Ally/Brush-off can be used where <i>Romulea</i> grows among native shrubs without killing natives
<i>Schinus terebinthifolius</i> Japanese Pepper	✓	✓			Moderate	Found in the vicinity of the Quinns Rocks Caravan Park	Remove small seedlings by hand. Cut stump method with Glyphosate or failing this try Velpar or Garlon. Follow up treatment is required.	In wetland areas treat the stumps in Summer/Autumn when water recedes	Smothers native plants. Has the potential to become very wide spread. Spread by birds. Very difficult to control.
<i>Tetragonia decumbens</i> Sea Spinach	✓	✓	✓		Moderate	Common on coastal dunes. Has become dominant in many vegetation types	No specific information for herbicide control available. Suggest high rates of Glyphosate/Roundup when actively growing.	When actively growing	Usually in highly disturbed areas. Only try to control in areas where there is no danger of erosion by wind (blowout). May be best to use a herbicide as the dead plant helps to reduce erosion. Do not confuse with native species. The native <i>Tetragonia implexicoma</i> , has less fleshy leaves and darker, narrower stems than <i>Tetragonia decumbens</i> .
<i>Trachyandra divaricata</i> Strapweed	✓	✓	✓		Mild	Common on coastal dunes and in disturbed bushland	Difficult to remove by hand due to regrowth and new germinants. Spot spraying with Ally/Brushoff in summer/autumn at 5g ha gives 95% control, spraying at same rate the following year gives 100% control. Wiping with 1g to 1L water eg 10L solution per ha gives 85 - 90% control.	Summer and autumn with follow up one year later.	Usually found in disturbed areas. Only control in areas where this is no danger of erosion by wind.

*Method 1 - Hand Weeding, Pulling, Digging; Method 2 - Herbicide Wipe, Stem Injection or Cut Stump; Method 3 - Spot Spraying; Method 4 - Blanket Spraying

Note: Glyphosate concentrations given are for Glyphosate 360.

A key to the herbicides and their active ingredients is provided below:

Product Name	Active Ingredient	Product Name	Active Ingredient
Ally ®	metsulfuron-methyl	Pulse ®	polyalkyloxyated dimethylpolysiloxane
Amitrol T ®	amitrole + ammonium thiocyanate	Roundup ®	glyphosate
Brushoff ®	metsulfuron-methyl	Spray-Seed ®	paraquat + diquat
Dalapon ®	2,2-DPA	Sertin ®	Sethoxydim
Fusilade ®	fluazifop-butyl	Targa ®	quizalofop-p-ethyl
Glean ®	chlorsulfuron		

Please note:

The products highlighted in **bold typeface** above have been registered for the above specific purposes with the National Registration Authority for Agricultural and Veterinary Chemicals. Other products may be registered via an Off-Label Permit, which allows use of registered or non-registered products for specific purposes.

It is necessary that the application of herbicides be in accordance to labelling requirements or the manufacturers Materials Safety Data Sheet, and must be undertaken by personnel trained in the use of herbicide chemicals. The application of any herbicide for purposes not specified on the labelling requires an Off-Label Permit from the National Registration Authority in Canberra. The application of herbicides must also be in accordance with water catchment restrictions

Site-Led Control

Site-led control focuses on identifying areas that require weed control to maintain their ecological and commercial values. Site-led control is appropriate for most of the Wanneroo coast. Generally, it is recommended that site-led control be undertaken after control of weeds recommended for species-led control. Weed species can be placed in this category if they:

- have wide-spread and well-established populations;
- require concentrated and/or long-term efforts to remove; and
- are highly detrimental to ecological functions of bushland if left unchecked.

Suitable areas for site led control are *Poor – Very Poor* condition bushland along the foreshore. Site-led weed control should also be undertaken in Kinsale Park as a priority as this area has recently been burnt and is at risk from weed invasion. Numerous weeds were seen in Kinsale Park during a site inspection and ongoing control should be undertaken at this early stage of germination.

Resource-Led Control

Resource-based weed control is recommended where a particular species is known to be within a defined area, and thereby can provide a focus for community projects. A resource led approach matches volunteer and professional labour to the best possible weed control outcomes. For example, volunteers may be best suited to target small populations of highly visible weeds which are readily removed by simple manual or chemical methods and are ideal for essential follow up and monitoring. Professional contractors should be used where spraying or machinery is required.

General Weed Control Action Plan

A general Weed Control Action Plan (Table 6.3) was developed, based on the guiding principles and approaches outlined previously. It is provided as a general guide for determining the priority for weed control activities. More detailed weed control action plans would require greater detail on the cover/abundance and distribution of priority weed species in these sections. This information could be gained by carrying out grid-based searches of each study area and recording cover/abundance values for priority weeds at defined intervals, for example every 100 or 200 metres. Cover/abundance should be measured using a standard scale, such as the Braun-Blanquet scale (Appendix 7) (Mueller-Dombois and Ellenberg, 1974). This task could be undertaken by environmental officers, consultants, community groups or students.

Table 6.3 General weed control action plan

Priority	General Procedures
Priority 1 Start with species-led control	<p>Species-led control:</p> <ol style="list-style-type: none"> 1. Select weeds for control on a species basis according to time of year and available resources. 2. For each weed species, use bushland condition maps to: <ul style="list-style-type: none"> • Start control efforts in <i>Very Good-Excellent</i> condition bushland • Move to <i>Good-Fair</i> condition bushland • Move to <i>Poor</i> condition bushland <p>The above represents primary weed control. Secondary weed control and long-term monitoring of weed populations will also need to be undertaken.</p>
Priority 2 Move to site- led control	<p>Site-led control:</p> <ol style="list-style-type: none"> 1. Select sites suitable for site-based control. 2. Use bushland condition and weed distribution maps to: <ul style="list-style-type: none"> • Start control efforts in <i>Very Good-Excellent</i> condition bushland • Move to <i>Good-Fair</i> condition bushland • Move to <i>Poor</i> condition bushland <p>Depending on resources and time of year it may be necessary to undertake control of different site-led species, prior to moving to other areas. Again, the above represents primary weed control. Secondary weed control and long-term monitoring of weed populations will also need to be undertaken.</p>
Priority 3 Move to resource-led control	<p>Resource-led control:</p> <ol style="list-style-type: none"> 1. Select sites suitable for resource-based control. 2. Use bushland condition and weed distribution maps to: <ul style="list-style-type: none"> • Start control efforts in <i>Very Good-Excellent</i> condition bushland • Move to <i>Good-Fair</i> condition bushland • Move to <i>Poor</i> condition bushland <p>Again, the above represents primary weed control. Secondary weed control and long-term monitoring of weed populations will also need to be undertaken.</p>

Post-fire Weed Management

Following fire, weed species have an opportunity to increase in density and abundance. Ongoing weed management must also include post-fire weed management to break the fire-weed cycle. Training should be provided to staff carrying out these duties, or specialist bush regenerators employed in order to achieve the desired outcome without compromising the ability of the bushland to regenerate. The post-fire environment is susceptible to further damage, and weed control works should be undertaken at a time that will give the vegetation the greatest chance of successful regeneration. Implementation of weed control in the post-fire environment should incorporate the following factors:

- If the fire occurs in early summer, weed control should be carried out three months after a fire;
- With later summer fires, inspections should be carried out at four, six and eight weeks after the fire in order to assess the most appropriate interval at which to carry out weed control. The interval will vary according to weather;

- The affected area should be monitored and, if necessary, a follow-up treatment should be applied; and
- As with all weed control programmes in natural areas, it should be linked to a regeneration programme. Assessment of individual situations is required to determine the needs for each site.

Monitoring and Evaluation

Monitoring and evaluation are key actions that need to be undertaken during weed management to measure the success of control strategies. Performance indicators should be developed to objectively assess the success of weed control strategies. This will not only contribute to accountability where public funds are involved, but also provide a mechanism for modifying the strategy and maintaining its flexibility.

When monitoring site specific projects, the following strategies are suggested:

- Establish monitoring quadrats in areas subject to weed control programmes to record the effectiveness of control methods;
- For species-led control – monitor effectiveness of control of discrete weed populations or patches, including presence or absence, and, if present, the degree of new infestation;
- For site-led control – establish monitoring quadrats and survey and record annually;
- For both control methods – monitor the effectiveness of different control methods used (manual vs. chemical control; spot spray vs. blanket spray; contractor vs. community control). The use of photographs from set points enhances this process; and
- Monitor quadrats for establishment of new weed species.

Performance Criteria

In order to determine the effectiveness of any weed control programme, there needs to be a method of determining success and ongoing progress. The following gives examples of the factors that could be assessed:

- Removal of a set number of priority weed species (say four or five) from the targeted areas over the next five years;
- Reduction in the area of priority weed infestations by 5% over 5 years; and
- Reduction in the total number of weed species present by 5% over 5 years.

6.2.4 Recommendations

No.	Recommendation	Priority	Responsibility ⁱ	Indicative Cost ⁱⁱ
7	Develop a comprehensive weed control plan within the study area, following the principles of the general weed control action plan and other guidelines detailed in this management plan.	High	Operations	\$4,000
8	Implement post fire weed control measures in Kinsale Park and recently burnt areas where appropriate.	High	Operations / State Government	\$5,000 Per Annum ¹
9	Develop a quadrat-based monitoring and evaluation programme to measure the success of weed management strategies implemented. Key performance indicators based on number, extent and density of weeds.	Medium	Operations	\$1,000 Per Annum

¹ 2 applications of glyphosate @ 10c / m²

6.3 Bushland Restoration

6.3.1 Objectives

The objectives for ecological restoration in the Quinns Rocks – Mindarie foreshore are to:

- reinstate indigenous flora and vegetation communities, where they have been disturbed and/or depleted;
- minimise the impact of activities that could result in degradation to vegetation communities through the use of appropriate management strategies;
- improve the overall condition of vegetation communities within the area; and
- ensure that vegetation communities are self-sustaining and are capable of natural regeneration.

6.3.2 Background

Ecological restoration involves restoring the vegetation and habitats through means of reinforcing and reinstating the system's ongoing natural regenerative processes. This involves reducing or eliminating disturbance factors, removal of inhibitors to natural regeneration such as weeds, and the reconstruction of the ecosystem in highly disturbed areas where the potential for natural regeneration has been markedly reduced or lost. Weed control is an important component of bushland regeneration and without adequate weed control, survivorship and growth of revegetated species is likely to be poor, while undertaking weed control without bushland restoration will result in reinvasion by weed species. Bushland restoration and weed control should therefore always be undertaken together. Weed control methods are detailed in Section 6.2.

As with weed control, the priorities for dune restoration and planting programmes should be set according to the bushland condition map (Map 2) and the infrastructure map (Map 5). Priority rehabilitation areas should be addressed first where possible, according to the sequence detailed below, followed by other areas of coast where rehabilitation is required. In general, seeding, planting and brush or mulching will not be required in areas of *Very Good – Excellent* condition. Restoration efforts should commence in areas of *Fair – Good* condition within *Very Good – Excellent* areas, with the aim of improving the condition of these areas to *Very Good – Excellent* in the long term. Efforts should move next to areas of *Fair – Good* condition bordering *Very Good – Excellent* areas, then to *Poor* areas within *Fair – Good* or *Very Good – Excellent* condition, then to *Poor* areas bordering *Fair – Good* or *Very Good – Excellent* condition, and finally to other *Poor* areas. However, given the dynamic nature of coastal areas, and the high potential for further damage to *Poor* and *Very Poor* condition areas, action should be taken as soon as possible to prevent further deterioration, and to prevent human access into these areas. This will generally involve erection of fences where these are not already present, or placement of temporary stabilisers such as brush, mulch and tritter on exposed surfaces.

The following terms describe the techniques that should be applied to the various condition areas:

Assisted Natural Regeneration

This method is used where a remnant of vegetation exists in *Fair – Good* to *Very Good – Excellent* condition and retains its natural regenerative capacity. It can also be used once a reconstructed community regains its natural regenerative capacity. Assisted natural regeneration involves removing weeds and disturbance factors from the environment.

Reconstruction

This technique is applicable where a bushland remnant is seriously depleted – for example where only some overstorey species are left, or when there is no remnant vegetation left. Reconstruction relies on methods to re-establish vegetation such as replanting, topsoil relocation and direct seeding.

There are currently several areas where bushland restoration has been undertaken by the Mindarie Coastcare Association, the Quinns Rocks Environmental Group Inc. and other community groups. Rehabilitation sites include: North Mindarie Beach, sites along the DUP between Mindarie Keys, Kinsale Park and Quinns Beach South and in bushland areas near Tapping Way.

6.3.3 Strategy

Assisted Natural Regeneration

The restoration of the vegetation should aim to maintain the resilience of good areas while restoring disturbed areas of the site. The restoration plan should follow three basic principals of bush regeneration known as the Bradley method (Appendix 6). This method involves selective weeding around native species to decrease competition, increase the size and number of native plants and gradually improve the condition of the bushland. The underlying principals of this method are:

- Work from areas in good condition to areas in poor condition. Start regeneration work in areas with least disturbance and increase the area's resilience and then gradually work into areas with more weeds
- Minimise disturbance while working. This is important so that regeneration work does not simply create conditions suitable for weed invasion. Minimise disturbance to soils and trampling of plants
- Let the rate of natural regeneration determine rate of weed removal. This can be important as over-weeding will leave large bare areas that can be invaded by more or different weeds.

Assisted natural regeneration following the Bradley method should be undertaken in bushland in *Fair – Good* condition or better. The priorities and methods for weed control in these areas are outlined in detail in Section 6.3.

Replanting and reconstruction should only be undertaken in *Poor – Very Poor* areas where the exclusion of disturbance factors alone will not lead to successful bushland restoration.

Reconstruction

Coastal environments, while highly resilient to harsh natural processes such as high winds, salt and associated desiccation, they have very low resistance to non-natural disturbances such as trampling and invasion by aggressive weeds. The removal of natural vegetation can also precipitate ongoing erosion which can result in widespread removal or replacement of native species as a result of relatively localised disturbance. In many areas where there have been high levels of disturbance and the Bushland Condition is in *Poor – Very Poor* condition, active revegetation will need to be undertaken. Bushland condition is shown in Map 2 and bare, sandy areas that are prone to erosion are shown in Map 5.

A number of different plant communities exist in the coastal zone reflecting the markedly different conditions brought about by changes in topography, soil and distance from the shoreline. The species composition of each vegetation community (Appendix 2) should be used to determine which revegetation species to use.

There are seven components to the reconstruction of coastal areas:

- Rebuilding foredunes that have been breached;
- Brushing or mulching the planted surfaces;
- Restoration of dune vegetation;
- Designing recreational areas and access points to the beach;
- Fencing;
- Public information and education; and
- Monitoring and maintenance.

Rebuilding Foredunes

Foredune rebuilding may be required in areas where they have been breached or eroded, as a result of loss of vegetation cover due to either natural or human-induced causes. Rebuilding foredunes prevents further wind funnelling, sand scour and sand transportation inland (Oma *et al.*, 1992). Rebuilding may be achieved by means of earthworks, brush layering or sand trapping fences. The latter two approaches are most relevant to the City of Wanneroo, as blowouts are generally localised in nature and in most cases the natural dune formations have not been comprised to the extent that large-scale, urgent reconstruction would be required.

Sand trapping fences may take several years to reform dune faces. The fences work on the principle that wind energy and speed is reduced as it flows over the fence, resulting in deposition of sand behind and downwind of the fence. The eventual height of the resulting dune is as high as the fence itself, with the width between five and ten times the height of the fence. The effectiveness of sand trapping fences depends on wind speed, the amount of sand transported by winds, and characteristics of fence construction (Oma *et al.*, 1992). These fences can only be used on stable or accreting coastlines, where there is a steady supply of sand to the beachfront. Brush layering works on the same principle as sand trapping fences, with layers of brush added to exposed sand, gradually building the height of the dune. Brush layering is much cheaper than sand fencing, has fewer problems with vandalism, and provides shelter for plant establishment. Brushing also has the added benefit of discouraging access to the rehabilitation area. This is particularly useful when closing and rehabilitating access tracks.

Mulching the Planted Surfaces

It is important to stabilise and protect the dune surface as soon as possible. Brushing or mulching protects the young plants and bare surfaces from erosive wind, sand blasting, sand creep and helps to conserve soil moisture, while creating a suitable environment for seed germination and establishment of young plants. Brushing has the added advantage of acting as a reservoir for wind blown sand and is a deterrent to pedestrians (Oma *et al.*, 1992).

Traditionally, brushing has been cited as the most effective and usually cheapest method of stabilising the bare sandy surface (Oma *et al.*, 1992). Brushing involves covering the bare dune surface with a single layer of shrub or tree branches, and is particularly suitable for sites exposed to wind or where pedestrian access is sought. The application of brush with sand fences controls sand movement by impeding the surface wind flow, trapping sand and sheltering plants. The density and alignment of brushing is critical to it performing its function adequately. *Melaleuca* and pine prunings are ideal brush materials as they retain leaves for long periods, increasing their ability to trap sand and protect the surface (Oma *et al.*, 1992). *Eucalyptus* prunings lose leaves quickly, so a denser layer of brush is needed. Prunings of local woody coastal vegetation, such as *Acacia* species, can introduce stocks of local seeds into dunes. Prunings could be sourced from street trees, or from pruning done as part of path maintenance along the foreshore, provided that those prunings do not contain seeds.

Mulching with locally available materials, which could include seaweed, and mulched street-tree prunings will also stabilise sandy surfaces. Mulch has a much lower capacity than brush to trap sand, and will not protect seedlings from sand blasting or wind once pore spaces have been filled (Oma *et al.*, 1992). This technique is best used where sand drift and sand blasting are not an issue, in sheltered sites and dune swales.

Brush can be easily blown away by the wind, as it contains a large volume of air pockets, along with bulky material such as logs. Brushing may also increase fire hazard due to the aeration of the material. . An alternative to this is tritter. Tritter consists of guillotined brush material, which means that brush can lie flatter and interlock more, without as much pore space. Cuttings of *Acacia rostellifera* are suitable for tritter and this species is locally available and is native to coastal dune areas. Trittering involves an initial higher cost than mulch and may therefore be less preferable in exposed areas, or where restricted access is desired .

Planting Dune Surfaces

Revegetation of degraded dune areas provides stability to dune surfaces, enhances environmental, conservation and visual amenity values. It may also reduce the cost of future maintenance of coastal areas by reducing erosion (South Metropolitan College of TAFE, nd). Species suitable for coastal dunes can be divided into primary, secondary and tertiary species, according to their hardiness and proximity to the coast. Primary colonising species should be used on foredunes and mobile dunes, with secondary species used behind the foredunes and mobile dunes. Tertiary species can represent the “climax” stage of dune succession, occurring in more sheltered positions on stable dunes further from the beach. Appropriate species for revegetation of foredunes are listed in Table 6.4 and those appropriate to secondary dunes are listed in Table 6.5.

In some areas of Western Australia, an assortment of native and exotic species is used to stabilise dune surfaces. However, given the conservation objective for much of the vegetation along the Wanneroo coast, the use of exotic colonising species is not recommended. Non-native species are acceptable only where:

- the proposed introduction offers benefits that surpass the native species (such as in erosion management); and
- where it is not an invasive threat to the native plant community.

It is best to use a variety of indigenous species that occur or would naturally occur in the vegetation type. Primary colonising species can be used on foredunes and mobile sand dunes, with a combination of primary and secondary species on dunes further from the beach. Cuttings or seed should be collected locally and the timing of first planting should occur when the first winter rains have dampened the sand to a depth of 20-30 cm, generally in June to July. Planting should be completed by the end of the wettest period of the year at the latest (September).

The sequence for revegetating foredunes and mobile dunes should be as follows:

- i) Foredunes and mobile dunes should be planted with *Spinifex hirsutus* and *S. longifolius*;
- ii) Foredunes and mobile dunes should be seeded and planted with some or all of the other primary dune colonising species in Table 6.4. Mobile dunes should also be planted with secondary dune colonising species, listed in Table 6.5.
- iii) Revegetated areas should be brushed and/or mulched.

Primary colonising species are hardy species adapted to sand blasting, inundation, salt spray and strong winds. The two main native primary colonising species in the Perth coastal area are *Spinifex hirsutus* and *S. longifolius*. *S. hirsutus* is propagated from cuttings, as the seed is not viable in Western Australia. Stem cuttings should be taken from established plants, and should be 40-60 cm long, containing several nodes. These should be hand planted 30-50 cm deep on a 50-75 cm grid, or more closely (eg 20 cm grid) where sand is accumulating rapidly or where foredunes are steeply sloping (Oma *et al.*, 1992). *S. longifolius* is usually propagated from seed, which ripens between November and January. Seed can be either threshed or scattered across the sand surface before brushing, or the whole seed head is sown on a 50 to 75 cm grid or closer as above with 1-2 cm of the spines protruding. Alternatively, seed heads can be germinated in pots in the dry season and sprouted heads planted out early in the wet season (Oma *et al.*, 1992).

Secondary dune colonising species should be re-established on all dunes behind the foredune and may also be established on the leeward side of large foredunes. Secondary species should be planted when sands are moist, as for the planting of the foredunes.

Table 6.4 Species to plant on foredunes and mobile dunes

Note: This is not an exhaustive list of all species suitable for use in revegetation programmes. Source: Oma *et al.* (1992) and Kimseed (2001)

Species	Common Name	Growth Habit	Annual or Perennial	Propagation Type	Harvest Time	Seed Cost \$/kg (2001)
<i>Isolepis nodosa</i>	Knotted Club-rush	Needle-leaved sedge	Perennial	Cuttings of rhizomes	June – August	638
<i>Lepidosperma gladiatum</i>	Coast Sword Sedge	Sword-leaved, sparsely tufted sedge	Perennial	Culms	June – August	1650
<i>Spinifex longifolius</i>	Beach Spinifex	Large, clumped grass	Perennial	Seed	December onwards	28
<i>Spinifex hirsutus</i>	Hairy Spinifex	Large, clumped grass	Perennial	Seed	December onwards	28

Table 6.5 Species to plant on secondary dunes

Note: This is not an exhaustive list of all species suitable for use in revegetation programmes. Source: Oma *et al.* (1992) and Kimseed (2001)

Species	Common Name	Growth Habit	Annual or Perennial	Propagation Type	Harvest Time	Seed cost (\$/kg)
<i>Acacia cyclops</i>	Red-eyed Wattle	Large shrubs in sheltered areas	Perennial	Seed, seedlings	September onwards, nursery	182
<i>Acacia rostellifera</i>	Summer Scented Wattle	Large shrubs in sheltered areas	Perennial	Seed, seedlings	September onwards, nursery	325
<i>Acacia saligna</i>	Coojong	Large shrubs in sheltered areas	Perennial	Seed, seedlings	September onwards, nursery	83
<i>Carpobrotus virescens</i> *	Pigface	Succulent ground cover	Perennial	Cuttings	June – August	842
<i>Hardenbergia comptoniana</i>	Wild Wisteria	Creeper	Perennial	Seed	November onwards	270
<i>Isolepis nodosa</i>	Knotted Club-rush	Needle-leaved sedge	Perennial	Cuttings of rhizomes	June – August	638
<i>Olearia axillaris</i>	Coastal Daisy Bush	Rounded, medium shrub	Perennial	Seed	February onwards	429
<i>Rhagodia baccata</i>	Berry Saltbush	Tangled, medium shrub	Perennial	Seed	March onwards	259
<i>Scaevola crassifolia</i>	Thick-leaved Fan Flower	Erect, medium shrub	Perennial	Seed	November onwards	424
<i>Spyridium globulosum</i>	Basket Bush	Medium or tall shrub	Perennial	Seed	September onwards	605
<i>Templetonia retusa</i>	Cockies Tongue	Medium shrub	Perennial	Seed	August onwards	429

* Care should be taken not to source *Carpobrotus edulis*

Additional species that may be considered for replanting at a later stage in sheltered locations on dunes that are well stabilised, with a high level of vegetation cover include:

<i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i>	Dune Moses	\$303/kg
<i>Cassutha racemosa</i>	Dodder	\$759/kg
<i>Eremophila glabra</i>	Tar Bush	\$319/kg
<i>Exocarpus sparteus</i>	Broom Bush	\$209/kg
<i>Melaleuca systena</i>	Coastal Honey Myrtle	\$385/kg
<i>Melaleuca huegelii</i> var. <i>huegelii</i>	Chenille Honey Myrtle	\$330/kg
<i>Melaleuca lanceolata</i>	Rottnest Island Tea Tree	\$215/kg
<i>Santalum acuminatum</i>	Sweet Quandong	\$28/kg
<i>Spyridium globulosum</i>	Basket Bush	\$605/kg
<i>Templetonia retusa</i>	Cockies Tongues	\$429/kg

Seed and propagule collection, processing, storage and germination should be undertaken by trained personnel. Bush regeneration and seed collection training courses are regularly provided by APACE AID Inc. The provision of appropriate plant collecting permits from the Department of Conservation and Land Management and approval from landowners and managers is also required before seed and propagules can be collected. Appendix 8 provides a list of all commercially available species that can be used within the study area based on the native species present. Species composition of vegetation communities should also be consulted so that the species used are complementary to that vegetation community.

Recreational Use

Active recreation areas and other facilities that attract crowds should be sited away from highly fragile conservation areas. Where this is not possible, access to these areas should be heavily restricted. Recreational areas are considered in more detail in Section 6.8.

Protection of Areas Under Rehabilitation

Fencing excludes people from fragile and rehabilitating areas and guides them to their destination through environmentally suitable areas. Fencing is considered in more detail in Section 6.8

Public Information and Education

Signage in appropriate locations helps inform visitors and the local community of the work which has been undertaken, the reasons why rehabilitation has been undertaken, and to encourage them to protect the area and use the facilities provided with care (Oma *et al.*, 1992). Signage in rehabilitation areas should be discreet and should represent the minimum wording, size and distribution required to effectively deter the public from entering rehabilitation areas (South Metropolitan College of TAFE, nd). Signage for rehabilitation areas should also be consistent to preserve visual amenity of the area. Signage is considered in more detail in Section 6.9.

Local newspapers, letterbox drops and community Bushcare events can also play a role in informing and educating the public.

Monitoring and Maintenance

Monitoring of rehabilitation areas should be undertaken to:

- check for plant vigour, establishment and survival;
- assess the adequacy of temporary stabilising agents such as brush and mulch;
- ensure that people are using accessways rather than trampling vegetation; and
- ensure that signs have not been vandalised.

Rehabilitated areas should be maintained constantly, as even minor damage to dunes can rapidly develop into a major problem.

Monitoring should occur regularly, preferably on a monthly basis for the first year. Generally, at least 30% of the original budget for implementing rehabilitation works should be allocated to maintain the rehabilitated area in the first wet season (Oma *et al.*, 1992). Up to 10% of the original budget may be required for future annual maintenance depending on the nature of the landforms, and coastal and use processes operating in the area (Oma *et al.*, 1992).

6.3.4 Indicative Costs

The following outlines the estimated cost of rehabilitation over a five year period. Ongoing yearly costs are equivalent to the final years' total costs.

Table 6.6: Cost of professional rehabilitation per square metre

	CONDITION RATING				COST
	Very Good to Excellent	Fair to Good	Poor	Very Poor	Erosion and Blowouts
Establishment			\$5.00	\$6.00	\$8.00
After 1st Year	\$0.10	\$0.50	\$2.00	\$3.00	\$3.00
After 2nd Year	\$0.10	\$0.10	\$1.00	\$1.20	\$1.20
After 3rd Year	\$0.10	\$0.10	\$0.50	\$0.50	\$0.50
Years thereafter	\$0.10	\$0.10	\$0.10	\$0.10	\$0.10

Table 6.7: Cost of professional rehabilitation for the Quinns Rocks – Mindarie Foreshore

	CONDITION RATING ²			TRACKS ³	COST	
	Very Good to Excellent (11.7 ha)	Fair to Good (8.6 ha)	Poor (5.9 ha)	Very Poor (3.1 ha)	Very Poor (0.5 ha)	Cost Per Year
Establishment	\$0.00	\$0.00	\$295,900	\$185,400	\$29,300	\$510,600
After 1st Year	\$11,700	\$43,100	\$118,400	\$92,700	\$14,600	\$280,500
After 2nd Year	\$11,700	\$8,600	\$59,200	\$37,100	\$5,900	\$122,500
After 3rd Year	\$11,700	\$8,600	\$29,600	\$15,500	\$2,400	\$67,800
Years thereafter	\$11,700	\$8,600	\$5,900	\$3,100	\$500	\$29,800
	Total Cost over Five Years				\$1,011,200	

6.3.5 Recommendations

No.	Recommendation	Priority	Responsibility ⁱ	Indicative Cost ⁱⁱ
10	Carry out assisted natural regeneration following the principles of the Bradley method in <i>Good – Excellent</i> condition areas, gradually progressing into <i>Fair – Good</i> areas (See Map 2).	High	Operations / State Government	\$115,700 See Table 6.7
11	Close and rehabilitate all tracks not required for access, walking trails or firebreaks (See Map 5).	High	Operations/ State Government	\$52,700 See Table 6.7
12	Carry out reconstruction / revegetation in areas of <i>Poor</i> and <i>Very Poor</i> condition bushland (see Map 2) using local provenance genetic material.	Medium	Operations / State Government	\$842, 800 See Table 6.7
13	Monitor rehabilitation works annually and ensure that accurate records are kept of progress.	Medium	Operations	\$200 / area / annum
14	Erect signage that is appropriate in location, size and information to inform the public of rehabilitation works.	Medium	Operations / State Government	\$500 per sign

² Note – This estimate does not include the North Mindarie sector. Vegetation and Bushland Condition mapping of this area was outside the scope of this project. Costs for rehabilitation of bare areas and blowouts have therefore been considered separately in Section 6.7.

³ Includes North Mindarie Sector. Assumes 3,255 m of 1.5 m wide informal track to be closed and rehabilitated.

6.4 Fire Management

6.4.1 Objectives

The prioritised objectives for fire management in foreshore bushland areas of Quinns Rocks – Mindarie are to ensure:

1. protection of human life;
2. protection of property; and
3. protection of ecological integrity and biological values.

6.4.2 Background

The immediate and cumulative impact of fires on biological values are of major concern. Fires can impact upon the natural vegetation in a number of ways including: promotion of weed growth; alteration of species composition; threat to the viability of rare, endangered or geographically restricted species; and threat to the viability of obligate seeder species (which are typically more sensitive to fire than lignotuberous species that can resprout following fire).

Fires at intervals more frequent than the inherent regenerative capacity of the vegetation can promote the spread of exotic weeds by creating the required conditions, including: increased light penetration through burnt-out overstorey; reduced competition from native perennial species; and increased availability of nutrients.

Increased weed growth, particularly annual grassy weeds, greatly increases the fire risk as it forms a highly flammable fine-textured fuel and produces a high annual fuel load depending on climate and growth rate. Grassy weeds can also form a continuous fuel bed, permitting a fire to spread quickly and creating a very hot fire at ground level. Native plants usually have gaps between them which act to slow down the spread of fire. They also generally take much longer to reach the same fuel levels. This situation leads to a cycle of increased weed growth leading to increased fire risk and thus increased fire intensity and frequency, which in turn lead to increased weed growth. The effect on natural communities is profound and can quickly lead to a greatly reduced diversity of flora and fauna.

Fires are of particular concern on coastal dunes if the ground cover and vegetation are consumed, as areas of bare sand can be easily eroded, especially if combined with inappropriate human or animal access, or weather conditions such as high wind or heavy rain. Areas that have been generally regenerate naturally in the following season, but replanting, reseeding and rebrushing may be required if regeneration does not occur after the first wet season. Brushing may also be required to protect the sandy surface, helping plants to germinate and grow (Oma *et al.*, 1992).

Existing Fire Management

Fire management within the City of Wanneroo is administered as per the procedures outlined in the Local Emergency Management Plan, documented by the City.

The study area is a gazetted fire district and as such is under the control of the Fire and Emergency Services Authority (FESA). The primary response team for fires within the study area is the Joondalup Fire and Rescue Station. Extra resources are also available from Fire and Rescue stations located within the Fire Services Perth North Coastal Region. As a last resort the resources of the City of Wanneroo Volunteer Bush Fire Brigade are also available upon request from the Fire and Rescue Station.

The City of Wanneroo Volunteer Bush Fire Brigade comprises three brigades with approximately 110 volunteer roster members. The current vehicle fleet consists of 6 Light Tanker 4 x 4 Appliances, 2 Heavy Duty 4 x4 Appliances, 1 Support 4 x4 Appliance and a mobile bus which is fitted out as an Incident Control Vehicle. Other resources of the city of Wanneroo are also available on request, as an example; earth moving machinery etc.

Hazard reduction burning is not appropriate within the study area as the built-up nature of the area, and the relatively small size make this unnecessary. Instead fire breaks and access points are maintained by the City of Wanneroo's Parks Operations. The most recent fire was in Kinsale Park which was completely burnt out in 2002.

Property owners in the City of Wanneroo are required to clear firebreaks by the 15th day of November each year and maintain them until the following April. On the 16th day of November each year Council's Rangers/Fire Control Officers conduct fire break inspections on all vacant land and rural properties.

6.4.3 Strategy

Fire management strategies generally have four core elements as follows:

- Hazard reduction;
- Fire suppression;
- Public education; and
- Post-fire recovery and incident analysis.

Hazard Reduction

Hazard reduction involves actively removing the incidence of fire ignition and reducing fuel levels.

Ignition reduction entails removing or reducing the causes of fires. The most common cause of fires in urban bushland is arson, however this is difficult to police and offenders are rarely caught. A community education programme highlighting the destructive nature of bushfires, and regular patrols by rangers during high-risk periods may help reduce the incidence of arson within the City of Wanneroo.

Bushfires can also be accidentally lit, with common causes including escapes from burning rubbish, barbecues and campfires, cigarette butts, escapes, powerlines, lightning and the operation of plant and machinery. A community education programme highlighting activities that could lead to accidentally lit bushfires could reduce the incidence of bushfires, especially near areas where the number of visitors is greatest. All barbecues in picnic areas should be gas or electric.

Fuel reduction involves reducing fuel levels to a point where any potential fire can be controlled by fire fighting crews on a normal summers day (Wycherley and Robley, 1983). The only appropriate method of fuel reduction in coastal areas is through weed control, especially on road verges, and next to pathways through the area. Prescribed burning is not an appropriate fuel reduction method in coastal areas.

Fire Suppression

Fire suppression involves fire-fighting application once a fire has started and taken hold. Fire suppression can only be effective if fires are detected quickly and fire fighters can respond and access the fire and contain it before it becomes uncontrollable. A "Fire Watch" programme can be of great assistance in alerting fire control authority to fires.

Fire suppression requires trained, experienced staff with suitable equipment, who are available within a short response time to fight fires. Fire suppression activities have the potential to degrade the environment through the unplanned construction of firebreaks and tracks, which lead to erosion, destruction of vegetation, and the proliferation of tracks. Fire suppression must therefore be integrated with effective ignition and fuel reduction programmes.

Public Education

A community education programme should be developed for the foreshore which highlights the dangers of wildfires to human life and property, and the destructive cumulative effects of frequent fire on flora and fauna. Education should focus on the risk of accidental fire lighting and the need for the public to be vigilant against arsonists. Education programmes should also include methods of preventing wildfire, controlling their spread and ensuring human safety in the event of a major fire along the foreshore.

Post-fire Recovery and Incident Analysis

Recovery

Coastal dunes are in a highly sensitive condition following fire. Most of the fine material is scorched or burnt, so that photosynthetic processes are reduced or cease. This affects food webs that shift, at least temporarily, from a herbivore base to a scavenger base. The sand is left bare and sensitive to erosion. Some of the fauna will have perished in the fire, while others will have sought unburnt refuges, placing greater strain on the resources of unburnt areas. Regrowth and germinating seedlings will be subject to intense grazing pressure from rabbits and native animals.

Following a fire, an initial assessment of bare ground should be undertaken and the potential for erosion determined. Erosion control measures should be implemented as soon as possible after the fire. Access to any burnt areas should be limited to management purposes only for the first six to twelve months. In areas of high pedestrian use, foot access should be limited to limestone-stabilised tracks or other firm surfaces. Temporary signage may also be appropriate.

Seed germination and resprouting in vegetation should be monitored for a year following fire. Although recovery should be adequate if grazing and weed control measures are implemented, additional direct seeding and tubestock replanting may need to be considered if germination success is low.

Fire fighting operations have the potential to cause mechanical damage through trampling of vegetation, water erosion and small scale clearing. This is sometimes unavoidable but should be minimised where possible. Trained personnel should undertake bush regeneration of damaged areas.

Incident Analysis

Post-fire incident analysis is an important facet of fire management that enables fire fighters and fire control authorities to review procedures, strategies and tactics and revise them in light of experience. All fires that occur in an area should be recorded. Information that should be compiled includes the date, season, time, cause of ignition, intensity and extent of the fire, fire control methods used and damage caused by the fire. This information can be used for long-term fire management planning.

Fire history has a major role to play in the determination of fuel condition and quantity. The recording of accurate fire histories is an essential component of fire management planning. This involves the recording, preferably on GIS, of the following factors:

- location of ignition;
- cause of ignition (if known);
- season/date and time of ignition;
- fire perimeter; and
- fire intensity and locations of unburnt refuges within the perimeter.

Fire histories built up in this way will provide a firm basis for identifying areas at high risk because of frequent burning. Time since last burn is of less importance in areas where grassy understorey is present as this returns to pre-fire fuel loads rapidly. Mapping of fire histories will also allow identification of areas that have not been burnt for many years, as these are also an important conservation value.

Fire Control Working Plan

An Urban Bushland Fire Plan should be developed for the Quinns Rocks – Mindarie foreshore in consultation with the Fire and Emergency Service Authority (FESA), community groups and other stakeholders and the City of Wanneroo Rangers. The Plan should incorporate response and recovery strategies, list key contacts and map the locations of hydrants, fire access tracks, infrastructure, nearby dwellings and biodiversity assets.

6.4.4 Recommendations

No.	Recommendation	Priority	Responsibility ⁱ	Indicative Cost ⁱⁱ
15	Reduce fuel levels in bushland through weed control (See Section 6.2).	High	Operations / State Government	Operational
16	Develop a Fire Control Working Plan for the Quinns Rocks – Mindarie Foreshore with an accompanying map showing locations of access tracks, water sources, assets, vulnerable property and areas of high conservation value.	High	FESA / Ranger & Safety Services	\$3,000
17	Commence a Fire Watch Programme for the community to assist in alerting fire control authorities to fires.	Medium	FESA / Ranger & Safety Services	N/A
18	Conduct ranger patrols of bushland areas during periods of high fire risk.	Medium	Ranger & Safety Services	Operational
19	Keep accurate records of fire histories of the foreshore areas including information on date.	Medium	FESA / Ranger & Safety Services	Operational
20	Develop a fire prevention community education programme.	Medium	FESA / Ranger & Safety Services	N/A

6.5 Plant Disease Management

6.5.1 Objectives

The objectives for disease management are to:

- prevent the spread of dieback and other plant pathogens into uninfected areas beyond its natural rate of expression
- educate bushland regenerators and the community about plant pathogens and ways to limit its spread

6.5.2 Background

Dieback

Phytophthora is unlikely to express as dieback disease in the study area due to its well-drained and alkaline soils.

However hygiene measures used to control *Phytophthora* can also be useful in restricting the introduction of weeds and disease in general. Care is taken to prevent dieback being transported in soil or plant root material to other bushland areas. Dieback can be spread by the introduction of plants and soil for bushland restoration, and vectors such as vehicles, earth-moving equipment, humans, bikes and horses through movement of infested soil and plant matter on tyres, boots and hoofs.

CALM has specified factors that indicate the degree of risk of spreading dieback (CALM, 1992). The risk of spreading dieback is related to the nature of the proposed operation or development, and the nature of the site. The sort of operations and activities that could occur within the City of Wanneroo that relate to dieback include track and firebreak construction and maintenance, weed control, bushland restoration, building construction (for example, the construction of the new Surf Life Saving Club), general maintenance, vehicle movement and pedestrian movement.

Honey Fungus

A plant pathogen which may be found in the City of Wanneroo foreshore region is *Armillaria luteobalbina* (also known as honey fungus), which is a mushroom-producing fungus that is native to Western Australia and commonly occurs in the south-west of the state. *A. luteobalbina* poses a greater threat to vegetation communities than *Phytophthora*, as it is not restricted to certain soil types and can occur anywhere along the foreshore. There is no known cure for the disease

As *A. luteobalbina* is not purely a soil-borne pathogen, it is difficult to contain the pathogen by utilising current hygiene practices. The best strategy for minimising the impact of the fungus is by reducing plant stress which will enable plants to resist and combat fungal attack. Spreading infected plant material during any dune stabilisation operations and other earth-moving activities should also be avoided.

Aerial Canker

At present there are no mechanisms to control this fungus other than removing infected material, so the best mitigating action would be to minimise factors that cause plant stress which will allow infected plants to combat infection.

6.5.3 Strategy

Restricting Spread

As there is no practical large-scale cure for *Phytophthora* or *Armillaria* dieback, prevention of infection is the primary means of defence. This involves preventing movement of infected soil, plant matter and water into uninfected areas, and careful placement of tracks so that they do not cross between infected and uninfected areas. Any soil or plant material used for bushland restoration or landscaping should be certified as *Phytophthora*-free.

Hygiene procedures should be implemented when conducting works within the study area including:

- disinfecting all machinery equipment and boots before entering bushland areas; and
- imported soil and fill should be certified dieback-free.

Reducing Plant Stress

Management strategies for reducing plant stress involve the ready availability of the plants' needs and prevention of adverse external factors. The use of appropriate revegetation techniques and minimisation of disturbance is of high importance particularly in the initial stages of plant development. Following is a list of techniques that can act to minimise plant stress and increase survival rates of seedlings.

- Tree guards help maintain a moist microenvironment and shelter from wind stress and sandblasting;
- Mulch primarily discourages weed growth but also helps trap nutrients and water and stabilises sand;
- Weed control is necessary to prevent competition;
- Limited reticulation may be required in some areas to alleviate water stress;
- Soil preparation – fertiliser may sometimes be required; and
- Brushing stabilises sand and deters disturbance by people.

The level of care required depends on the species. When planting hardy dune binding grasses such as *Spinifex* species, techniques to stabilise the sand and combat wind stress and water loss will be more important than maintaining nutrient levels. In these areas placement of brush or tritter is all that will be necessary. When planting heath species in more sheltered and stable areas, additional methods such as tree guards and reticulation may be used depending on the situation and the budget.

Education

Perhaps the most important aspect of plant disease management is education in hygiene procedures for people undertaking rehabilitation or other conservation works in natural areas. Short day-courses can be an invaluable way to raise awareness amongst rehabilitation practitioners and can also provide an opportunity for conservation workers from friends groups and local government to meet and interact.

6.5.4 Recommendations

No.	Recommendation	Priority	Responsibility ⁱ	Indicative Cost ⁱⁱ
21	Initiate hygiene procedures to prevent the spread of dieback and other plant diseases into uninfected areas.	High	Operations	\$57,000 ⁴
22	Monitor vegetation for signs of stress and plant pathogens annually.	Low	Operations	\$500

⁴ Wash down bay \$20,000, bore \$30,000, electrics \$5,000, ongoing maintenance \$2,000

6.6 Fauna Management

6.6.1 Objectives

The objectives for Fauna Management on the Quinns Rocks – Mindarie Foreshore are to:

- maintain good quality habitat for native fauna species;
- create and maintain linkages and wildlife corridors between natural areas;
- control feral animals to a level where they have a minimal impact on the biological values study area;
- ensure that feral animal control measures do not adversely impact on the native biota of the study area or on people visiting the area; and
- restrict the movements of domestic animals and pets within the study area.

6.6.2 Background

A diverse array of fauna habitats are present within the study area that are potentially able to be used by native fauna including threatened and priority fauna such as the Western Brush Wallaby *Macropus irma* and the Honey Possum *Tarsipes rostratus*.

Numerous threatening processes exist for certain species of animals in urban areas and these include:

- loss of habitat (type, area and quality);
- disturbance; and
- predation and competition by feral animals.

Feral cats and foxes predate on a wide range of small native animals, including birds, mammals, frogs and reptiles. Feral cats are seen as particularly important and Action 10 of the City of Wanneroo's Local Environmental Strategy (City of Wanneroo, 2002d) is to "Investigate potential strategies to control the impact of cats on native fauna". Rabbits can undermine dune stabilisation and rehabilitation efforts through construction of warren systems and generally degrade the dune vegetation whilst foraging. If a fire occurred in this area, regeneration would be impeded, as rabbits would consume most of the young seedlings.

6.6.3 Strategy

Strategies for preserving fauna habitat are primarily achieved through weed control and rehabilitation of natural areas. Maintenance and rehabilitation of linkages are particularly important to allow dispersal and migration of native fauna. The provision of adequate cover is particularly important for species susceptible to predation by feral animals and this can only be achieved through the provision of corridors of an adequate width. Slow dispersing animals such as insects and small reptiles, may spend their entire lives within a corridor and so to be effective must meet all their needs while within the corridor.

This is often very difficult to achieve in urban areas and most 'wildlife corridors' rarely support more than a handful of highly mobile species such as birds. At Quinns Rocks-Mindarie, potential linkages are oriented to the north and south of the study area into large areas of bushland at Jindalee and Burns Beach respectively. Jindalee is currently under development and Burns Beach is expected to shortly be developed. It is important that

sufficient contiguous bushland (approximately 80 m wide) is retained in the development of these areas to allow the passage of fauna species. Minimum coastal setbacks of 100 m should fulfil this requirement.

There is little scope in the provision of effective wildlife corridors within the study area apart from the retention and maintenance of all existing bushland, including the retention of dead or fallen trees as they provide important fauna habitat. The foreshore bushland is near contiguous apart from Mindarie Keys and at Lot 211. Mindarie Keys is an insurmountable obstacle to most terrestrial fauna species and little can be done to improve this; however the proposed development of Lot 211 provides opportunities to incorporate elements of fauna habitat into the landscaping of the foreshore. The design plan in Section 3.3.2 provides some scope for this type of landscaping particularly along the foreshore area of the existing car park, proposed drainage swale for 1 in 100 year storm and various other landscaping works. While there does not appear to be sufficient room to establish a corridor between the foreshore and the bush forever area, landscaping areas can be designed to meet the following requirements:

- Local species should be used for all landscaping works, particularly in the use of important coastal food-plants for fauna;
- Plantings should be as dense as practicable and incorporate strata or vegetation layers commonly found in the area to provide sufficient cover;
- where possible plantings should be contiguous with surrounding bushland; and
- incorporate fauna habitat elements such as dead logs and food plants into rehabilitation projects and landscaping.

As a general management strategy, logs and dead trees should always be left rather than removed to provide habitat for fauna where this does not pose a threat to public safety.

Fox control using 1080 poison (sodium monofluoroacetate) is not appropriate within the area due to the proximity of the bushland to urban areas. Native animals tolerate low levels of 1080 poison, but the poison is highly toxic to humans and domestic animals as well as feral animals. If foxes become a problem, a program of trapping should be initiated in consultation with the Department of Conservation and Land Management.

Control of feral cats is very difficult; however selective trapping and removal of individuals could be implemented if cats became a significant problem in the area. Domestic cats that roam at night also pose a significant threat to wildlife and a strategy of education should be implemented. Local government cat laws should also be reviewed to investigate the feasibility of implementing a 'cat-curfew' to ensure that cats do not roam after dark.

Rabbit control should be undertaken in areas of rehabilitation and revegetation. The use of Pindone baits may not be appropriate, particularly considering non-target native fauna may also be affected, instead rabbit-proof fencing should be erected around rehabilitation areas. If rabbit infestation is high, mesh or wire tree-guards may be necessary.

Dogs are not permitted on most of the study area. However there is a 'dog beach' located at the northern end of the study area for dog exercising. This area is seen as very important as there are insufficient areas of this type within the City of Wanneroo. Unrestrained dogs can have an impact on the natural environment as well as posing danger or distress to other

recreational users. Dog faeces pose a hazard to health and must be removed by the dog owners under council by-laws. There is little scope for additional dog-exercising areas within the study area due to potential conflicts between other users and threats to natural areas. Signs are already erected at most beach access points. Signs should also be erected at access points to the Dual Use Pathway.

6.6.4 Recommendations

No.	Recommendation	Priority	Responsibility ⁱ	Indicative Cost ⁱⁱ
23	Erect rabbit-proof fencing around rehabilitation sites.	Medium	Operations / State Government	\$5.50 / m ⁵
24	Initiate an education campaign to raise awareness of the environmental problems of cats roaming at night. Distribute leaflets to surrounding residents.	Medium	Planning Services	\$1,500 ⁶
25	Install signage prohibiting dogs from recreational areas within study area with the exception of the beach area accessed from Tapping Way.	Medium	Operations	\$2,000 ⁷
26	Monitor and record feral cat and fox sightings if these become a significant problem in the area, implement selective trapping and removal of individuals.	Low	Operations / CALM	Operational

⁵ 10 m roll chicken wire (\$30.00) and star picket every 2 m (\$5.00 each)

⁶ Design (\$500.00), 2000 leaflets @ \$0.50 each

⁷ 10 signs @ \$200.00 per sign

6.7 Erosion Control

6.7.1 Objectives

The objectives for the prevention and control of erosion for the Quinns Rocks – Mindarie Foreshore area are to:

- control erosion in coastal dune areas and rehabilitate existing eroded areas;
- anticipate, control and monitor foreshore erosion of Quinns Beach North;
- prevent erosion caused by inappropriately placed tracks; and
- prevent erosion after weeds have been removed.

6.7.2 Background

There are two processes contributing to high erosion risk in the study area:

- Wind erosion contributing to sediment transport and dune blowouts; and
- longshore and nearshore currents contributing to sediment transport.

Foredune and beachfront erosion as a result of wind and water erosion is most severe at Quinns Beach North. Three 25 m long groynes are being constructed in this area to minimise sediment transport and protect assets along this foreshore. Other parts of the foreshore are not currently showing a pattern of net erosion, however changing conditions such as increased storm frequency, changes in the prevailing winds and sea-level change may result in Quinns Beach South and North Mindarie exhibiting net erosion.

The unconsolidated sands of the Quindalup Dunes are at high risk of wind erosion if vegetation cover is removed. Erosion and destabilisation of foredunes, particularly in the North Mindarie area, is initiated from loss of vegetation due to uncontrolled human movement and accelerates once initial vegetation cover has been lost resulting in dune blowouts. While erosion and the formation of blowouts are naturally occurring processes in coastal areas; human activities have accelerated the rate and extent of erosion within the study area.

Erosion can occur following the removal of vegetation in coastal areas, including removal of weeds. In many areas weeds form the dominant component of the flora, so weed control must be carefully managed to ensure that large areas of bare sand are not exposed after weeding. In some cases the physical function of weed species in preventing erosion can take precedence over their deleterious effects on native flora populations in high erosion risk areas.

Wildfire events can significantly contribute to erosion in coastal areas, as it frequently results in loss of vegetation and leaf litter, which can destabilise the sand and inhibit natural regeneration.

6.7.3 Strategy

Erosion of the beach and foredunes along Quinns Beach North is being addressed by the construction of three 25 m groynes spaced approximately 460 m apart. Local opinion is that the two groynes that have been constructed appear to be working despite some late winter storms. Limited preliminary shoreline data also appear to suggest this (M. Rogers pers. comm.); however it is too early to draw definite conclusions.

Until reliable, long-term data of shoreline sediment movement is obtained, development of large assets and infrastructure such as dual-use paths, car parks, buildings or boat ramps is not appropriate in this area. Minor developments such as landscaping and movable assets such as playgrounds, barbecues and picnic tables may be feasible, however these should be set back from the beach as far as possible.

Erosion control in vegetated dune areas should address human and vehicle movement in areas susceptible to erosion. Tracks that are not required for pedestrian or management / fire access, should be closed and rehabilitated (See Section 6.3), as should bare areas on the dune surfaces (see Map 5). Costs for rehabilitation of 39,210 m² of bare areas within the study area are shown in Table 6.8. Formal access tracks should be sealed with bitumen or crushed limestone to prevent erosion of the sand surface. Access should also be restricted in areas where weed control, ecological restoration or erosion control has taken place, or where a fire has occurred within the last 12 months. These areas will be susceptible to erosion because of disturbances to the ground or plant communities.

Table 6.8 Cost of Rehabilitating Bare areas and Dune Blowouts

	Cost / m ²	Cost
Establishment	\$8.00	\$313,700
After 1st Year	\$3.00	\$117,600
After 2nd Year	\$1.20	\$47,100
After 3rd Year	\$0.50	\$19,600
Years thereafter	\$0.10	\$3,900
Total after 5 years		\$501,900

Fencing of both the seaward and leeward sides of the foredunes to discourage trampling of dune vegetation could be trialled along a section of the beach where dunes are showing signs of vegetation loss and erosion. If the trial is successful, temporary fencing could be considered around rehabilitation sites (particularly those in high-use areas). Signage to inform people of the risk of erosion and well-defined walking tracks will also help prevent damage to dune vegetation from trampling.

Weeds should only be controlled where erosion risk is minimal, preferably using herbicide so that the dead plant material remains to bind the soil. Weed control should always be accompanied by revegetation. Placement of brush and / or mulch should also accompany weed control / revegetation activities in order to prevent further erosion, provide protection for emerging plants and encourage natural regeneration. Brush can be obtained from maintenance works (e.g. street trees) etc. It is important to make sure brush derived from non-invasive species is used.

6.7.4 Recommendations

No.	Recommendation	Priority	Responsibility ⁱ	Indicative Cost ⁱⁱ
27	Rehabilitate bare areas shown in Map 5 to prevent erosion and immobilise sand dunes.	High	Operations/ State Government	\$501,900 (Table 6.8)
28	Conduct monitoring survey of coastal cliffs and erosion every two years.	Medium	Operations	\$5,000 over 2 years (\$2,500 per survey)
29	Seal sandy tracks to be formalised (Map 5) with bitumen or crushed limestone to prevent further erosion of the sand surface.	High	Operations/ State Government	Limestone - \$33,200 ⁸
				Bitumen - \$57,500
30	Undertake ongoing monitoring of beach profiles and sediment transport at Quinns Beach North.	High	Operations	\$1,500 / annum
31	Conduct ranger patrols at North Mindarie sector to discourage sandboarding.	High	Ranger & Safety Services	Operational
32	Trial fencing of both the seaward and leeward sides of the foredunes along sections of North Mindarie beach where dunes are showing signs of vegetation loss and erosion.	Low	Operations/ State Government	\$2,000 ⁹

⁸ Assumes 2,875m path to be formalised (Map 5) cost crushed limestone (CL) \$11.50 / m² Bitumen (B) \$20.00 / m²

⁹ Assumes 100 m of fencing at \$20 / m

6.8 Access and Recreation

6.8.1 Objectives

The objectives for access and recreation management in the Quinns Rocks – Mindarie Foreshore are to:

- provide an appropriate level of access whilst preserving the ecological values of the study area;
- facilitate appropriate recreational activities by providing suitable resources and infrastructure; and
- provide a safe environment for passive recreation.

Access management is relevant to recreational use and management of the foreshore. As the two purposes are closely related, and as many of the tracks developed for management access will also be used for recreational use and vice versa, the two issues are dealt with together.

6.8.2 Background and Strategy

Access

Access to recreational areas is of high importance to residents and visitors of the foreshore area; however this must be managed in such a way as to preserve the ecological integrity of the area. This will be achieved by facilitating appropriate access to recreational areas and restricting access that results in the degradation of natural areas. Issues and management of access in each sector is explored below (See Figure 1.1 for sector locations). Management requirements for specific paths within the study area are shown in Map 5. Paths should comply with Australian Standards AS2156.2-2001 Walking Tracks – Infrastructure Design.

Disabled access should be provided wherever possible and should facilitate the independent use of people with a range of disabilities including physical disabilities, hearing and vision impairment. Disabled access should comply with the following Australian Standards:

- AS 1428.1-2001 Design for Access and Mobility – General Requirements for Access – New Building Work;
- AS 1428.2-1992 Design for Access and Mobility – Enhanced and Additional Requirements – Buildings and Facilities;
- AS 1428.3-1992 : Design for access and mobility – Requirements for children and adolescents with physical disabilities; and
- AS NZS 1428.4-2002 Design for Access and Mobility – Tactile Indicators.

North Mindarie

Inappropriate access is exemplified in the North Mindarie sector where a network of four wheel drive tracks has accelerated dune erosion, weed invasion and degradation of vegetation condition. Legitimate access to this area is also difficult as there is little parking and the beach is located at some distance from the parking area on the verge of Long Beach Promenade. An access road and car park exists, however this has been closed due to vandalism and anti-social behaviour. Access for emergency vehicles is by removable

bollards at Long Beach Promenade. This should be retained and access to the beach should be made suitable for authorised four wheel drive vehicles.

Another access point also exists off Long Beach Promenade opposite Savona Grove. This track leads to Tuart Grove and ultimately the Beach Access at Rosslare Promenade. This path should also be formalised (Map 5).

Formalising pedestrian access will direct and control movement. This should be done by surfacing with crushed limestone and erecting directional signage at intersections. Fencing along the path can also discourage people from straying into the dunes. Paths that are to be closed (see Map 5) should be rehabilitated and temporarily fenced. Laying brush has also been found to be an effective deterrent. Where fences can easily be cut or jumped, brush is more difficult to surmount. Brush does however have a drawback in that it can be easily burnt.

Four wheel drive access in this area is a particular problem as it is in most little-used parts of the coast. The rise in four wheel drive ownership over the last decade has resulted in a rise in off-road recreational activities, with subsequent degradation of sensitive dune areas. Management will require a number of responses some of which will need to be implemented outside the study area. Blocking access is the primary initial response. This can be difficult because of the capability of four-wheel drives to trample fences. Minor earthworks can be a cheap and effective way of blocking access in problem areas, however it can be unsightly and also blocks authorised access. This strategy is probably best employed to block people entering in areas south of Mindarie Beach. Other strategies include:

- erecting removable bollards where occasional access by maintenance or emergency vehicles is required (i.e. at Long Beach Promenade and the access from
- ranger patrols to administer and enforce the Control of Motor Vehicles (Off-Road Areas) Act, 1978
- encourage nearby residents to report off-road vehicles
- organise annual weekend 'blitzes' in association with CALM and the WA Police. These should be publicised before and after the event to deter very occasional users and raise awareness.

The other access point to this sector is from the car-park off Alexandria View. This leads to the beach adjacent to the northern headland. This section of the beach is extremely hazardous due to the rocky nature of the headland and a permanent rip is also located in this area (Armstrong, *et al.*, 1999). This area is often used by surfboard riders and there is the potential for conflicts with swimmers.

There is a need for improved access to the North Mindarie Beach section of the study area. The main track to the beach from Long Beach Promenade should be upgraded, fenced and sealed with crushed limestone or bitumen. Map 5 shows which tracks should be retained and which closed and rehabilitated.

Mindarie Keys to Quinns Beach South

Access to the limestone cliffs in the North Mindarie to Quinns Beach section of the foreshore should also be restricted. This area is extremely hazardous (Armstrong *et al.*, 1999) and while attempts have been made to restrict access, people are still able to access the cliff areas for fishing. Improved fencing of the post and rail type with ringlock panels should be erected along the DUP in this section of the foreshore. Existing lookouts should be similarly fenced (See map 5 for fencing and lookout requirements). There is a car-park at the southern end of the DUP, which appears adequate for access to the DUP and a small beach at Mindarie Keys.

Tracks in this sector are generally in good condition and are appropriate. Additional access is not required.

Quinns Beach South

Plans for the proposed Community Facility at **Quinns Beach South** include wide cement steps to the beach. This is appropriate as this area is likely to become the primary recreational node within the study area (see Section 6.8.3 and Section 3.3.2). Accordingly surrounding conservation values will need to be protected. Access tracks should be sealed with bitumen or crushed limestone and adequate fencing of conservation areas should be implemented as part of the development. The proposed Community Facility car park is also within Bush Forever Site 397 and is adjacent to good condition bushland. There is a high potential for disturbance as a result of this and post-and-ringlock fencing should be erected between the car-park and the bushland to minimise disturbance to the conservation values of the area. Vehicular access to the beach from the car park needs to be controlled.

Access within this area will need to be carefully managed to prevent conflict and enhance enjoyment by recreational users. The Dual Use Pathway (DUP) which presently passes adjacent to the caravan park should be retained, however pedestrian areas within the Lot 211 development should be declared an 'off-bicycle' zone to prevent conflict and increase safety within this area. Adequate bicycle racks and signage will therefore need to be provided here. An additional DUP should also be constructed alongside the proposed Quinns Rocks Caravan Park access road that goes through the car park and then links up with the proposed DUP along Ocean Drive (see Section 3.3.3).

The development of Lot 211 also has scope for the provision of disabled access to the car-park, essential services building, picnic areas, toilet, change rooms and café-restaurant development. The feasibility of providing disabled access to the beach should also be investigated and could comprise of a ramp alongside the main access steps or associated with the planned SLSC boat-launching ramp. Rubber matting on the beach has also been implemented at Busselton and Monkey Mia to allow people with disabilities to access the water independently. An access consultant can be very beneficial when incorporating disabled access at the planning stage.

Vehicular access to the beach will also be required by the Surf Lifesaving Club. This should utilise the same ramp as for boat launching.

Quinns Beach North

All access tracks to the beach in the Quinns Beach North sector show a high level of erosion and are generally characterised by a steep drop-off to the beach. While attempts have been made to close access, it is evident that they are still being used, particularly the dog beach at Camira Way, which is also possibly the most dangerous. These tracks should be closed and rehabilitated or upgraded to allow safe access to the beach (see Map 5). This may involve sand nourishment if the erosion is minor, or the construction of wooden steps as shown below. Further investigation is required to assess the feasibility of such an option in the face of erosion threat.

The existing surf club and car park has also suffered from erosion and while groynes have been constructed, development should proceed with caution in this area (see Section 6.8.3). The proposed upgrade to Ocean Drive (see Section 3.3.3) with associated DUP will provide increased access to this area by pedestrians and cyclists.



Wooden lookout and staircase

Recreation

The primary recreation activities within the study are passive recreation (walking, jogging etc), cycling, fishing, picnicking, surfing, dog exercising and swimming. With appropriate management and provision of facilities, these activities are sustainable with minimal impact on the natural environment and conflict between people engaging in different recreational activities. The following describes the major recreational user groups within the study area and management guidelines.

Passive Recreation

Passive recreation activities such as walking, jogging etc is one of the primary recreational pursuits in the study area and is currently facilitated by the DUP from Mindarie Keys to Quinns Beach, and the path from the car park at Alexandria View to Tuart Grove Picnic Area. Infrastructure required to facilitate this activity are:

- clearly defined paths suitable for walking
- seating provided at strategic locations
- car parking
- toilets
- interpretive and regulatory signage

There is a potential for conflict with cyclists in the study area as these two groups share facilities. Measures to reduce conflict include:

- physical separation in all areas apart from designated dual-use pathways
- additional Dual Use Pathways should be built to Australian Standards incorporating appropriate width and line-of-sight.
- prohibit cycling within primary nodes (see Section 6.8.3)

Management requirements for paths within the study area are detailed in the previous section and shown in Map 5.

Pedestrian Access should comply with the following Australian Standards:

- AS 2156.1-2001 Walking Tracks – Infrastructure Design
- AS 2156.2-2001 Walking Tracks – Classification and Signage

Seating within the study area is currently limited to bus-shelter type benches. These need to be removed and replaced by durable but aesthetically pleasing seating placed at strategic locations along the existing DUP in the Mindarie – Quinns Beach North Sector. Seating should be associated with the lookouts proposed for this area (see Map 5). Seating should also be placed in the Lot 211 development and existing Surf Club and Car Park in the north Mindarie sector associated with landscape concept plans for these areas. Strategic seating in these areas can be associated with:

- playgrounds
- picnic areas; and
- facing the ocean.

All seating should be uniform and consistent with the surrounding environment.

Interpretive signage is appropriate in *High* and *Medium* intensity recreation areas. Information shelters are a useful way to provide interpretive signage as well as guidelines for recreational use in the area. An example of an information shelter and interpretive signage are shown below. Regulatory and cautionary signage is dealt with in Section 6.9.



Examples of information shelter and interpretive signage

Cycling

The Dual Use Pathway (DUP) from Mindarie Keys to Quinns Beach and associated paths are currently the only pathways within the Study Area suitable for cycling. Community consultation has indicated a need for an additional DUP to the north. A DUP has been incorporated into preliminary plans for the upgrade of Ocean Drive that will link the northern beaches with the existing DUP (see Section 3.3.3).

Bicycle facilities should comply with the following Australian Standards:

- AS 1742.9-2000 : Manual of uniform traffic control devices - Bicycle facilities
- AS 2890.3-1993 : Parking facilities - Bicycle parking facilities
- HB 69.14-1999 : Guide to traffic engineering practice Bicycles (handbook)

There is a potential for conflict with passive recreation users in these areas and this should be minimised by appropriate traffic management. The proposed development of Lot 211 should be made pedestrian access only with an additional DUP alongside the proposed Quinns Rocks Caravan Park access road and linking with Ocean Drive.

Fishing, Boating and Diving

Facilities for shore-based fishing are limited within the Quinns Rocks – Mindarie area, however there is a fishing platform for the disabled at Mindarie Keys near the end of Alexandria View. Shore based fishing was also observed on the limestone cliffs between Mindarie Keys and Quinns Beach. This is extremely dangerous and access to this area needs to be more heavily restricted. The groynes under construction at Quinns Beach North will attract shore-based fishing enthusiasts, however as these groynes are relatively low, these sites will be dangerous in poor weather conditions. Signage should be erected at the car-park to advise of hazards.

Fishing has the potential to conflict with swimming activities and should be discouraged in the vicinity of High and Medium intensity use areas (see Map 4). The most suitable safe areas for shore based fishing are the breakwaters at the entrance to Mindarie Keys. Of these, the southern breakwater is more suitable as there is access by car.

These breakwaters and sections of the beach designated Low Intensity Recreation (Map 4), are able to support shore-based fishing with minimal potential for conflict. Fishing should be prohibited in other areas, particularly High Intensity Recreation Zones. Appropriate signage should be erected in the following areas:

- at the start of access tracks leading to High and Medium Intensity Recreation Zones;
- on the groyne opposite the existing surf lifesaving club;
- at the existing surf-lifesaving club car park; and
- at the proposed Lot 211 development.

The Trails Master Plan for the City of Wanneroo (Ecoscape, 2003) made provision for a marine trail starting at the Quinns Rocks Area. The primary requirement for this is access to a boat ramp with adequate room to gear-up.

There are limited facilities for boat launching within the study area, currently consisting only of a private boat ramp at Mindarie Keys, although there is a recognised need for one in the community to facilitate offshore fishing, boating and diving. During busy periods there are shortages of parking and ramp access with resulting conflict between users. As this ramp is privately owned, its future availability to the general public is not assured. The boat ramp at the existing SLSC has been removed due to high erosion in this area. Another boat ramp should not be built at this site for the following reasons:

1. The site is very exposed and for this reason is unlikely to meet Australian Standards. While the groyne to the immediate north of the site will provide protection in some conditions, onshore and southerly winds will make boat launching from this site hazardous.
2. While the groynes and renourishment appear to be having some effect, the long-term impact of the groynes on beach sediment transport has not been determined. The development of major assets in this area therefore should not be undertaken until long-term data of coastal processes is available to undertake a risk assessment of the area.
3. The area has increasing importance as a swimming beach, particularly as housing developments to the north increase. Boat launching and swimming are not compatible activities due to the risk of pollution and other hazards and injury risk associated with boat launching.

Unfortunately other options for the provision of boat launching facilities within the study area are less than satisfactory. The nearest alternative boat ramp is at Ocean Reef Boat Harbour, 15 km by boat and 25 km by car from Mindarie Keys. There is presently no ideal location for a boat ramp in the proximity of the study area, however possible options that may be considered for development of a boat ramp include:

1. Negotiate the transfer of the existing private boat-ramp at Mindarie Keys to the City of Wanneroo.
2. Negotiate the provision of a public boat-ramp as a condition of future development in the Jindalee area. As the coastline is exposed in these areas, the provision of an offshore seawall will also need to be included. This option will also necessitate the destruction of native vegetation and is also likely to affect coastal processes including sediment transport. It may therefore need to be associated with a stable section of the coastline. Long-term coastal process data will need to be collected and a full analysis of the probable impacts will need to be undertaken before this option can be considered.

Picnic areas and playgrounds

The development of the Community Facility at Quinns Beach will provide a picnic area and playground for use by the general public. There is also a small playground facility at Frederick Stubbs Park near the existing SLSC. There is scope for this playground to be upgraded as well as the provision of picnic tables and electric barbecues in this area. The degraded areas around the existing SLSC should also be developed for family recreation. A Landscape Concept Plan should be undertaken as a preliminary step before implementing landscape works in the area (see Section 6.8.3).

A picnic area and playground was also recommended in the Draft Lot 211 Structure Plan (City of Wanneroo, 2003c). These should be located together and adhere to the following guidelines:

- it should be located in view of the beach;
- adequate lighting should be installed;
- shade and shelter from the wind should be provided;
- picnic areas and facilities should be uniform with other seating and sympathetic to the surrounding environment.

Playground equipment should adhere to the following Australian Standards:

- AS 1924.1-1981 : Playground equipment for parks, schools and domestic use - General requirements
- AS 1924.2-1981 : Playground equipment for parks, schools and domestic use - Design and construction - Safety aspects (incorporating Amdt 1)

Construction of playgrounds should adhere to the following Australian Standards:

- AS/NZS 4422:1996 : Playground surfacing - Specifications, requirements and test method
- AS/NZS 4486.1:1997 : Playgrounds and playground equipment - Development, installation, inspection, maintenance and operation

The picnic area at Tuart Grove in the North Mindarie section of the study area has been destroyed by vandalism and has not been rebuilt. The isolated nature and poor access to this site suggests a lack of use and as such the area should be closed and rehabilitated.

Swimming and Surfing

Surfing is well provided for in the study area with a car-park and lookout area at North Mindarie Beach. The fence at the lookout has been destroyed in order to provide a better view of the surf conditions. A fenced lookout should be established in this area and the degraded area rehabilitated.

A toilet and changeroom would also be beneficial as this area is likely to gain popularity as the surrounding population expands.

Swimming and beach activities are the main recreational pursuit at the high and medium intensity beach recreation zones (Figure 6.1). Surf lifesaving patrols are currently undertaken at the existing surf lifesaving club from the start of the surf lifesaving season (generally October) and will also be undertaken at Quinns Beach South when the new surf lifesaving club has been constructed.

Swimming activities should take precedence over other activities in these areas (e.g. shore-based fishing). Provision and maintenance of facilities including toilets / changerooms, adequate rubbish facilities, shelters and beach showers. These should be maintained to an appropriate standard and upgraded periodically.

Dog Exercising

There is currently provision for dog exercising at the dog beach near Tapping Way. While there has been requests from dog owners for the provision of additional dog exercising areas, this is unfeasible in the study area as dog exercising is not compatible with many other recreation activities including swimming, walking and cycling. Improving access to the current dog beach is the preferred option. Access to the dog beach is currently highly eroded and is very hazardous. Section 6.6 contains specific recommendations regarding dog control. The access track should be repaired as a priority.

There have also been requests for a toilet at this location. A cost-effective means of providing this would be through the provision of a composting toilet as described in Section 6.9 (Figure 6.7).

6.8.3 Recreational Nodes

Nodes are sites where recreational activities are focussed. Consideration of nodes is useful in order to determine infrastructure requirements and to effectively identify and manage recreational requirements. The following nodes were identified from field observations, projected use and the results of the Coastwise (1999) study (see Section 3.1.2).

Two primary nodes and five secondary nodes have been identified and these are located in High and Medium Intensity Recreation Zones (See Section 6.1 and Map 4 for locations of nodes). A brief description of the recreational nodes is as follows:

Primary nodes are (North to South): the Surf Lifesaving Club and Car Park; and Lot 211 / Quinns Rocks Caravan Park. Secondary nodes are: the Dog Beach, Mary Street Car Park, Rosslare Promenade Car Park, Alexandria View Car Park and Long Beach Promenade access.

Primary Nodes

Surf Lifesaving Club and Car Park

This primary node was identified as having the highest concentration of beach users in February, 1999 (Coastwise, 1999) and had over three times the concentration of users than at the next highest location (Lot 211 / Quinns Rocks Caravan Park). While pressure on this area may be alleviated in the short term from the construction of the Lot 211 development, population growth in Wanneroo, particularly at Jindalee, will likely see no net reduction in future use and possibly an increase of recreational use in this area.

This area has been subject to heavy erosion which has threatened the car-park and associated infrastructure including the surf lifesaving club shed and toilets. The construction of a groyne adjacent to this area may alleviate this threat however monitoring over a number of years should be undertaken before major development is undertaken in this area.

There is however much scope for improvement in safety, function and aesthetics in this area. At present the car park is in disrepair, particularly on the western edge which has suffered from erosion. These edges should be repaired and fenced to avoid further erosion from inappropriate pedestrian access. Access to the beach needs to be formalised in at least three places through the construction of wooden steps. The remains of the boat ramp should also be landscaped and short steps erected to the beach.

The surf-lifesaving club shed should remain as patrols will still be undertaken at this site. The existing toilet-block and change rooms should also be retained with minor upgrades to better accommodate families and lighting installed to increase safety and discourage anti-social behaviour. Lighting should be installed along the eastern side of the car park to minimise the risk of erosion. Landscaping should be undertaken on the northern side of the access road and within Frederick Stubbs Park. This should include minor earthworks and amenity planting using attractive local species. Seating should also be installed near the playground. A Landscape Concept Plan should be drawn up for this area prior to works commencing.

A summary of works required for this area is:

- a concept plan outlining landscaping works for the area;
- provision of access steps to the Beach;
- removal of Victorian Tea Tree (*Leptospermum laevigatum*) and replacement with native dune-binding species;
- repair car park, remark lines;
- install lighting along western edge of car park;
- replace fencing along western edge of car park;
- block vehicle access to the beach (north and south) from the car park;
- revegetate dune between car park and beach;
- remove remains of boat ramp, landscape and provide wooden steps to the beach;
- formalise tracks to the road with embedded wooden steps and bitumen surface;
- landscape weedy area on northern side of access road;
- upgrade playground facilities and install barbecue and picnic area; and
- erect regulatory signage (no fishing sign on groyne)

Lot 211 / Quinns Rocks Caravan Park

This primary node is currently the site of Quinns Rocks Caravan Park and associated car park and picnic area. This area does not have the level of erosion that exists at Quinns Beach North, which is probably due in part to the sheltering effect of Quinns Rock off this part of the coast.

This area is currently in poor repair however the development of Lot 211 will see this area become a primary node with the highest concentration of beach use. Plans for this development are outlined in Section 3.3.2 and include the provision of a community facility, essential services building including Surf Lifesaving Club, café/restaurant, picnic/barbecue area and parking for 212 vehicles.

The primary activities undertaken in this area will be walking/swimming and eating/drinking. It is recommended the existing dual-use pathway terminates here and another DUP is constructed adjacent to the Quinns Rock Caravan Park access road to link with the proposed DUP at Ocean Drive to minimise the possibility of conflict between cyclists and pedestrians (see Sections 3.3.2. and 3.3.3).

A summary of works required for this node are:

- development of Lot 211 outlined in the Structure Plan (City of Wanneroo, 2002c);
- a concept plan outlining landscaping works for the area;
- revegetation of foredune area cognisant with the provision of a wildlife linkage;
- revegetation of areas disturbed by works using local species appropriate to surrounding vegetation types;
- landscaping above foredunes and the provision of seats, picnic tables and a playground;
- provision of a Dual Use Pathway alongside Quinns Rocks Caravan Park access road to link with Ocean Drive;
- signage to inform cyclists to walk bicycles within the Lot 211 development;
- Interpretive signage relevant to the surrounding bushland;
- provision of ramp for SLSC to launch small vessels and provide emergency four wheel drive access to the beach;
- disabled access to all buildings and if feasible to the beach (possibly utilising part of SLSC ramp);
- conservation fencing around entire Lot 211 nature reserve and track/pathway fencing on both sides of paths within adjacent bushland (see Map 5);
- weed control and revegetation on dunes adjacent to caravan park; and
- amenity planting using local species.

Secondary Nodes

Dog Beach

The dog beach, located adjacent to Camira Way, is the only area where dog exercising is permitted. There is a small, relatively new car park in this area and it is a popular spot for dog owners. There has been an identified need for a toilet in this area. A composting toilet as shown in Plate 6.1 should be sufficient for this area given the lower levels of use it receives compared to the primary nodes. Since the construction of the groyne and sand renourishment, beach access at this location has improved. A bitumen path has been laid and the sandy banks have been battered to provide safe access.

A summary of works required for this node are:

- provision of wooden steps to the beach;
- construction of composting toilet; and
- provision of dog poo bags at the head of the track.

Mary Street Car Park

This car park and beach access consists of a crushed limestone car park and a very steep drop-off to the beach as the path has been completely eroded. Preliminary drawings of the planned upgrade to Ocean Drive show an associated upgrade to this car park. The dunes are very steep in this area and the existing car park is at considerable risk. If upgraded this

car-park should not be enlarged and beach access should be reinstated through the construction of wooden steps to the beach.

Work required for this node is:

- provision of wooden steps to the beach.

Rosslare Promenade Car Park

This car park and toilet block is located at the northern end of Mindarie Keys. The beach use survey (Coastwise, 1999; Section 3.1.2) identified this node as having the fewest people during the survey. Consequently few additional recreational facilities will need to be added. The main use of this area is likely to be by cyclists and walkers, therefore the provision of a toilet in this area is appropriate as a number of formal tracks meet at this point.

There is a large bare area where the tracks meet that appears to be regularly mowed. Surrounding natural areas are also heavily infested with Rose Pelargonium. This bare area should be landscaped and revegetated to improve visual amenity at this node. Seating should also be implemented to provide rest for walkers and cyclists.

A summary of works required for this node are:

- seating
- bare areas landscaped and revegetated where tracks meet.

Alexandria View Car Park

This car park is located on the southern end of Mindarie Keys Marina and is mainly used by surfers. This area is more exposed than the majority of the study area and has large waves and rips. The fence has been broken at the head of the access stairs down the limestone cliffs to allow a good view of the surf, resulting in trampling of dune vegetation, erosion and weed invasion. This lookout should be formalised and the surrounding area rehabilitated. It is important that the lookout allows a good elevated view of the surf and coastline.

The remainder of infrastructure in this area such as fences and signs are in poor condition and will need to be repaired or replaced. This is addressed in Section 6.9.

A summary of works required for this node are:

- provision of adequate lookout and rehabilitation of surrounding degraded areas
- replace signage conforming to Australian Standards
- replace fencing
- replace chain-gate with removable bollards

Long Beach Promenade

This area currently has street parking and several tracks that meander through the dunes. A road and car park lead into the dunes, which has since been closed to vehicular traffic due to vandalism and antisocial behaviour. There appear to have been attempts to rehabilitate the car park but this has not been very successful. There is car-parking along the street but no other amenities.

A Picnic area was constructed in a grove of tuarts, however this was located too far from the parking area and was under-utilised and not maintained. It has now been almost completely destroyed by vandalism. This area should be rehabilitated.

The major issue for this area is the high number of informal tracks through the dunes. Inappropriate vehicular and pedestrian access has resulted in a number of dune blowouts which will exacerbate if they are not rehabilitated. Tracks that need to be closed and rehabilitated are shown along with tracks that should be formalised in Map 5. Bare areas that need to be rehabilitated are also shown in Map 5.

A summary of works required for this node are:

- recommence rehabilitation of closed car park;
- fence main access track;
- close and rehabilitate access tracks indicated in Map 5;

6.8.4 Recommendations

No.	Recommendation	Priority	Responsibility ⁱ	Indicative Cost ⁱⁱ
33	Formalise beach access where indicated (Map 5) through surfacing and the construction of wooden steps on paths north of the existing Surf Life Saving Club (SLSC).	Medium	Operations / State Government	\$400,000 ¹⁰
34	Restrict access to limestone cliffs by converting existing tracks to lookouts (see Map 5) and installing cliff hazard warning signage to Australian Standards.	High	Operations / State Government	\$3,140 ¹¹
35	Repair and formalise car park, including access, and install edging at the existing SLSC.	High	Operations	\$50,000
36	Install short wooden steps access to beach at existing SLSC to formalise access.	High	Operations	\$5,000
37	Upgrade toilet-block at existing SLSC node.	High	Operations	\$5,000
38	Install bollards where indicated in Map 5.	Medium	Operations / State Government	\$9,685
39	Install lighting at existing SLSC node.	Medium	Operations	\$12,500 ¹²
40	Landscape existing SLSC node.	Medium	Operations	\$8,200 ¹³
41	Provide seating near lookouts along Dual Use pathway (DUP).	Medium	Operations	\$3,300 ¹⁴
42	Investigate options for the provision of a boat ramp in the proximity of the study area.	Low	Planning Services	Operational
43	Close and rehabilitate picnic area at Tuart Grove.	Medium	Operations/ State Government	\$10,000 (Table 6.6)
44	Construct toilet block and change rooms at Alexandria View Car Park.	Medium	Operations	\$200,000
45	Upgrade picnic and playground facilities at Frederick Stubbs Park, install barbecue.	Medium	Operations	14,000 ¹⁵
46	Install lookout at Alexandria View car park with regulatory and warning signage	Medium	Operations	\$860
47	Install interpretive signage and/or an information shelter at Bush Forever Site adjacent to Lot 211 developments.	Low	Operations	\$2,000
48	Install composting toilet at the Dog Beach.	Low	Operations	\$20,000

¹⁰ Assumes 4 sets of staircases required at an average cost of \$100,000 per staircase.

¹¹ fencing for 3 lookouts @ \$150 each plus 4 cliff hazard signs @ \$200 / sign

¹² 5 light poles @ \$2,500 / pole

¹³ earthworks - \$3,000; seating (2) \$2,200; amenity planting \$3,000

¹⁴ 3 seats @ \$1,100 / seat

¹⁵ upgrade playground (\$10,000), barbecue and surrounds (\$4,000)

6.9 Infrastructure

6.9.1 Objectives

The objectives for the provision and maintenance of infrastructure in the Quinns Rocks – Mindarie Foreshore are to:

- maintain a safe environment
- protect natural and built values; and
- enhance recreation;

6.9.2 Background and Strategy

Fences

The 6.8 km of fencing within the study area are shown in Figure 6.1. While these are generally well placed, their condition is generally poor and their style is variable. Nearly all fences should be replaced starting with those in the worst condition or those that increase user safety, for example fences between the DUP and limestone cliffs. Fencing should also be of a consistent type and strong enough to stop access but should still harmonise with the natural environment without restricting views. A 1.5 m post, wire and rail type with coated ring-lock panels or coated chain-link (cyclone) mesh similar to fencing around Kinsale Park is recommended for most of the study area. Fencing at the proposed Lot 211 car park, should consist of 2.4 m high chain-link fence. Where vehicle access only is restricted, bollards should be erected (see Map 5).

A summary of the current state of fencing and requirements for each sector is given below.

North Mindarie Beach

North Mindarie Beach has approximately 2 km of fencing. The perimeter fencing is generally in good condition. The vegetation along Long Beach Promenade is well fenced off from the road and access can only be gained through the formal access points. Fencing is limited within the vegetation zone and fencing along access tracks needs to be undertaken. Fencing around the car park at Alexandria View, although inconsistent, is generally in moderately good condition; however the fence at the lookout has been cut to allow access and has been replaced only with orange plastic mesh. Fences along the staircase from the car park down to the beach are in very poor condition.

Fencing should be erected on both sides of the formalised access path shown in Map 5.

Mindarie Keys to Quinns Beach

The 1 km of fencing along the dual use path from Mindarie Keys to Quinns Beach, is in moderate condition until the area opposite Quinns Rocks Caravan Park, which is in extremely poor condition. Some access points and lookouts along the dual use pathway have been cut or else are insufficient to prevent access. Kinsale Drive is separated from the vegetation by a reasonably well maintained bollard fence. Vehicle access to the Caravan Park is restricted with bollards. Fencing around the perimeter of Kinsale Park is in excellent condition, consisting of post and rail with chain-link mesh. This type of fencing should be the standard for all other foreshore areas in Quinns Rocks – Mindarie to ensure consistency, durability and functionality.

All existing fencing in this area should be replaced and additional fencing added as indicated in Map 5 to protect bushland within this relatively high use area. The proposed development at Lot 211 should be fenced where it borders bushland.



Poor and damaged fencing in study area

Quinns Beach South and North

The dune vegetation at Quinns Beach South and Quinns Beach North is reasonably well fenced from Ocean Drive, with approximately 3.6 km of fences. However, fences blocking access to the beach are in very poor condition.

Bollards protect Frederick Stubbs Park from vehicular access and a post and rail fence along the vegetation perimeter restricts access to the dunes. The perimeter fencing at the car park adjacent to the existing Surf Life Saving Club is in reasonable condition; however there are access points to the dangerously eroded beach that are not adequately fenced off. Two sets of stairs that enter the car park from the road have well maintained fences.

A small unsealed car park north of the Life Saving Club has a highly eroded and hazardous access path. Orange mesh used to discourage access is inadequate as it should only be used as a temporary measure.

The car park at Tapping Way in the northern end of the study area has a very dangerous access path to the beach. Attempts to block access have been unsuccessful.

All fencing in this area should be replaced or erected according to Map 5.

Signs

Signage in the study area was assessed by Armstrong *et al.* (1999) and was found to be generally poor and did not meet Australian Standards. Signage in the study area will need to be replaced so that it complies with the appropriate Australian Standards:

- AS 2899.0-1986 : Public information symbol signs - Consolidated index
- AS 2899.1-1986 : Public information symbol signs - General information signs;
- AS 2899.2-1986 : Public information symbol signs - Water safety signs
- AS 2156.1-2001 : Walking tracks - Classification and signage

Descriptions of existing and required signage for each sector are as follows.

North Mindarie Beach

At the car park near Tuart Grove there is a regulatory sign outlining prohibited and permitted activities. The symbols do not comply with Australian Standards and the sign has become overgrown by vegetation. Next to this sign is a "Sand Boarding Prohibited" sign which also does not comply with Australian Standards (Armstrong *et al.*, 1999). There are several prohibition and informational signs at the Mindarie Beach car park from Alexandria View. Some of these do not comply with Australian Standards (Armstrong *et al.*, 1999). All signs, including the entry statement at Alexandria View should be replaced according to Australian Standards. Additional signage may be required to direct pedestrians away from rehabilitation areas.

Signage required in this sector is as follows:

Alexandria View Car Park

- entry statement;
- sandboarding prohibited;
- surf hazard;
- rip hazard; and
- cliff hazard.

Long Beach Promenade

- entry statement; and
- sandboarding prohibited.



Poor Signage at Quinns Rocks – Mindarie

Mindarie Keys to Quinns Beach South

From Mindarie Keys to Quinns Beach South there are a variety of warning signs at access paths and along the limestone cliffs. Some signs are ineffectual; for example warning signs with poorly restricted access. Additionally there is insufficient signage to warn of hazards, while existing signs do not comply with Australian Standards (Armstrong *et al.*, 1999). These signs will need to be replaced.

Signage required in this sector is as follows:

Rosslare Promenade

- Dual Use Pathway (keep left); and
- dogs prohibited.

Dual Use Pathway

- 6 x cliff hazard; and
- interpretational signage.

Lot 211 development

- walk bicycle area;
- 2 x Dual Use Pathway (keep left)
- entry statement;
- surf patrol / swim between flags; and
- interpretational signage.

Quinns Beach North and Quinns Beach South

There is little signage at Quinns Beach North and Quinns Beach South to identify hazards. Many of these signs are in disrepair or do not meet Australian Standards. There are also some areas where numerous signs are placed a similar location. Signs arranged in this way are distracting and reduce visual amenity. They are also less effective. Possible solutions are the provision of an information shelter or combinations of messages on a single sign. More appropriate placement of standalone signs is also warranted.

Signage required in this sector is as follows:

Quinns Beach South

- 3 x dogs prohibited (at access tracks).

Existing SLSC area

- entry statement;
- dogs prohibited;
- surf patrol / swim between flags; and
- fishing prohibited.

Quinns Beach North

- 3 x dogs prohibited (at access tracks);
- 1 x dogs permitted; and
- 1 x clean up after your dog (provide pouches).



Sign Clusters

Facilities and Car Parks

Facilities such as toilets, picnic tables, benches, rubbish bins and playgrounds facilitate and enhance recreational pursuits and should be strategically placed for maximum benefit. For example toilets are ideally placed with car parks, seating along walkways at scenic spots, change rooms near surf beaches and picnic tables in sheltered, pleasant areas. Facilities should be consistent in appearance, attractive and unobtrusive. This is important as unattractive facilities will detract from the visual experience of the area and will not encourage people to respect and look after them.

Car parks allow access to recreational sites and are of high importance for tourists and other visitors to the area. While there are a number of car parks in the study area, most are quite small. The proposed Community Facility at Lot 211 includes parking for 212 vehicles which should be adequate for this area. Existing car parks should not be expanded, particularly along the Quinns Rocks North sector as the risk of further erosion in this area is currently unknown. The car park at the existing SLSC node has been damaged by erosion and should be repaired. If additional car parking needs are required in this area, the feasibility of placing an additional car park on the eastern side of Ocean Drive where the road reserve is widened considerably should be investigated. This should only be constructed after examining erosion data monitoring over several years. Should the need for car parks arise in the future, these should also be set well back from the foreshore area to protect them from erosion risk and to conserve the biological values of the area.

Existing rubbish bins are of the wheelie-bin type which allows easy collection. It may be appropriate to install bin housings for these as they are unattractive and vulnerable to high winds and seagulls. Recycling bin facilities should be installed and their function prominently advertised at the existing SLSC and the proposed Development of Lot 211. It is recommended that rubbish bins only be provided at recreational nodes consistent with the level of use (see Section 6.8.3 for recreational nodes). The Department of Conservation and Land Management has a policy of not providing rubbish bins, as bins that are not emptied promptly can result in rubbish being spread in surrounding areas (and the absence of bins is thought to encourage people to take their rubbish away with them). This policy should be followed in most areas, with limited rubbish bins provided only in High and Medium Intensity Recreation Zones and recycling bin facilities at High Intensity Recreation Zones (see Section 6.1 for Management Zones).

Seating should be placed near lookouts along the existing DUP and in High Intensity Recreation Zones. These should be uniform in appearance and attractive yet sympathetic with the surrounding natural areas. Currently seating is of the bus-shelter type which detracts significantly from the scenic amenity.

The following outlines the level of existing facilities and recommendations for improvement in each sector.

North Mindarie Beach

North Mindarie Beach has limited facilities. Tuart Grove picnic area has been destroyed and access is limited. Compared to other parts of the study area, North Mindarie Beach does not receive high levels of use, and therefore there is no immediate need for additional facilities and there is a high potential for vandalism due to its isolated nature. The level of use should continue to be monitored and if required a toilet block and changeroom should be erected at the Alexandria View Car Park

Mindarie Keys to Quinns Beach South

From Mindarie Keys to Quinns Beach South there are a number of existing facilities. The sealed car park adjacent to Rosslare Promenade has toilets, disabled parking bays, benches and bins. Along the dual use pathway and at most of the lookouts, benches and bins have been provided.

Facilities required in this area include:

- seating associated with lookouts
- bins at recreational nodes
- upgraded toilet and changeroom facilities as part of Lot 211 development
- picnic and seating facilities at Lot 211 development
- recycling bin facilities at Lot 211 development

Quinns Beach North and South

Quinns Beach North and South have a number of facilities. Adjacent to Quinns Rocks Caravan Park is a car park with toilet and shower facilities, benches, bins, and bike racks. A small playground with swings and a barbeque area is also located next to the Caravan Park, however this has a dilapidated appearance. A new picnic area and playground has been proposed as part of the proposed Community Facility. Frederick Stubbs Park also has a playground and seating for public use, however there is no lighting in the Park. Lighting should be implemented at both these locations once they have been upgraded to discourage antisocial behaviour.

Adjacent to the Quinns Mindarie Surf Lifesaving Club is another toilet and change room facility, as well as picnic shelters for picnicking in the nicer weather. Disabled parking bays, bike racks, benches and bins are also provided.

Most formal beach accesses along Quinns Beach North are provided with rubbish bins. Rubbish bins in Low Intensity Recreation Zones should be removed. Dog bags are also provided at some locations where dogs are not permitted. These should also be removed as it conveys an inconsistent message. The car park at the northern end of the study area is sealed with one disabled parking bay and bins but no toilet facilities are provided.

There have been requests to provide a toilet at the dog beach, and an example of a cheap and environmentally friendly way to achieve this is seen at Two Rocks, to the north of the study area, where a composting toilet has been installed (Figure 6.7). This should be considered for the dog beach to facilitate public needs.

Facilities required for this area include:

- upgrade of toilet facilities at existing SLSC node
- upgrade of playground facilities at existing SLSC node
- recycling bin facilities at existing SLSC node
- upgrade car park at existing SLSC node
- upgrade seating facilities at existing SLSC node
- composting toilet at Dog Beach
- dog poo bag dispenser at Dog Beach
- rubbish bins at dog beach



Composting Toilet at Two Rocks

6.9.3 Recommendations

No.	Recommendation	Priority	Responsibility ^j	Indicative Cost ⁱⁱ
49	Upgrade and install fencing where indicated in Map 5 using post, rail and coated mesh.	High	Operations/ State Government	\$213,588 ¹⁶
50	Replace signage that does not meet Australian Standards ensuring signage is consistent and does not detract unnecessarily from visual amenity.	High	Operations	\$17,000 ¹⁷
51	Install bin housings for rubbish bins in the study area.	Medium	Waste Services	\$9,000 ¹⁸
52	Install recycling bin facilities at the existing SLSC and the proposed Community Facility.	Medium	Waste Services	\$4,000 ¹⁹
53	Remove dog bags where dogs are prohibited.	Medium	Operations	Operational

¹⁶ 7,628 m fencing @ \$28 / m

¹⁷ Assumes \$200 for regulatory signage, \$500 for entry statements and \$500 for interpretational signage

¹⁸ Assumes 1 bin at medium intensity node car parks and 2 bins at high intensity nodes @ \$1,000 each

¹⁹ Assumes 2 recycling bins similar in appearance to above @ \$1,000 each

7.0 Implementation Programme

Foreshore Management Plan: Mindarie – Quinns Rocks

A five year implementation programme has been developed and is outlined in Table 7.1. This table is intended to guide works undertaken over several years and these will therefore not match recommendations. A recommendations summary with year of completion is included in Table 7.2

The implementation programme aims to achieve the implementation of major capital works, including pathways, fencing, signage and erosion control. At the end of each year the recommendations for that year should be audited and where applicable transferred to the following year. Timing is concurrent with the financial year.

Table 7.1 Five Year Implementation Programme

WORKS	YEAR 1 (2004/2005)	YEAR 2 (2005/2006)	YEAR 3 (2006/2007)	YEAR 4(2007/2008)	YEAR 5 (2008/2009)
Management Zones	<p><i>High Priority</i></p> <ul style="list-style-type: none"> survey 10 m x 10 m quadrats to verify inferred TECs. Analyse using the original data from Gibson <i>et al.</i> (1994) In association with CALM. 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> Conduct conservation plan in conjunction with the Department of Conservation and Land Management for any TECs verified. <p><i>Medium priority</i></p> <ul style="list-style-type: none"> Undertake vegetation survey for Kinsale Park. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> Negotiate management responsibilities and vesting of reserves where appropriate (including transfer of Reserve #25997 to City of Wanneroo). 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Undertake beach use survey and reassess management zones. 		<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Undertake beach use survey and reassess management zones.
Weed Control	<p><i>High Priority</i></p> <ul style="list-style-type: none"> Commence weed control programme in high priority areas, including areas requiring species-led control. Implement post-fire weed control measures in Kinsale Park, Lot 211 and recently burnt areas where appropriate. <p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Determine priority weed control areas by 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> Continue weed control programme, concentrating on any further areas requiring species-led control, and areas requiring site-led control. Control weeds in restoration areas. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> Establish further weed monitoring quadrats in areas subject to control 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> Continue weed control programme. Control weeds in restoration areas. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> Establish further weed monitoring quadrats in areas subject to control as necessary. Monitor existing weed monitoring quadrats and incorporate results into weed control programme. 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Continue weed control programme. Control weeds in restoration areas. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> Establish further weed monitoring quadrats in areas subject to control as necessary. Monitor existing weed monitoring quadrats and incorporate results into weed control programme. 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Continue weed control programme. Control weeds in restoration areas. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> Establish further weed monitoring quadrats in areas subject to control as necessary. Monitor existing weed monitoring quadrats and incorporate results into weed control programme.

WORKS	YEAR 1 (2004/2005)	YEAR 2 (2005/2006)	YEAR 3 (2006/2007)	YEAR 4(2007/2008)	YEAR 5 (2008/2009)
	<p>undertaking a grid-based survey for the presence of priority weeds.</p> <ul style="list-style-type: none"> Develop more detailed weed action plans for defined zones within the park using data gained from the survey. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> Establish weed monitoring quadrats in areas subject to control. 	<p>as necessary.</p> <ul style="list-style-type: none"> Monitor existing weed monitoring quadrats and incorporate results into weed control programme. 			
Ecological Restoration	<p><i>High Priority</i></p> <ul style="list-style-type: none"> Close all tracks not required for access, walking trails or firebreaks. Carry out reconstruction works and assisted natural regeneration, noting costs, timing and results. <p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Map and prioritise areas requiring restoration works (both assisted natural regeneration and reconstruction). Monitor and evaluate the success of track restoration and dune reconstruction works. Establish a baseline 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> Commence restoration of tracks not required for recreational use or management. Continue reconstruction works and assisted natural regeneration, noting costs, timing and results. <p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Implement reconstruction works in identified areas. Determine reconstruction areas for 2006/2007 and commence detailed design plans for each area identified. Continue assisted natural regeneration in identified areas. 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Continue track restoration. Continue reconstruction works and assisted natural regeneration, noting costs, timing and results. Monitor and evaluate the success of track restoration and dune reconstruction works. Determine reconstruction areas for 2007/2008 and commence detailed design plans for each area identified. Identify species to be used in reconstruction areas for 2007/2008 and collect seeds and cuttings 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Continue track restoration. Continue reconstruction works and assisted natural regeneration, noting costs, timing and results. Monitor and evaluate the success of track restoration and dune reconstruction works. Determine reconstruction areas for 2008/2009 and commence detailed design plans for each area identified. Identify species to be used in reconstruction areas for 2008/2009 and collect seeds and cuttings 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Continue track restoration. Continue reconstruction works and assisted natural regeneration, noting costs, timing and results. Monitor and evaluate the success of track restoration and dune reconstruction works. Determine reconstruction areas for 2009/2010 and commence detailed design plans for each area identified. Identify species to be used in reconstruction areas for 2009/2010 and collect seeds and cuttings

WORKS	YEAR 1 (2004/2005)	YEAR 2 (2005/2006)	YEAR 3 (2006/2007)	YEAR 4(2007/2008)	YEAR 5 (2008/2009)
	<p>photographic record of both good and poor condition areas.</p> <ul style="list-style-type: none"> • Determine reconstruction areas for 2005/2006 and commence detailed design plans for each area identified. • Identify suitable areas and commence assisted natural regeneration following the principles of the Bradley method. • Identify species to be used in reconstruction areas for 2005/2006 and collect seeds and cuttings for growing on in an approved nursery. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Identify facility for storing local seed for future use in restoration programmes. 	<ul style="list-style-type: none"> • Monitor and evaluate the success of track restoration and dune reconstruction works. • Identify species to be used in reconstruction areas for 2006/2007 and collect seeds and cuttings for growing on in an approved nursery. 	<p>for growing on in an approved nursery.</p>	<p>for growing on in an approved nursery.</p>	<p>for growing on in an approved nursery.</p> <ul style="list-style-type: none"> • Repeat collection of photographic records.
<p>Fire Management</p>	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Develop and distribute a Fire Control Working Plan (FCWP) documenting the Fire Control Policy and Fire Management Plan. • Develop and distribute a Fire Control Working Map (FCWM) showing all 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Restrict access and implement weed control, erosion control and other post-fire recovery measures should a fire occur. Record details of fire. 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Restrict access and implement weed control, erosion control and other post-fire recovery measures should a fire occur. Record details of fire. 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Restrict access and implement weed control, erosion control and other post-fire recovery measures should a fire occur. Record details of fire. 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Restrict access and implement weed control, erosion control and other post-fire recovery measures should a fire occur. Record details of fire.

WORKS	YEAR 1 (2004/2005)	YEAR 2 (2005/2006)	YEAR 3 (2006/2007)	YEAR 4(2007/2008)	YEAR 5 (2008/2009)
	<p>physical features of the area that could assist or hinder fire suppression, and the boundaries of cells to be defended.</p> <ul style="list-style-type: none"> • Restrict access and implement weed control, erosion control and other post-fire recovery measures should a fire occur. Record details of fire. • Upgrade and/or maintain firebreaks and fire access trails. <p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Undertake fuel reduction in weed-dominated areas and on road and track verges. • Conduct ranger patrols of bushland during periods of high fire risk. • Devise and instigate a Fire Watch programme. 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Maintain firebreaks and fire access trails. • Undertake fuel reduction in weed-dominated areas and on road and track verges. • Conduct ranger patrols of bushland during periods of high fire risk. • Continue Fire Watch Program. • Develop and instigate a fire prevention community education programme. 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Maintain firebreaks and fire access trails. • Conduct ranger patrols of bushland during periods of high fire risk. • Continue Fire Watch Program. • Continue fire prevention community education programme. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Undertake fuel reduction in weed-dominated areas and on road and track verges. 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Maintain firebreaks and fire access trails. • Undertake fuel reduction in weed-dominated areas and on road and track verges. • Conduct ranger patrols of bushland during periods of high fire risk. • Continue Fire Watch Program. • Continue fire prevention community education programme. 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Maintain firebreaks and fire access trails. • Conduct ranger patrols of bushland during periods of high fire risk. • Continue Fire Watch Program. • Continue fire prevention community education programme. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Undertake fuel reduction in weed-dominated areas and on road and track verges.
Pest and Disease Control	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Initiate hygiene procedures to prevent the spread of dieback and other plant diseases into uninfected areas. 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Integrate pest and disease management with management in nearby bushland areas. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Monitor vegetation for signs of stress and plant 	<p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Monitor vegetation for signs of stress and plant pathogens. 	<p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Monitor vegetation for signs of stress and plant pathogens. 	<p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Monitor vegetation for signs of stress and plant pathogens.

WORKS	YEAR 1 (2004/2005)	YEAR 2 (2005/2006)	YEAR 3 (2006/2007)	YEAR 4(2007/2008)	YEAR 5 (2008/2009)
		pathogens.			
Fauna Management	<p><i>Moderate Priority</i></p> <ul style="list-style-type: none"> Erect rabbit-proof fencing around rehabilitation sites. Develop education campaign to raise awareness of dangers of roaming cats at night. Install signage prohibiting dogs in recreational areas. 	<p><i>Moderate Priority</i></p> <ul style="list-style-type: none"> Erect rabbit-proof fencing around rehabilitation sites. Continue education campaign to raise awareness of dangers of roaming cats at night. 	<p><i>Moderate Priority</i></p> <ul style="list-style-type: none"> Erect rabbit-proof fencing around rehabilitation sites. Continue education campaign to raise awareness of dangers of roaming cats at night. 	<p><i>Moderate Priority</i></p> <ul style="list-style-type: none"> Erect rabbit-proof fencing around rehabilitation sites. Continue education campaign to raise awareness of dangers of roaming cats at night. 	<p><i>Moderate Priority</i></p> <ul style="list-style-type: none"> Erect rabbit-proof fencing around rehabilitation sites. Continue education campaign to raise awareness of dangers of roaming cats at night.
Erosion Control	<p><i>High Priority</i></p> <ul style="list-style-type: none"> Begin rehabilitating bare areas shown in Map 5. Start with dune blowouts at South Mindarie. Prohibit sand boarding and vehicle access to North Mindarie Beach by conducting ranger patrols of the area. Initiate ongoing monitoring of beach profiles and sediment transport at Quinns Beach South and North Mindarie Beach. <p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Implement temporary erosion control measures for badly eroded areas at risk of further erosion. 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> Continue rehabilitating bare areas shown in Map 5. Construct fencing at the foot of foredunes in the most heavily trafficked areas to discourage human access. Prohibit sand boarding and vehicle access to North Mindarie Beach by conducting ranger patrols of the area. Formalise and seal access tracks to the beach. Continue monitoring beach profiles and sediment transport at Quinns N&S and Mindarie 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> Complete rehabilitating bare areas shown in Map 5. Arrange for construction of fencing at the foot of foredunes for the length of the beach within the park, and begin construction. Prohibit sand boarding and vehicle access to North Mindarie Beach by conducting ranger patrols of the area. Continue sealing of access tracks. Continue monitoring beach profiles and sediment transport at Quinns N&S and 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> Continue construction of fencing along the foredunes. Prohibit sand boarding and vehicle access to North Mindarie Beach by conducting ranger patrols of the area. Continue monitoring beach profiles and sediment transport at Quinns N&S and Mindarie. <p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Assess the success of dune stabilisation and revegetation works and adjust programme as necessary. Identify any new areas 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> Prohibit sand boarding and vehicle access to North Mindarie Beach by conducting ranger patrols of the area. Continue monitoring beach profiles and sediment transport at Quinns N&S and Mindarie. <p><i>Medium Priority</i></p> <ul style="list-style-type: none"> Conduct monitoring survey of coastal cliffs and erosion. Identify any new areas requiring erosion control. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> Assess fencing of leeward and seaward

WORKS	YEAR 1 (2004/2005)	YEAR 2 (2005/2006)	YEAR 3 (2006/2007)	YEAR 4(2007/2008)	YEAR 5 (2008/2009)
			<p>Mindarie.</p> <p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Conduct monitoring survey of coastal cliffs and erosion. • Assess the success of dune stabilisation and revegetation works and adjust programme as necessary. • Identify any new areas requiring erosion control. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Trial fencing of leeward and seaward sides of dunes. 	<p>requiring erosion control.</p> <p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Maintain beach fencing. 	<p>sides of dunes.</p>
<p>Pathways and Access</p>	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Implement more effective temporary deterrents to illegal private vehicle access to tracks within the park. This should include larger, more robust blocks at the entrance to all tracks. • Close and commence rehabilitation of all tracks not required for recreation or management. • Convert tracks to lookouts at limestone cliffs where indicated in Map 5. 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Complete rehabilitation of all tracks not required for recreation or management • Install wooden steps to beach at existing SLSC node. • Repair and formalise car park, including access, and install edging at existing SLSC node. <p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Formalise beach access where indicated in Map 5 including the construction of wooden steps at 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Complete construction of pathways and lookouts <p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Maintain steps and pathways. 	<p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Maintain steps and pathways. 	<p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Maintain steps and pathways.

WORKS	YEAR 1 (2004/2005)	YEAR 2 (2005/2006)	YEAR 3 (2006/2007)	YEAR 4(2007/2008)	YEAR 5 (2008/2009)
		Quinns Beach. <ul style="list-style-type: none"> • Install lookout at Alexandria View car park. 			
Recreational Facilities	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Prepare landscape concept plans for Primary Nodes. • Investigate strategic placement and appropriate design of seating. <p><i>Medium</i></p> <ul style="list-style-type: none"> • Install recycling bin facilities at Primary Nodes. 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Upgrade toilet block at existing SLSC node. <p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Upgrade picnic and playground facilities at Frederick Stubbs Park. • Commence landscaping for areas near the existing SLSC. • Install bin housings for rubbish bins. • Maintain recreational facilities. • Install lighting at existing SLSC node. • Close and begin rehabilitation of Tuart Grove Picnic Area • Install lookout at Alexandria View Car Park 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Maintain recreational facilities. • Complete landscaping existing SLSC node areas • Install recycling bin facilities at the existing SLSC and proposed Community Facility. • Install bollards where indicated in Map 5 • Provide seating near lookouts along existing DUP • Continue rehabilitation of Tuart Grove Picnic Area <p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Investigate options for provision of boat ramp in proximity of study area. 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Maintain recreational facilities • Continue rehabilitation of Tuart Grove Picnic Area • Construct toilet block and change rooms at Alexander View Car Park <p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Install composting toilet at Dog Beach 	<p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Maintain recreational facilities • Continue rehabilitation of Tuart Grove Picnic Area
Fencing	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Upgrade fencing along DUP and lookouts • Replace fences in very poor condition and in hazardous areas with 1.5 m post and rail with ring-lock / chain-link mesh 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Commence construction of perimeter fences and access gates with a view towards completion within the financial year. 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Complete fence and gate construction if not already completed. <p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Maintain fences and gates. 	<p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Maintain fences and gates. 	<p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Maintain fences and gates.

WORKS	YEAR 1 (2004/2005)	YEAR 2 (2005/2006)	YEAR 3 (2006/2007)	YEAR 4(2007/2008)	YEAR 5 (2008/2009)
	<ul style="list-style-type: none"> • Rebuild fencing at lookout near Alexandria View • Erect post and ringlock fence between bushland and proposed Community Facility before construction commences. 				
Signage	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Identify signage requirements and review existing signage. • Construct and erect visible signs to Australian Standards. • Construct mobile signage that can be used to tell patrons that access is restricted to environmentally sensitive areas such as weed control areas, erosion control areas and rehabilitation work. <p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Identify themes to be conveyed by interpretive signage and / or information shelters • Identify appropriate sites for interpretive signage. and / or information shelters 	<p><i>High Priority</i></p> <ul style="list-style-type: none"> • Construct and install signage for coastal paths informing patrons of the process of coastal erosion and asking them to keep to paths. <p><i>Medium Priority</i></p> <ul style="list-style-type: none"> • Construct and install interpretive signage for at Bush Forever Site adjacent to Lot 211. • Maintain signage. 	<p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Maintain signage. 	<p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Maintain signage. 	<p><i>Low Priority</i></p> <ul style="list-style-type: none"> • Maintain signage.

Table 7.2 Summary of Management Recommendations

Priority category definitions are as follows:

High Recommendation should be initiated within the next two financial years

Medium Recommendation should be initiated within three years

Low Recommendation should be initiated within five years depending on budget constraints

No.	Recommendation	Priority	Responsibility ⁱ	Indicative Cost ⁱⁱ
1	Verify inferred Threatened Ecological Communities (TECs) nearby to the proposed Lot 211 development using the original data from Gibson <i>et al.</i> (1994).	High	Planning Services/State Government	\$2,000
2	Monitor management zones by undertaking surveys of beach use every 3 years and amend accordingly.	Medium	Planning Services	\$1,500
3	Verify other inferred TECs in the study area using the original data from Gibson <i>et al.</i> (1994).	Medium	Planning Services/State Government	\$2,000
4	Undertake a vegetation survey for Kinsale Park by 2006.	Medium	Operations	\$1,000
5	Prepare a Conservation Plan in conjunction with the Department of Conservation and Land Management for any TECs verified.	Medium	CALM / Planning Services	\$5,000
6	Negotiate management responsibilities and vesting of reserves where appropriate with relevant government agencies.	Low	Planning Services	N/A
7	Develop a comprehensive weed control plan within the study area, following the principles of the general weed control action plan and other guidelines detailed in this management plan.	High	Operations	\$4,000
8	Implement post fire weed control measures in Kinsale Park and recently burnt areas where appropriate.	High	Operations / State Government	\$5,000 per annum ²⁰
9	Develop a quadrat-based monitoring and evaluation programme to measure the success of weed management strategies implemented. Key performance indicators based on number, extent and density of weeds.	Medium	Operations	\$1,000 per annum
10	Carry out assisted natural regeneration following the principles of the Bradley method in <i>Good – Excellent</i> condition areas, gradually progressing into <i>Fair – Good</i> areas (See Map 2).	High	Operations / State Government	\$115,700* (Table 6.7)
11	Close and rehabilitate all tracks not required for access, walking trails or firebreaks (See Map 5).	High	Operations/ State Government	\$52,700* (Table 6.7)

²⁰ 2 applications of glyphosate @10c/m²

No.	Recommendation	Priority	Responsibility ⁱ	Indicative Cost ⁱⁱ
12	Carry out reconstruction / revegetation in areas of <i>Poor</i> and <i>Very Poor</i> condition bushland (see Map 2) using local provenance genetic material.	Medium	Operations	\$842,800* (Table 6.7)
13	Monitor rehabilitation works annually and ensure that accurate records are kept of progress.	Medium	Operations / State Government	\$200 / area / annum
14	Erect signage that is appropriate in location, size and information to inform the public of rehabilitation works.	Medium	Operations / State Government	\$500 per sign
15	Reduce fuel levels in bushland through weed control.	High	Operations / State Government	Operational
16	Develop a Fire Control Working Plan for the Quinns Rocks – Mindarie Foreshore with an accompanying map showing locations of access tracks, water sources, assets, vulnerable property and areas of high conservation value.	High	FESA / Ranger & Safety Services	\$3,000
17	Commence a Fire Watch Programme for the community to assist in alerting fire control authorities to fires.	Medium	FESA / Ranger & Safety Services	N/A
18	Conduct ranger patrols of bushland areas during periods of high fire risk.	Medium	Ranger & Safety Services	Operational
19	Keep accurate records of fire histories of the foreshore areas.	Medium	FESA / Ranger & Safety Services	Operational
20	Develop a fire prevention community education programme.	Medium	FESA / Ranger & Safety Services	N/A
21	Initiate hygiene procedures to prevent the spread of dieback and other plant diseases into uninfected areas.	High	Operations	57,000 ²¹
22	Monitor vegetation for signs of stress and plant pathogens annually.	Low	Operations	\$500
23	Erect rabbit-proof fencing around rehabilitation sites.	Medium	Operations / State Government	\$5.50 / m ²²
24	Initiate an education campaign to raise awareness of the environmental problems of cats roaming at night. Distribute leaflets to surrounding residents.	Medium	Planning Services	\$1,500 ²³

²¹ Wash down bay \$20,000, bore \$30,000, electrics \$5,000, ongoing maintenance \$2,000.

²² 10 m roll chicken wire (\$30.00) and star picket every 2 m (\$5.00 each)

²³ Design (\$500.00), 2000 leaflets @ \$0.50 each

No.	Recommendation	Priority	Responsibility ⁱ	Indicative Cost ⁱⁱ
25	Install signage prohibiting dogs from recreational areas within study area with the exception of the beach area accessed from Tapping Way.	Medium	Operations	\$2,000 ²⁴
26	Monitor and record feral cat and fox sightings if these become a significant problem in the area, implement selective trapping and removal of individuals.	Low	Operations/ CALM	Operational
27	Rehabilitate bare areas shown in Map 5 to prevent erosion and immobilise sand dunes.	High	Operations / State Government	\$501,900 (Table 6.8)
28	Conduct monitoring survey of coastal cliffs and erosion every two years.	Medium	Operations	\$5,000 per survey (\$2,500 per annum)
29	Seal sandy tracks to be formalised (Map 5) with bitumen or crushed limestone to prevent further erosion of the sand surface.	High	Operations/ State Government	CL - \$33,200 ²⁵
				B - \$57,500
30	Undertake ongoing monitoring of beach profiles and sediment transport at Quinns Beach North.	High	Operations	\$1,500 / annum
31	Conduct ranger patrols at North Mindarie sector to discourage sandboarding.	High	Ranger & Safety Services	Operational
32	Trial fencing of both the seaward and leeward sides of the foredunes along sections of North Mindarie beach where dunes are showing signs of vegetation loss and erosion.	Low	Operations/ State Government	\$2,000 ²⁶
33	Formalise beach access where indicated (Map 5) through surfacing and the construction of wooden steps on paths north of the existing Surf Life Saving Club (SLSC).	Medium	Operations / State Government	\$400,000 ²⁷
34	Restrict access to limestone cliffs by converting existing tracks to lookouts (see Map 5) and installing cliff hazard warning signage to Australian Standards.	High	Operations / State Government	\$3,140 ²⁸
35	Repair and formalise car park, including access, and install edging at the existing SLSC.	High	Operations	\$50,000
36	Install short wooden steps access to beach at existing SLSC to formalise access.	High	Operations	\$5,000
37	Upgrade toilet-block at existing SLSC node.	High	Operations	\$5,000
38	Install bollards where indicated in Map 5.	Medium	Operations / State Government	\$9,685 ²⁹

²⁴ 10 signs @ \$200.00 per sign

²⁵ Assumes 2,875m path to be formalised (Map 5) cost crushed limestone (CL) \$11.50 / m² Bitumen (B) \$20.00 / m²

²⁶ Assumes 100 m of fencing at \$20 / m

²⁷ Assumes 4 sets of staircases required at \$75,000 per staircase.

²⁸ fencing for 3 lookouts @ \$150 each plus 4 cliff hazard signs @ \$200 / sign

²⁹ Assumes 150 m of bollards at \$65 / m

No.	Recommendation	Priority	Responsibility ⁱ	Indicative Cost ⁱⁱ
39	Install lighting at existing SLSC node.	Medium	Operations	\$12,500 ³⁰
40	Landscape existing SLSC node.	Medium	Operations	\$8,200 ³¹
41	Provide seating near lookouts along Dual Use Pathway (DUP).	Medium	Operations	\$3,300 ³²
42	Investigate options for the provision of a boat ramp in the proximity of the study area.	Low	Planning Services	Operational
43	Close and rehabilitate picnic area at Tuart Grove.	Medium	Operations/ State Government	\$10,000 (Table 6.6)
44	Construct toilet block and change rooms at Alexandria View Car Park.	Medium	Operations	\$200,000
45	Upgrade picnic and playground facilities at Frederick Stubbs Park, install barbecue.	Medium	Operations	14,000 ³³
46	Install lookout at Alexandria View car park with regulatory and warning signage.	Medium	Operations	\$860
47	Install interpretive signage and/or an information shelter at Bush Forever Site adjacent to Lot 211 developments.	Low	Operations	\$2,000
48	Install composting toilet at the Dog Beach.	Low	Operations	\$20,000
49	Upgrade and install fencing where indicated in Map 5 using post, rail and coated mesh.	High	Operations / State Governments	\$213,588 ³⁴
50	Replace signage that does not meet Australian Standards ensuring signage is consistent and does not detract unnecessarily from visual amenity.	High	Operations	\$17,000 ³⁵
51	Install bin housings for rubbish bins in the study area.	Medium	Waste Services	\$9,000 ³⁶
52	Install recycling bin facilities at the existing SLSC and the proposed Community Facility.	Medium	Waste Services	\$4,000 ³⁷
53	Remove dog bags where dogs are prohibited.	Medium	Operations	\$200

ⁱ Responsibility for actions subject to review/agreement as appropriate

ⁱⁱ All costs are indicative and will be subject to funding availability

NOTE: Management and funding responsibilities for all actions where the State Government is noted in the 'Responsibility' column will be subject to negotiation with the State Government.

***NOTE: The costings for actions 10,11,12 are based on estimates for professional rehabilitation as given in Table 6.7, but may vary by up to 20%.**

³⁰ 5 light poles @ \$2,500 / pole

³¹ earthworks - \$3,000; seating (2) \$2,200; amenity planting \$3,000

³² 3 seats @ \$1,100 / seat

³³ upgrade playground (\$10,000), barbecue and surrounds (\$4,000)

³⁴ 7,628 m fencing @ \$28 / m

³⁵ Assumes \$200 for regulatory signage, \$500 for entry statements and \$500 for interpretational signage

³⁶ Assumes 1 bin at medium intensity node car parks and 2 bins at high intensity nodes @ \$1,000 each

³⁷ Assumes 2 recycling bins similar in appearance to above @ \$1,000 each

Maps

Foreshore Management Plan: Mindarie – Quinns Rocks

Map 1 Vegetation Communities of the Quinns Rocks – Mindarie Foreshore

Map 2 Bushland Condition for the Quinns Rocks Mindarie

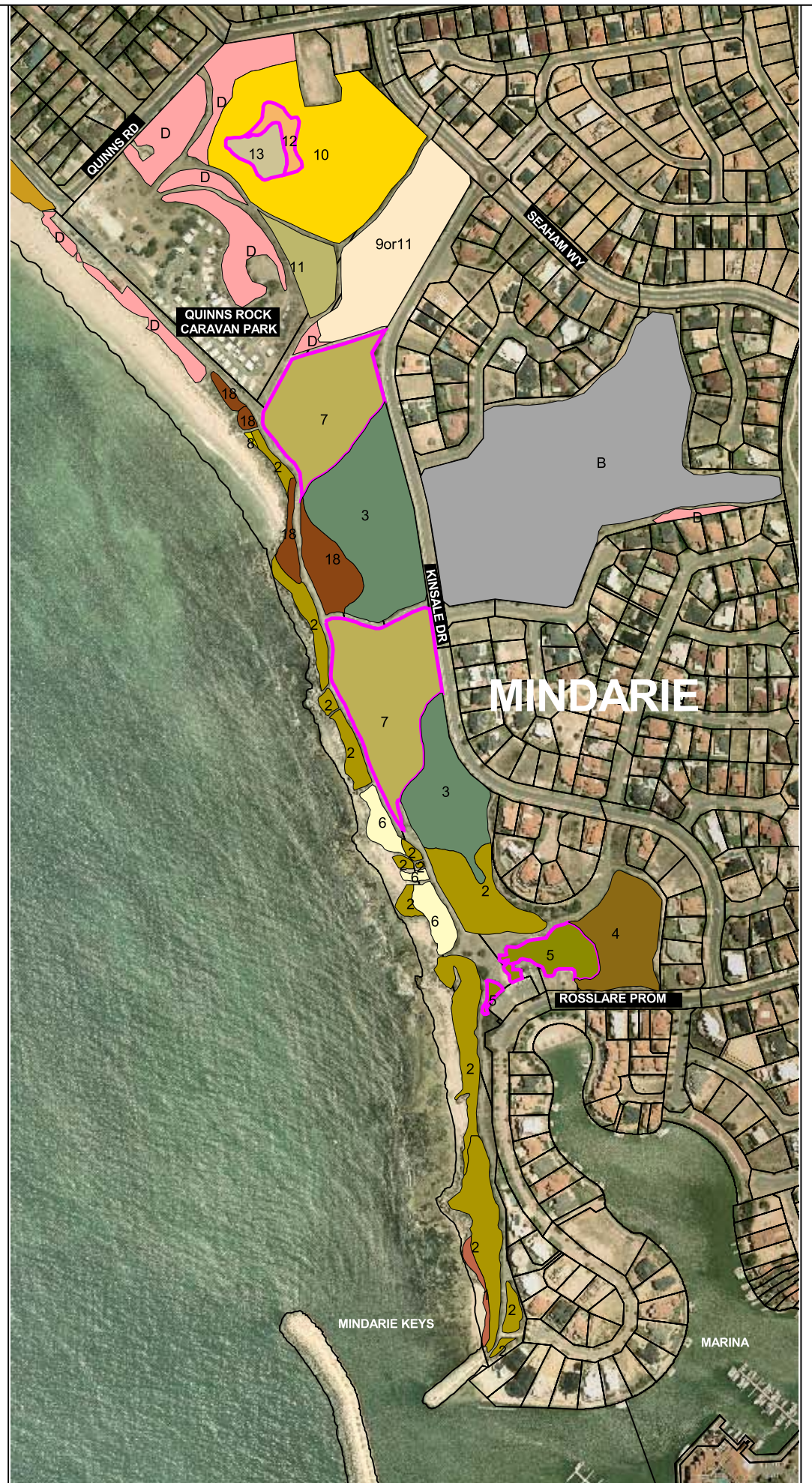
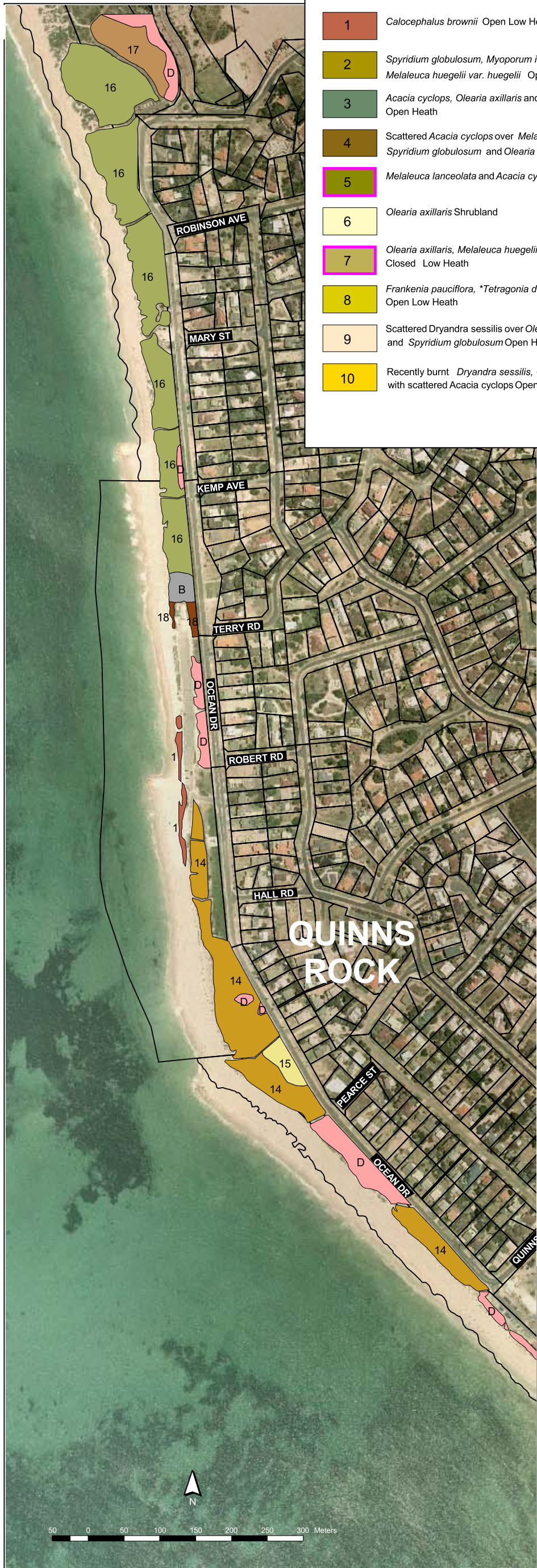
Map 3 Tenure and Bush Forever Boundaries

Map 4 Management Zones, Nodes and Existing Facilities

Map 5 Infrastructure, Proposed Facilities, Dune Blowouts and Cliff Hazards.

Vegetation Communities

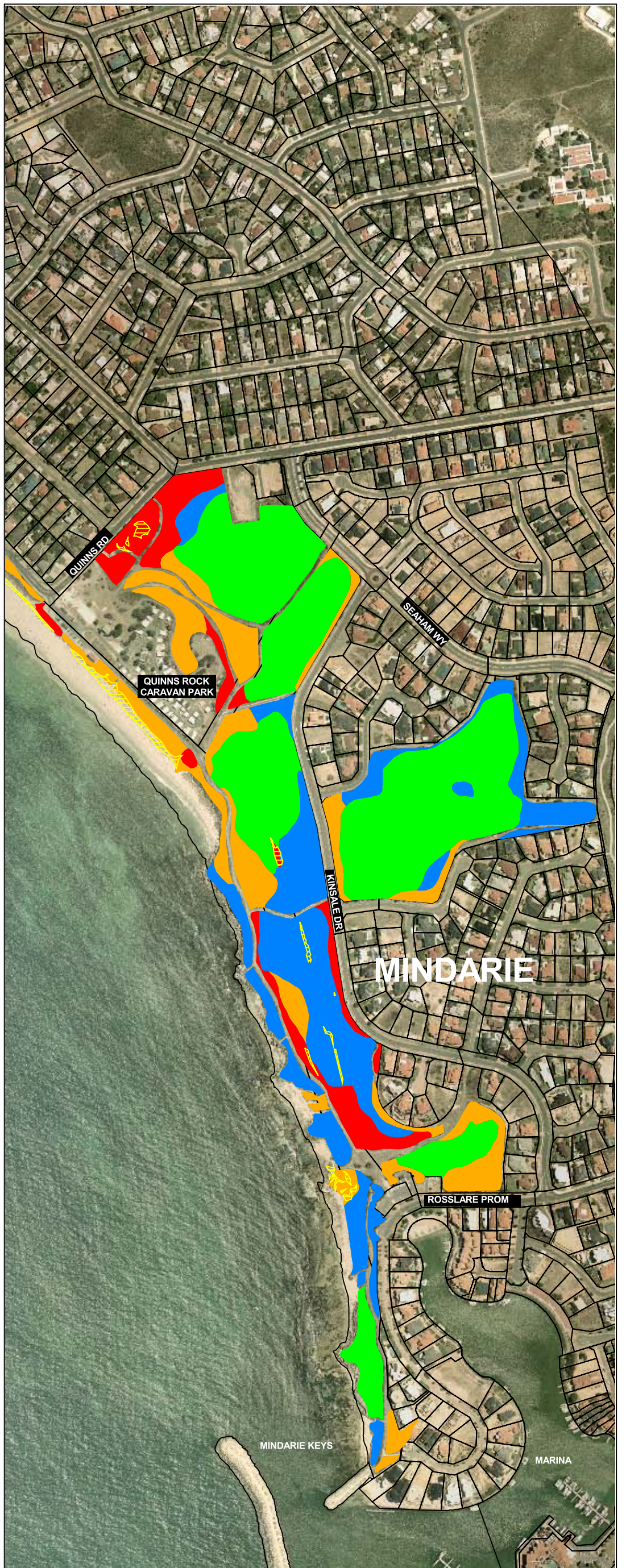
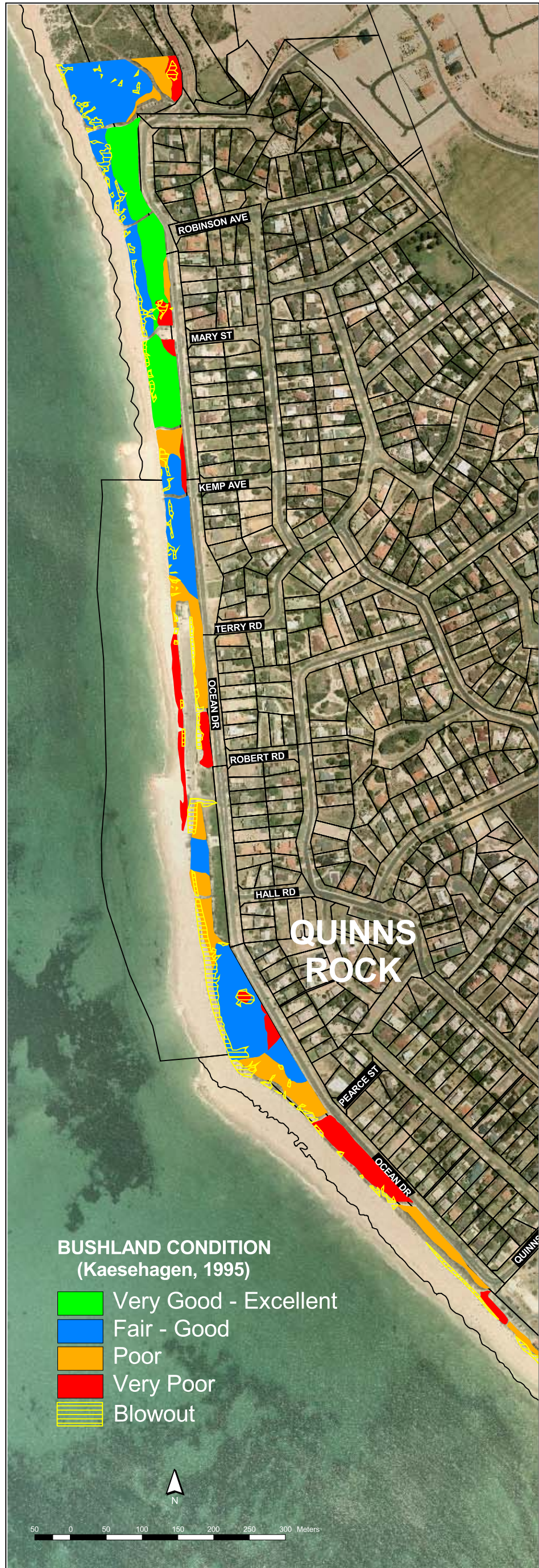
1	<i>Calocephalus brownii</i> Open Low Heath	11	<i>Dryandra sessilis</i> , <i>Calothamnus quadrifidus</i> with scattered <i>Acacia cyclops</i> Open Heath
2	<i>Spyridium globulosum</i> , <i>Myoporum insulare</i> and <i>Melaleuca huegelii</i> var. <i>huegelii</i> Open Shrubland	12	<i>Acacia cyclops</i> Closed Tall Scrub
3	<i>Acacia cyclops</i> , <i>Olearia axillaris</i> and <i>Spyridium globulosum</i> Open Heath	13	<i>Acacia truncata</i> , <i>Melaleuca huegelii</i> and <i>Scaevola anchusifolia</i> Open Low Heath
4	Scattered <i>Acacia cyclops</i> over <i>Melaleuca huegelii</i> , <i>Spyridium globulosum</i> and <i>Olearia axillaris</i> Open Heath	14	<i>Olearia axillaris</i> Open Shrubland
5	<i>Melaleuca lanceolata</i> and <i>Acacia cyclops</i> Low Closed Forest	15	<i>Acacia ?rostellifera</i> and <i>Olearia axillaris</i> Shrubland
6	<i>Olearia axillaris</i> Shrubland	16	Scattered <i>Olearia axillaris</i> and <i>Scaevola crassifolia</i> , * <i>Pelargonium capitatum</i> and * <i>Euphorbia terracina</i> Open Low Heath
7	<i>Olearia axillaris</i> , <i>Melaleuca huegelii</i> and <i>Spyridium globulosum</i> Closed Low Heath	17	<i>Spyridium globulosum</i> and <i>Olearia axillaris</i> Open Heath
8	<i>Frankenia pauciflora</i> , * <i>Tetragonia decumbens</i> and <i>Threlkeldia diffusa</i> Open Low Heath	18	<i>Lepidosperma gladiatum</i> and scattered * <i>Pelargonium capitatum</i> Sedgeland
9	Scattered <i>Dryandra sessilis</i> over <i>Olearia axillaris</i> , <i>Melaleuca huegelii</i> and <i>Spyridium globulosum</i> Open Heath	D	Degraded - cannot define vegetation community
10	Recently burnt <i>Dryandra sessilis</i> , <i>Calothamnus quadrifidus</i> with scattered <i>Acacia cyclops</i> Open Heath	B	Recently burnt - cannot define vegetation community
			Inferred Threatened Ecological Community



MAP 1: VEGETATION COMMUNITIES OF THE QUINNS ROCK - MINDARIE FORESHORE

CLIENT: CITY OF WANNEROO
 PROJECT: MINDARIE TO QUINNS ROCK FORESHORE MANAGEMENT PLAN
 JOB NO: 1083
 DATE: 21-08-03

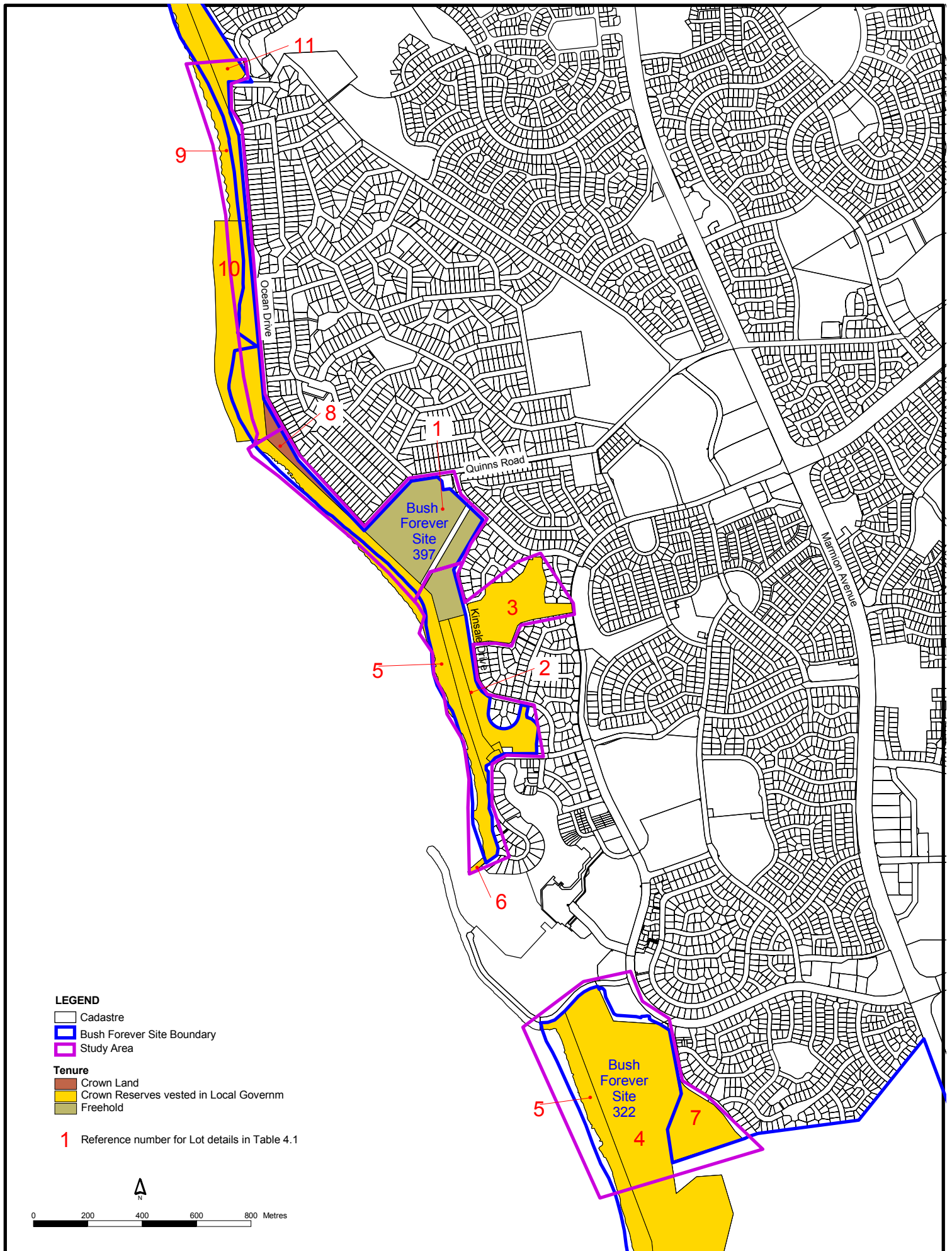




MAP 2: BUSHLAND CONDITION FOR THE QUINNS ROCK - MINDARIE FORESHORE

CLIENT: CITY OF WANNEROO
 PROJECT: MINDARIE TO QUINNS ROCK FORESHORE MANAGEMENT PLAN
 JOB NO: 1083
 DATE: 21-08-03





LEGEND

- Cadastre
- Bush Forever Site Boundary
- Study Area

Tenure

- Crown Land
- Crown Reserves vested in Local Governm
- Freehold

1 Reference number for Lot details in Table 4.1



0 200 400 600 800 Metres

Map 3: Tenure and Bush Forever Boundaries

CLIENT:	CITY OF WANNEROO
PROJECT:	MINDARIE TO QUINNS ROCK FORESHORE MANAGEMENT PLAN
JOB NO:	1083
DATE:	21-08-03





Map 4: Management Zones, Nodes and Existing Facilities

CLIENT:	CITY OF WANNEROO
PROJECT:	MINDARIE TO QUINNS ROCK FORESHORE MANAGEMENT PLAN
JOB NO:	1083
DATE:	21-08-03





Map 5: Infrastructure, Proposed Facilities, Dune Blowouts and Shoreline Hazard

CLIENT: CITY OF WANNEROO
 PROJECT: MINDARIE TO QUINNS ROCK FORESHORE MANAGEMENT PLAN
 JOB NO: 1083
 DATE: 21-08-03



References

Foreshore Management Plan: Mindarie – Quinns Rocks

- Alan Tingay and Associates (1998) *Vertebrate Fauna – Dalyellup Beach Estate, Shire of Capel*. Unpublished report for Homeswest, Home Building Society and Satterley Real Estate.
- Armstrong, A; Brigg, P; and Leahy, S (1999) *Coastal Safety Audit City of Wanneroo Beaches, WA* Unpublished report for City of Wanneroo, Western Australia
- BBG (2003) *Foreshore Vegetation Survey and Management Recommendations Mindarie, Yanchep and Two Rocks* Bowman Bisham Gorham, Subiaco, Western Australia
- Bradley J (1971) *Bush Regeneration* Mosman Parklands and Ashton Park Association, Sydney, New South Wales
- Bradley J (1988) *Bringing Back the Bush: the Bradley Method of Bush Regeneration* Landsdowne Press, Sydney, New South Wales
- City of Wanneroo (1991) *Hillarys Beach – Hillarys Park Foreshore Management Plan* City of Wanneroo Town Planning Department, Western Australia
- City of Wanneroo (2000) *Bush Fire Control* (Online) Available at URL: <http://www.wanneroo.wa.gov.au/atoz/ranger/bushf.html> [Last accessed 06/08/03]
- City of Wanneroo (2002a) *Media Release - Groynes Preferred Option for Quinns Beach* (Online) Available at URL: <http://www.wanneroo.wa.gov.au/> [Last accessed 01/09/03]
- City of Wanneroo (2002b) *Our People Our Future – City of Wanneroo Strategic Plan 2002 – 2005*. Wanneroo, WA.
- City of Wanneroo (2002c) *Draft Local Structure Plan Lot 211 Ocean Drive Mindarie* Unpublished report prepared for the Western Australian Planning Commission, Western Australia
- City of Wanneroo (2002d) *City of Wanneroo Local Environmental Strategy – A New Direction* September, 2002.
- Churchward, HM and McArthur, WM (1980) *Landforms and Soils of the Darling System Western Australia*. In *Department of Conservation and Environment, Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

- Coastwise (1999) *Metropolitan Beach User Survey: 7 February 1999* Unpublished report prepared for the City of Wanneroo, Western Australia
- Department of Conservation and Environment (1983) Environmental Protection Authority – 1983: The Darling System - System 6 Part II: Recommendations for Specific Localities Report 13. Department of Conservation and Environment, Perth Western Australia
- Department of Conservation and Land Management (CALM) (1992) *Dieback Disease Hygiene Manual* Department of Conservation and Land Management, Perth, Western Australia
- Department of Conservation and Land Management (CALM) (1999) *Environmental Weed Strategy for Western Australia* Includes *weedBase* – a digital weed database. Department of Conservation and Land Management, Perth, Western Australia
- Department of Conservation and Land Management (CALM) (2000)
- Department of Conservation and Land Management (CALM) (2003) *Priority Flora List 2003* (Online) Available at URL: <http://www.naturebase.net/science/florabase.html> [Last accessed 08/08/03]
- Department of Environmental Protection (DEP) (1995). *Southern Metropolitan Coastal Waters Study (1991 – 1994) Final Report*.
- Department of Foreign Affairs (1995) *JAMBA Agreement. Agreement Between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment*. Australian Government Publishing Service, Canberra, ACT
- Department of Indigenous Affairs (2003) *Register of Aboriginal Sites* (Online) Available at URL: http://www.aad.wa.gov.au/Heritage/heritage_sites_register.aspx [Last accessed 11/08/03]
- Dixon, B and Keighery, G (1995) Weeds and their Control. In: Scheltema M and Harris J (Eds) *Managing Perth's Bushlands* Pp. 65-141. Greening WA, Perth, Western Australia.
- Ecoscope (2003) *Trails Master Plan Stage 1 – City of Wanneroo* Unpublished report prepared for the City of Wanneroo, Western Australia
- English, V., Blyth, J. (1997) *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*. ANCA National Reserves System Cooperation Program, Project Number N702. Western Australian Threatened Species Unit, W.A. Department of Conservation and Land Management, Perth, Western Australia

- Environmental Protection Authority (1994) *Proposal to change land use affecting System Six areas and lakes protected under the Environmental Protection Policy to Urban, Industrial, Special Uses and transportation purposes, to be reflected in the major Metropolitan Region Scheme Amendments for the South West Corridor. Report and Recommendations of the Environmental Protection Authority* EPA Bulletin 746. EPA, Perth, Western Australia
- Fire and Rescue Service of Western Australia (1997) *Incident Statistics 1996/97* Published by Government of Western Australia, WA Fire Brigades Board and Fire and Rescue Service, Perth, Western Australia
- Fire and Rescue Service of Western Australia (1998) *Incident Statistics 1997/98* Published by Government of Western Australia, WA Fire Brigades Board and Fire and Rescue Service, Perth, Western Australia.
- Gibson, N., Keighery, G.J., Burbidge, A.H., Lyons, M.N. (1994) *A Floristic Survey of the Swan Coastal Plain*. Unpublished Report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).
- Government of Australia (1995) *Living on the Coast: - The Commonwealth Coastal Policy*.
- Government of Western Australia (2000) *Bush Forever Volume 2 – Directory of Bush Forever Sites* Department of Environmental Protection, Perth, Western Australia
- Government of Western Australia (2001) *Draft Coastal Zone Management Policy for Western Australia*
- Hames Sharley (1992) *Coastal Planning Study - Burns Beach to Jindalee Technical Report* Hames Sharley Australia, Subiaco, Western Australia
- Heddle, EM, Loneragan, OW and Havel JJ (1980) Vegetation complexes of the Darling System Western Australia. In: Department of Conservation and Environment, *Atlas of Natural Resources Darling System Western Australia* Department of Conservation and Environment, Perth, Western Australia
- James, B (1994) *Mindarie Foreshore Reserve Management Plan Mindarie Keys Harbour Estate for Gumflower Pty Ltd* Bill James Landscape Architecture, Perth, Western Australia
- Jones, AK and Gole, C (2003) *Birds and Reserves of the City of Wanneroo: A Survey and Review* Birds Australia WA Inc, Floreat, Western Australia
- K.A. Adam and Associates (2003) *Old Quinns Rocks Residential Planning Study – Recommended Residential Planning Strategy and Study Report* Unpublished report prepared for the City of Wanneroo, Western Australia

- Kaesehagen, DB (1995) Bushland Condition Mapping, in: *Invasive Weeds and Regenerating Ecosystems in Western Australia* G Burke (ed), Institute for Science and Technology Policy, Murdoch University, Murdoch, Western Australia
- Kimseed Environmental (2000) *Australian Native Seed Catalogue 2000/2001* Kimseed Environmental Pty Ltd, Perth, Western Australia
- MP Rogers and Associates (1999) *Quinns Beach Coastal Protection Works Stage 1 Report* MP Rogers and Associates, Osborne Park, Western Australia
- MP Rogers and Associates (2001) *Quinns Beach – Erosion Risk Management Study Report July 2001* MP Rogers and Associates and Fireplan WA, Osborne Park, Western Australia
- MP Rogers and Associates (2002) *City of Wanneroo Quinns Beach Erosion and Coastal Protection* MP Rogers and Associates, Osborne Park, Western Australia
- Oma, VPM, Clayton, DM, Broun, JB and Keating, CDM (1992) *Coastal Rehabilitation Manual* Department of Agriculture Bulletin 4248. Perth, Western Australia
- South Metropolitan College of TAFE (nd) *Coastal Rehabilitation Techniques* Unpublished course manual
- Tasker, K (2003) *Community Groups* (Online) Available at URL: http://www.mindariekeys.com.au/sites/mkpm/Community_Groups.asp [Last accessed 18/08/03]
- Trudgen, M. E. (1996) *An Assessment of the Conservation Values of the Remnant Vegetation in the City of Wanneroo with Recommendations for Appropriate Reserves for the City* Unpublished report prepared for the City of Wanneroo, Western Australia
- WAPC (1997) *State Planning Strategy*. Western Australian Planning Commission.
- WAPC (2002) *The Review of the Structural Arrangements for Coastal Planning and Management in Western Australia*. Western Australian Planning Commission
- WAPC (2003a) *Statement of Planning Policy No. 2.6 – State Coastal Planning Policy*. Prepared under section 5AA of the Town Planning and Development Act 1928. Western Australian Planning Commission.
- WAPC (2003b) *Statement of Planning Policy No. 2 – Environment and Natural Resources Policy*. Western Australian Planning Commission
- Western Australian Museum (1978) *Faunal Studies of the Northern Swan Coastal Plain – A Consideration of Past and Future Changes* Department of Conservation and Environment, Perth, Western Australia

Wycherley, RR and Robley, J (1983) The Bush Fire Risk in the Perth Metropolitan Region.
In: Moore S (Ed) *The Management of Small Bush Areas in the Perth Metropolitan Region*. Pp. 6-10. Proceedings of a seminar held on 20/09/83 by the Department of Fisheries and Wildlife

Woods, PJ (1984) *Results of the Wanneroo Coastal Study with Draft Goal, Objectives and Recommendations for a Coastal Management Policy*. Unpublished report prepared for the Shire of Wanneroo, Western Australia

Appendix One: Flora Survey Methods

Foreshore Management Plan: Mindarie – Quinns Rocks

Objectives

The purpose of the flora survey was to document the flora and vegetation occurring within the Mindarie to Quinns Rocks foreshore study area. This information was gathered and prepared in order to develop a comprehensive foreshore management plan for the entire Quinns Rocks coastal area.

The scope of work included:

- undertake a field survey to assess flora and vegetation values;
- record all flora species observed within recording sites;
- assess and map the condition of the vegetation in the survey area;
- make note of major weed occurrences and opportunistic recording of weed species;
- review the significance and conservation status of the vascular plant species and assemblages by reference to: current literature; current listings by the Department of Conservation and Land Management (CALM); plant collections held at the State Herbarium and the Federal EPBC Act schedules;
- define and map the native vegetation community types; and
- document the findings from the survey.

Methods

Desktop review

Literature relevant to coastal vegetation, the general study area and broadscale mapping of the Mindarie and Quinns Rocks area of the Swan Coastal Plain was reviewed prior to field work. Unpublished reports detailing vegetation of the study area (BBG, 2003) and the general area (Trudgen, 1996) were also reviewed to become familiar with the vegetation of the local area.

Flora Survey

Prior to fieldwork, a record search was carried out of CALM's Declared Rare and Priority Flora database for species known to occur in the general area (CALM, 2003). Relevant species were examined at the Western Australian State Herbarium prior to the field survey being undertaken.

A botanist from Ecoscape undertook the field-based assessment over two days, in early August 2003. The site was surveyed by traversing the area on foot, using a compass and GPS unit. For each survey site, the dominant flora was systematically recorded using a relevé plot method and collections of plant specimens were made where further identification was required.

All plant specimens collected during the field survey were handled and identified in accordance with the requirements of the Western Australian Herbarium. Where required, specimens were compared with pressed specimens housed at the Herbarium, and where necessary plant taxonomists with specialist skills were consulted. Nomenclature of recorded species follows that recommended by the Western Australian Herbarium.

The flora and vegetation survey included opportunistic searches for Declared Rare and Priority Flora. Species of flora are defined as Rare or Priority conservation status where their populations are restricted geographically or threatened by local processes. CALM recognises these threats of extinction and consequently applies regulations towards population and species protection (see Appendix 7).

Rare Flora species are gazetted under subsection 2 of section 23F of the *Wildlife Conservation Act 1950* and therefore it is an offence to “take” or damage rare flora without Ministerial approval. Section 23F of the *Wildlife Conservation Act* defines “to take” as “... to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or cause or permit the same to be done by any means.”

The *Environment Protection and Biodiversity Conservation Act 1999* also protects significant flora and vegetation. Appendix 7 contains the definitions of the categories of threatened species under Section 179 of the Act.

Vegetation

The vegetation communities occurring within the survey area were described in detail in the field. The use of a standard data collection form ensured data were collected in a systematic and consistent manner. At each site the following records were also made:

- condition rating;
- degree of disturbance;
- topography;
- percentage litter cover;
- soil ratio;
- percentage bare ground;
- outcropping rocks and their type; and
- time since fire.

For each species recorded, the average height and percent foliage cover of species both alive and dead were noted. Aerial photography was used to extrapolate and map plant communities and condition, in combination with running notes made during the course of the survey.

Vegetation communities were assigned a ‘Condition Rating’ adopting the scale Kaesehagen (1995) which ranges in scale from ‘Very Poor’ to ‘Excellent’. This scale is reproduced in Appendix 7.

Limitations of Study

The flora and vegetation survey was undertaken during the winter, which generally precludes the observation of orchid and annual species and additionally, few plant species are flowering. This is not a problem within the context of a management plan but means that the number of recorded flora is far less than the total number of flora expected to occur. It is expected that this survey recorded approximately 60% of the total flora for the study area.

The purpose of the survey was to map broad vegetation associations with dominant species of each vegetation strata rather than to record every species within the study area. Therefore, it is possible that additional species of significant flora may not have been recorded/observed during the survey.

Kinsale Park was recently burnt and was therefore not able to be sampled or mapped accurately. From the burnt plant remains and adjacent vegetation it was possible to attribute an assumed vegetation type.

Appendix Two: Vegetation Communities

Foreshore Management Plan: Mindarie – Quinns Rocks

Vegetation Communities Described for Mindarie to Quinns Rocks Foreshore MP, August 2003.

	Comm Code	Vegetation description	Inferred FCT	Resv. Status	Consv. Status
1	CbOLH	<i>Calocephalus brownii</i> Open Low Heath over <i>Scaevola crassifolia</i> Low Shrubland over bare sand and exposed limestone with scattered herbaceous and grassy weeds.	?		
2	SgMiMhOS	<i>Spyridium globulosum</i> , <i>Myoporum insulare</i> and <i>Melaleuca huegelii</i> var. <i>huegelii</i> Open Shrubland over <i>Scaevola crassifolia</i> , <i>Rhagodia baccata</i> subsp. <i>dioica</i> over <i>Acanthocarpus preissii</i> , <i>Carpobrotus virescens</i> Very Open Herbland on grey-white sand.	30c	Unreserved	Insufficiently known
3	AcOaSgOH	<i>Acacia cyclops</i> , <i>Olearia axillaris</i> and <i>Spyridium globulosum</i> Open Heath over <i>Grevillea preissii</i> subsp. <i>preissii</i> , <i>Templetonia retusa</i> , <i>Acacia truncata</i> , <i>Lasiopetalum membranaceum</i> and <i>Melaleuca huegelii</i> var. <i>huegelii</i> Open Low Heath over <i>Desmocladus flexuosus</i> , <i>Dryandra lindleyana</i> var. <i>lindleyana</i> Very Open Herb/Sedgeland on grey-white sand with exposed limestone.	29a	Poorly reserved	Susceptible
4	AcMhSgOaOH	Scattered <i>Acacia cyclops</i> over <i>Melaleuca huegelii</i> var. <i>huegelii</i> , <i>Spyridium globulosum</i> and <i>Olearia axillaris</i> Open Heath over <i>Rhagodia baccata</i> subsp. <i>dioica</i> and * <i>Tetragonia decumbens</i> Low Open Shrubland over <i>Acanthocarpus preissii</i> , * <i>Euphorbia terracina</i> and * <i>Ehrharta</i> sp. Very Open Grass/Herb/Sedgeland on grey-white sand.	30c	Unreserved	Insufficiently known
5	MIAcLCF	<i>Melaleuca lanceolata</i> and <i>Acacia cyclops</i> Low Closed Forest over <i>Rhagodia baccata</i> subsp. <i>dioica</i> Low Open Shrubland over an * <i>Ehrharta</i> sp. Very Open Grassland on grey-white sand.	30a	Poorly reserved	Vulnerable
6	OaS	<i>Olearia axillaris</i> Shrubland over a <i>Scaevola crassifolia</i> Open Low Heath over * <i>Tetragonia decumbens</i> and <i>Spinifex longifolius</i> Very Open Herb/Grassland on grey sands.	S13	*>PMR/S	
7	OaMhSgCLH	<i>Olearia axillaris</i> , <i>Melaleuca huegelii</i> var. <i>huegelii</i> and <i>Spyridium globulosum</i> Closed Low Heath over <i>Rhagodia baccata</i> subsp. <i>dioica</i> and <i>Templetonia retusa</i> Low	26a	Unreserved	Susceptible

		Shrubland over <i>Acanthocarpus preissii</i> , <i>Hardenbergia comptoniana</i> and <i>Lepidosperma gladiatum</i> Very Open Sedge/Herbland on grey sand with occasional limestone outcropping.			
8	FpTdTdOLH	<i>Frankenia pauciflora</i> , * <i>Tetragonia decumbens</i> and <i>Threlkeldia diffusa</i> Open Low Heath over <i>Carpobrotus virescens</i> over bare ground on limestone cliffs.	16	Poorly reserved	Vulnerable
9	DsOaMhSgOH	Scattered <i>Dryandra sessilis</i> var. <i>cygnorum</i> over <i>Olearia axillaris</i> , <i>Melaleuca huegelii</i> var. <i>huegelii</i> and <i>Spyridium globulosum</i> Open Heath over <i>Calothamnus quadrifidus</i> , <i>Grevillea preissii</i> subsp. <i>preissii</i> , <i>Templetonia retusa</i> , * <i>Pelargonium capitatum</i> and <i>Rhagodia baccata</i> subsp. <i>dioica</i> Open Low Heath over a Very Open Grassland of assorted weeds on grey sands.	29b/30c	Unreserved or poorly reserved	Insufficiently known / susceptible
10	Burnt DsCqAcOH	Recently burnt, most similar to 11.	30c	Unreserved	Insufficiently known
11	DsCqAcOH	<i>Dryandra sessilis</i> var. <i>cygnorum</i> , <i>Calothamnus quadrifidus</i> with scattered <i>Acacia cyclops</i> Open Heath over <i>Rhagodia baccata</i> subsp. <i>dioica</i> , <i>Leucopogon parviflorus</i> and <i>Hibbertia hypericoides</i> Low Shrubland over <i>Desmocladius flexuosus</i> , * <i>Euphorbia terracina</i> and * <i>Gladiolus caryophyllaceus</i> Very Open Herb/Sedgeland on grey sands.	30c	Unreserved	Insufficiently known
12	AcCTS	<i>Acacia cyclops</i> Closed Tall Scrub over <i>Grevillea preissii</i> subsp. <i>preissii</i> , <i>Phyllanthus calycinus</i> and <i>Rhagodia baccata</i> subsp. <i>dioica</i> Low Open Shrubland over a <i>Conostylis aculeata</i> subsp. <i>aculeata</i> , * <i>Euphorbia terracina</i> and assorted grassy weeds Open grass/herbland on grey-brown sands.	?26a	Unreserved	Susceptible
13	AIMhSaOLH	<i>Acacia truncata</i> , <i>Melaleuca huegelii</i> var. <i>huegelii</i> and <i>Scaevola anthesisifolia</i> Open Low Heath over <i>Melaleuca systema</i> , <i>Phyllanthus calycinus</i> , <i>Grevillea preissii</i> subsp. <i>preissii</i> and <i>Dryandra lindleyana</i> var. <i>lindleyana</i> Low Open Shrubland over <i>Desmocladius flexuosus</i> , <i>Lomandra maritima</i> and <i>Carpobrotus</i> sp. on dark grey sand with exposed limestone.	26a	Unreserved	Susceptible
14	OaOS	<i>Olearia axillaris</i> Open Shrubland over <i>Scaevola crassifolia</i> , * <i>Pelargonium capitatum</i> and <i>Rhagodia baccata</i> subsp. <i>dioica</i> Shrubland over <i>Lepidosperma gladiatum</i> Open Sedgeland with numerous herbaceous and annual weeds on white sand.	S13	*>PMR/S	
15	ArOaS	<i>Acacia ?rostellifera</i> and <i>Olearia axillaris</i> Shrubland over <i>Lepidosperma gladiatum</i> Open Sedgeland with numerous grassy weeds within dune swales.	S13	*>PMR/S	

16	OaScPcEtOLH	Scattered <i>Olearia axillaris</i> over <i>Scaevola crassifolia</i> , <i>*Pelargonium capitatum</i> and <i>*Euphorbia terracina</i> Open Low Heath over <i>Lepidosperma gladiatum</i> Open Sedgeland with numerous grassy weeds on dune face.	S13	*>PMR/S	
17	SgOaOH	<i>Spyridium globulosum</i> and <i>Olearia axillaris</i> Open Heath over <i>Scaevola crassifolia</i> and <i>*Pelargonium capitatum</i> Low Open Shrubland over <i>*Euphorbia terracina</i> (or <i>Lepidosperma gladiatum</i> if within dune swales) Very Open Herbland on deep grey sands.	30c	Unreserved	Insufficiently known

Notes:

*>PMR/S – distribution goes well beyond the Perth Metropolitan Region (PMR) but is also the southernmost location in the PMR

Appendix Three: Plant Species Lists

Foreshore Management Plan: Mindarie – Quinns Rocks

Vascular Plant Species Recorded for the Mindarie – Quinns Rocks FMP

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Family	Genus and species																		
POACEAE	? <i>Austrostipa</i> sp.		x																
	* <i>Cynodon dactylon</i>																		
	* <i>Ehrharta</i> sp.		x		x	x	x		X										
	* <i>Lagurus ovatus</i>	x					x	x		x		x	X						
	<i>Poa</i> sp.	x																	
	<i>Spinifex longifolius</i>						X												
CYPERACEAE	<i>Isolepis nodosa</i>		X					x											
	<i>Lepidosperma gladiatum</i>			x			x	X											x
	<i>Lepidosperma squamatum</i>												X						
RESTIONACEAE	<i>Desmocladus flexuosus</i>																		
ASPHODELACEAE	<i>Trachyandra divaricata</i>		x		x		x	x					x		x	x			x
DASYPOGONACEAE	<i>Acanthocarpus preissii</i>	x	x	x	x		x	x							x	x	x		
	<i>Lomandra maritima</i>			x	x					x				x	x	X			
PHORMIACEAE	<i>Dianella revoluta</i> var. <i>divaricata</i>																		
HAEMODORACEAE	<i>Conostylis aculeata</i> subsp. <i>aculeata</i>			x									X		x	x			
IRIDACEAE	* <i>Gladiolus caryophyllaceus</i>									X		x							
	* <i>Romula rosea</i>												X						
AGAVACEAE	* <i>Agave americana</i>																		
ORCHIDACEAE	<i>Caladenia</i> sp.			X															
CASUARINACEAE	<i>Allocasuarina lehmanniana</i> subsp. <i>lehmanniana</i>																		
PROTEACEAE	<i>Calothamnus quadrifidus</i>		x							x		x	X						
	<i>Dryandra lindleyana</i> var. <i>lindleyana</i>		x	X															

Appendix Three

	<i>Dryandra sessilis</i> var. <i>cygnorum</i>			x	x				x		x		X					
	<i>Grevillea preissii</i> subsp. <i>preissii</i>			x							x	x	X					
	<i>Hakea lissocarpha</i>																	
	<i>Hakea prostrata</i>			X							x							
	<i>Hakea trifurcata</i>																	
	<i>Petrophile</i> <i>serruriae</i>			x									X					
SANTALACEAE	<i>Exocarpos</i> <i>sparteus</i>		X		x													
	<i>Santalum</i> <i>acuminatum</i>								X									
CHENOPODIACEAE	<i>Rhagodia baccata</i> subsp. <i>dioica</i>	x	x		x	x			x		x	x		x	X			
	<i>Threlkeldia diffusa</i>	x						X	x					x	X			
AIZOACEAE	* <i>Carpobrotus</i> <i>edulis</i>		x				x											x
	<i>Carpobrotus</i> <i>virescens</i>							x	x	x		x		X				
	* <i>Tetragonia</i> <i>decumbens</i>		x	x	x		x						x	x	x	x		
PORTULACEAE	<i>Calandrinia</i> sp.																	
RANUNCULACEAE	<i>Clematis</i> <i>linearifolia</i>																	
LAURACEAE	<i>Cassytha</i> <i>racemosa</i>			x				x		x			X					
DROSERACEAE	<i>Drosera</i> sp. (climbing)													X				
MIMOSACEAE	<i>Acacia cochlearis</i>																	x
	<i>Acacia cyclops</i>		x	x		x	x	x			x	X						
	<i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i>		x															
	<i>Acacia truncata</i>			X										x				
	<i>Acacia pulchella</i> var. <i>glaberrima</i>														x	X		
	<i>Acacia</i> <i>?rostellifera</i>															X		
	<i>Acacia saligna</i>				X													
PAPILIONACEAE	<i>Bossiaea</i> <i>eriocarpa</i>		x						X									
	<i>Gompholobium</i> <i>tomentosum</i>		X															
	<i>Hardenbergia</i> <i>comptoniana</i>		x	x	x	x		x		x		x	x	x	x	x	x	x
	<i>Hovea trisperma</i>										X							
	<i>Nemcia reticulata</i>																	
	<i>Templetonia</i> <i>retusa</i>		x	x		x		x		x				x	X			
GERANIACEAE	* <i>Pelargonium</i> <i>capitatum</i>		x				x		x			x		x	x	x		x
OXALIDACEAE	* <i>Oxalis</i> sp.																	
EUPHORBIACEAE	* <i>Euphorbia</i> <i>terracina</i>		x		x		x		x		x	x					x	x

	<i>Phyllanthus calycinus</i>			X															
	* <i>Ricinus communis</i>											x	x						
RHAMNACEAE	<i>Spyridium globulosum</i>		x	x	x				x		x				x	x			x
	<i>Trymalium ledifolium</i> subsp. <i>ledifolium</i>																		
STERCULIACEAE	<i>Lasiopetalum membranaceum</i> P3				X														
DILLENACEAE	<i>Hibbertia ?stellaris</i>				X														
	<i>Hibbertia hypericoides</i>											x		X					
FRANKENIACEAE	<i>Frankenia pauciflora</i>		x					x		X									
MYRTACEAE	<i>Eucalyptus decipiens</i>												X						
	<i>Melaleuca systena</i>													x	x	x	X		
	<i>Melaleuca cardiophylla</i>			x	x					X				x	x	x	x		
	<i>Melaleuca huegelii</i> var. <i>huegelii</i>		x		X				x						x				
	<i>Melaleuca lanceolata</i>							X											
	* <i>Melaleuca nesophila</i>																		
APIACEAE	* <i>Foeniculum vulgare</i>																		
EPACRIDACEAE	<i>Astroloma microcalyx</i> P3				X														
	<i>Leucopogon parviflorus</i>				x											x	X		
PRIMULACEAE	* <i>Anagallis arvensis</i>																		
LAMIACEAE	<i>Hemiandra pungens</i>															X	x		x
SOLANACEAE	* <i>Solanum nigrum</i>												X						
MYOPROACEAE	<i>Eremophila glabra</i>				X				x										
	<i>Myoporum insulare</i>		x																x
GOODENIACEAE	<i>Lechenaultia linarioides</i>																		
	<i>Scaevola crassifolia</i>	x	x			x													x
	<i>Scaevola anchusifolia</i>					x													x
ASTERACEAE	* <i>Dimorphotheca ecklonis</i>																		
	* <i>Sonchus oleraceous</i>			x															
	<i>Olearia axillaris</i>	x		x	x		x	x		x					x	x			x
	* <i>Gazania linearis</i>																		
	<i>Calocephalus brownii</i>	x																	

Appendix Four: Avifauna

Foreshore Management Plan: Mindarie – Quinns Rocks

Avifauna of the Study Area

(Source: Jones and Gole, 2003)

Nankeen Kestrel	<i>Falco cenchroides</i>
Silver Gull	<i>Larus novaehollandiae</i>
Laughing Turtle-Dove	<i>Streptopelia chinensis</i>
Carnaby's Black Cockatoo	<i>Calyptorhynchus banksii</i>
Galah	<i>Eolophus (Cacatua) roseicapilla</i>
Australian Ringneck	<i>Barnadius zonarius</i>
Splendid Fairy Wren	<i>Malurus splendens</i>
White Winged Fairy Wren	<i>Malurus leucopterus</i>
White Browed Scrub Wren	<i>Sericornis frontalis</i>
Western Thornbill	<i>Acanthiza inornata</i>
Yellow Rumped Thornbill	<i>Acanthiza chrysorrhoa</i>
Red Wattlebird	<i>Anthochaera carunculata</i>
Little Wattlebird	<i>Anthochaera lunulata</i>
Singing Honeyeater	<i>Lichenostomus virescens</i>
Brown Honeyeater	<i>Lichmera indistincta</i>
New Holland Honeyeater	<i>Phylidonyris novaehollandae</i>
White Cheeked Honeyeater	<i>Phylidonyris albifrons</i>
Western Spinebill	<i>Acanthorhynchus superciliosus</i>
Scarlet Robin	<i>Petroica multicolor</i>
White Breasted Robin	<i>Eopsaltria pulverulenta</i>
Rufous Whistler	<i>Pachycephala rufiventris</i>
Grey Fantail	<i>Rhipidura fuliginosa</i>
Willie Wagtail	<i>Rhipidura leucophrys</i>
Black Faced Cuckoo Shrike	<i>Coracina novaehollandiae</i>
Dusky Woodswallow	<i>Artamus cyanopterus</i>
Grey Butcherbird	<i>Cracticus torquatus</i>
Silvereye	<i>Zosterops lateralis</i>

Appendix Five: Issues and Recommendations Status from Previous Studies

Foreshore Management Plan: Mindarie – Quinns Rocks

North Mindarie Beach

Coastal Planning Study – Burns Beach to Jindalee Technical Report (Hames Sharley, 1992)

Issue	Still relevant?
Rubbish dumping and vehicles ruining Tuart Grove area	No rubbish but signs of vehicles
Development of the area is not feasible due to the chaotic terrain. SLSC identified need for SLC facilities but not really any suitable place for this.	Yes

Recommendation	Implemented?
High dune to the south of breakwater road provides good views of the coast. Path, steps and lookout proposed.	No

Mindarie Beach Foreshore Reserve Management Plan (James, 1994)

Issue	Still Relevant?
Dunes have been degraded (mostly 4WD and grazing)	Yes – sandboarding also having an impact
Recreational activities such as swimming will be more common as development increases. Particularly during the summer. Southern part of beach more attractive but is a bit too far from the carpark on Alexandria View. The carpark at Tuart Grove was built for this purpose.	Yes – Car park built but has been closed since.
Access by 4WD's a problem. Close access.	Yes - Access closed but recent signs of 4WD activity

Recommendation	Implemented?
Surfing is the principle recreational activity (mostly during winter). Requires a lookout area near the carpark.	Yes – however fence has been cut for better view of waves
Quinns Mindarie SLSC identified the need for a building and removable platform on the beach with a 4WD access track to the beach.	No
Extraneous tracks need to be closed. Convert to Lookouts.	No
Formalise some existing paths. Limestone paths should be in place from Mindarie Keys Development.	Yes

Recommendation	Implemented?
Tuart Grove picnic area in a shady dune swale developed	Yes – Consists of two picnic tables that have since been destroyed
Fencing should have be constructed on the boundary of long beach prom, along paths and around Tuart Grove.	Boundary fence constructed. No fencing along paths or around Tuart Grove
Sand hill adjacent to Long Beach Prom should be stabilised (rehab and stone spalled batters).	Yes
As funds become available from land sales: Lookouts, access paths (N-S), steps to beach at Alexandria View, carpark near Tuart Grove, toilets and showers (Alexandria View), Tuart grove picnic area, sand trapping fences (blowout on E-W Access track), brushing and seeding of eroded areas	No Yes Yes Yes – now closed No Yes No If done largely unsuccessful

Coastal Safety Audit – City of Wanneroo Beaches (Armstrong *et al.*, 1999)

Issue	Still relevant?
Tuart Grove Car park and picnic area seem rarely utilised as access restricted to foot traffic.	Yes – gravel carpark being rehabilitated.
No formal access to beach from car park and picnic areas.	Yes
Permanent rip along northern headland of Mindarie Beach, numerous other rips.	Yes
Surf action close to shore. Submerged rocks north of blow out.	Yes
Carpark #1 access track leads straight to permanent rip.	Yes
Sign at Carpark #1. Symbols on signs don't conform to AS. also vandalized and in disrepair. Inappropriate no sand boarding sign (not AS).	Yes
Inappropriate signs at carpark #2.	Yes

Recommendation	Implemented?
Alexandria View carpark needs advice of hazards, rubbish bins and locations of services.	Wheelie bins installed. Signage not implemented
Carpark #2 closed off from public access by removable poles. Picnic area no longer maintained. Needs to be advice of hazards and service locations. Also maintenance program for Tuart Grove.	No
Carpark #1 need signs, also informal path to limestone rocks. Needs fencing at bottom of steps to restrict access to limestone rocks.	No
Formalised access track, unsuitable, not maintained and lead to top of dune. Fence needs to be removed and track rehabilitated. Major need to repair and upgrade access tracks.	No
Signage should display all applicable council prohibitions and to AS 2416	No

Foreshore Vegetation Survey and Management Recommendations – Mindarie (BBG, 2003)

Issue	Still relevant?
Priority Three Flora species trigger plant <i>Stylidium maritimum</i> found in one area on the Mindarie Foreshore.	Yes
Erosion risks and rehabilitation requirements in dunes are very high.	Yes

Recommendation	Implemented?
Entire beach area / dune faces require native species replanting, at rate of 1 plant per square metre.	No
Construction of concrete paths between foreshore areas and residential areas will reduce property vulnerability to fire	No
Fencing is recommended to protect revegetated areas and deter dune access, eg pine bollards.	No
Native species observed regularly along dune faces and beach areas should be planted along beach lines and dune faces.	No
Brushing of areas requiring significant rehabilitation should be undertaken.	Minor brushing
Removal of weeds should be staged and replanting should be undertaken concurrently to maintain soil holding capacity.	No

Mindarie Keys to Quinns Beach

Coastal Planning Study – Burns Beach to Jindalee Technical Report (Hames Sharley, 1992)

Issue	Still Relevant?
Paths not fenced but little evidence of degradation except on northern headland west of carpark.	Fencing on seaward side (poor condition)
Non-indigenous vegetation planted.	No (except car park and roadside amenity planting))

Recommendation	Implemented?
Cycle route through Mindarie keys to be reinstated after development	Yes
Need for pedestrian trail over headland area to reduce disturbance.	Yes

Coastal Safety Audit – City of Wanneroo Beaches (Armstrong *et al.*, 1999)

Issue	Still Relevant?
area sheltered by reef, submerged rocks in area	Yes
few clear access points into water. Those that do have continuous rips.	Yes
Formalised paths hazardous, numerous trip hazards and large drop-offs.	Yes
Keep out signage ignored	Yes

Recommendation	Implemented?
Area is extremely hazardous with limestone cliffs and submerged rocks. Access should be restricted.	Not effectively

Kinsale Park

Kinsale Park Rehabilitation Demonstration Site Plan

Issue	Still Relevant?
Rehabilitation demonstration site on the corner of Kinsale Park and Dungannon Rise (65 m X 15 m)	Yes
Protected by bollards	Yes

Quinns Beach

Coastal Planning Study – Burns Beach to Jindalee Technical Report (Hames Sharley, 1992)

Issue	Still Relevant?
Reserve width is minimal, especially adjacent to caravan park however this is where limestone occurs closest to the coast and no problems are anticipated.	Yes
Part of the lot for the new SLSC is unstable (tamala limestone passes inland) and future development should take this into account.	Yes
Little scope for development.	Yes at North Quinns
Small boat launching facility – frequently unable to be used as there is no protection.	Yes
Vacant lot adjacent to southern car park is leased to a caravan park owner. Part of the lot is potentially unstable due to the Tamala limestone ridge passing inland. Any future use would need to take into account this instability.	Yes

Recommendation	Implemented?
Both car parks could benefit from the planting of trees and improving the aesthetics of their settings.	No
Existing surf lifesaving, located in the central parking area, should remain on a temporary basis until a permanent site is identified.	Yes

Quinns Beach Coastal Protection Works Stage 1 Report (M.P. Rogers and Associates, 1999)

Issue	Still Relevant?
Condition of sea wall along Southern Car Park has deteriorated over time.	No
Limited buffer between Northern Beach and car park, and trees which shade picnic area to south are being undermined.	Yes
Significant erosion is observed to the north and accretion is noted to the south. Also observed is a band of erosion along a section of the primary dune of the Southern Beach.	Yes

Recommendation	Implemented?
Additional protection to the northern car park should be provided through an increase in the buffer or through structural protection.	No

Recommendation	Implemented?
Sand renourishment on an as needed basis in response to severe storm erosion at both Northern and Southern Beaches.	Yes
A low strength seawall may be constructed to protect the Northern Car Park and the southern flank of Ocean Drive.	No
Headland or groyne construction to alter the coastal dynamics and remove the annual deficit with significant beach nourishment to form wider foredunes as a storm buffer.	Yes

Quinns Beach Erosion Risk Management Study Report (M.P. Rogers and Associates, 2001)

Issue	Still Relevant?
Sections of the beach have incurred erosion, with the recession of the foreshore threatening to undermine public assets and reduce the recreation amenity of the beaches.	Yes

Recommendation	Implemented?
Essential that ongoing sand nourishment along northern flank be continued.	Yes
Placement of rock along the erosion scarp would halt erosion	No
Removal or relocation of several works: powerlines and light pole on seawall side of carpark; septic tanks, toilet blocks and road drainage infrastructure; relocation of debris from the beach.	No
Manage public safety issues created by steep erosion scarps by controlling access, erecting warning signs, public awareness and possibly reshaping the erosion scarp.	Yes – limited success

City of Wanneroo Quinns Beach Erosion and Coastal Protection (M.P. Rogers and Associates, 2002)

Issue	Still Relevant?
Coastal erosion problems at Quinns Rocks for many decades.	Yes
Between 1977 and 1997 the coastal vegetation line near the Northern Carpark and Toilet Block has retreated about 20 metres.	Yes

Recommendation	Implemented?
Option 1: construction of three groynes and large scale initial nourishment to saturate the groynes. Main focus from Frederick Stubbs Reserve to the coast near Tapping Way to the north.	Yes – third groyne to be completed
Option 2: Rock headlands, similar to the existing headland built at the cusp in 1977. Position of headlands would be same spacing as for groynes.	No
Option 3: Build a rock seawall and complete ongoing sand nourishment.	No

Quinns Rocks Estate Stage 2 Foreshore Management Plan (Alan Tingay and Associates, 1999)

Recommendation	Implemented?
Dual use path to be constructed at Quinns Rocks Estate	Yes

Coastal Safety Audit – City of Wanneroo Beaches (Armstrong *et al.*, 1999)

Issue	Still Relevant?
Extreme erosion in front of the Quinns-Mindarie SLSC has created unsettled dunal conditions.	Yes
Beach can be considered moderately hazardous.	Yes
Limited signage regarding identified hazards at the beach; signs erected are in disrepair or do not meet Australian Standards.	Yes
No surf safety messages in the region	Yes

Recommendation	Implemented?
Permanent fencing is required to restrict access to the beach from the playground in the south.	Yes
Continual maintenance is required to ensure boat ramp near surf club is serviceable.	N/A
Car park #2 has fencing in disrepair and requires fixing. Should be sealed.	No
Steps at bottom of access path from carpark 2 have eroded and are a trip hazard and should be repaired.	No
All signage should display applicable Council Prohibitions and meet AS 2416.	No
Maintenance program required to ensure facilities and fencing are adequate and serviceable.	Yes

Old Quinns Rocks Residential Planning Study: Recommended Residential Planning Strategy (K.A. Adams and Associates, 2003)

Recommendation	Implemented?
Street tree planting of appropriate species native to the coast and providing substantial shade.	No
Provide cycle paths along and to the beachfront	No
Plant native coastal lower-storey planting on street verges and public parks	No
Provide for a purpose designed aged person's development	No
Attractive and appropriate landscaping and street treatment to Ocean Drive, considering pedestrian safety, car parking and access to beach front	No
Retention of natural areas within the suburb and consideration of the preservation of significant trees not within reserves.	No
Installation of additional children's play areas	No

Appendix Six: Bradley Method of Bush Regeneration

Foreshore Management Plan: Mindarie – Quinns Rocks

The aim of bush regeneration by the Bradley method is the systematic removal of weeds to allow native plants to re-establish themselves when and where they choose. This method does not involve replanting – simply the gradual removal of weeds so that no large openings are made. This makes the Bradley method ideal for many situations, such as where native plants are able to colonise the site by seeds or vegetative means, areas sensitive to erosion and areas likely to be over-used.

UNDERLYING PRINCIPLES

1. Always work from areas with native plants towards weed-infested areas.

This makes good ecological sense. If you are relying on natural regeneration then choose areas that will contain the maximum number of existing native plants and native plant seeds, and minimal weed seeds and vegetative reproductive organs of weeds.

2. Make minimal disturbance.

Application of this principal depends on the native species to regenerate. Many plant communities (both weeds and native) need disturbed and sunlit soil for successful regeneration. However, by following the 1st principle above, any weed regeneration should be minimised. Any soil that is disturbed should be returned in its original layers, thus ensuring that any native seed stored in the soil will still be on top. This principle also applies to the application of natural plant mulch in the work area – where a gap is left as a result of weeding, it is recommended that mulch from surrounding areas be added to the gap. This helps to minimise weed regeneration.

3. Let native plant regeneration dictate the rate of weed removal.

The ability to follow this principle may depend on the amount of time and money committed to a particular project. If few weeds and many native plants regenerate, or if the ground remains weed free, little time will need to be spent re-weeding a site, allowing time to be spent on other sites. If masses of weeds regenerate then a lot of time will be required re-weeding so that regenerating native plants can flourish.

DEVELOPING WORK PLANS

1. Prevent deterioration of good areas.

Start by removing weeds scattered through otherwise clean bush. Practically no follow up work will be needed, but it should be checked once or twice a year.

2. Improve the next best area.

Once you are confident you have prevented deterioration of better condition bush, you can start work on thicker patches of weed. Choose a place you can visit easily and often, where thick native growth is pushing up against weeds, preferably no worse than one weed species to every two native plant species. Start with a strip approximately 12 feet wide and no longer than can be managed with monthly weeding days. If the area to be cleared of weeds runs up a slope that may erode, clear a number of smaller patches instead.

3. Hold the advantage gained.

Resist the temptation to push deeper into the weeds before regenerating natives have stabilised each cleared area. The natives do not need to be very tall, but they usually need to form an almost complete ground cover. Weeds will always nearly keep germinating until this is achieved. These newly regenerated areas are most vulnerable to weed reinvasion and so must be re-weeded as required. If weeding occurs adjacent to the regenerating area prior to sufficient new cover light from adjacent cleared patches can affect the regeneration of natives.

4. Cautiously move into the really bad areas.

When new growth coming up consists almost entirely of native plants with only a few weeds among them, it is safe to move deeper into the weeds. Keep working along the regeneration boundary, making new clearings smaller as the weeds get denser.

WEEDING TECHNIQUES

1. Disturb the soil as little as possible.

All tools used for weeding programmes should be small, such as a broad boning knife, trowels, secateurs, pliers (for pulling roots), loppers, hatchet and small saws. This recommendation is based on the belief that using small tools will cause minimum soil disturbance and minimal damage to the roots and shoots of nearby native plants.

2. Sweep back the mulch surface.

Any weeding will disturb the ground litter and soil will be exposed. Repair the damage as you go, by pushing back as much mulch as possible. It is often helpful to sweep aside mulch prior to removing large plants, so that it can easily be redistributed when you have finished removing the plant.

3. Mulch with the weeds themselves.

Weeds removed can be used to add to existing mulch. In dry areas leaving the weed with its roots exposed will be sufficient to kill it. In moist areas, hanging the weeds on nearby native vegetation will allow them to dry out and die. Some items are unsuitable for mulch, and these are removed from the site. Such items include bulbs and tubers, plants that root at every node and free-seeders with ripe seed.

4. Watch where you put your feet.

Be careful how you move through the bush. A small weeding party moving through thick bush single file can open up a track. Efforts should be made to not walk on the same paths all the time, and to watch where you walk to ensure you are not trampling native vegetation.

Appendix Seven: Classification Schemes

Foreshore Management Plan: Mindarie – Quinns Rocks

Definition of Rare and Priority Flora Species (Department of Conservation and Land Management, 2003)

Conservation Code	Category
R	Declared Rare Flora – Extant Taxa. “Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such.”
P1	Priority One – Poorly Known Taxa “Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as ‘rare flora’, but are in urgent need of further survey.”
P2	Priority Two – Poorly Known Taxa “Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (ie. not currently endangered). Such taxa are under consideration for declaration as ‘rare flora’, but urgently need further survey.”
P3	Priority Three – Poorly Known Taxa “Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (ie. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as ‘rare flora’ but need further survey.”
P4	Priority Four – Rare Taxa “Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.”

Bushland Condition Scale (Kaesehagen, 1995)

Condition Rating	Criteria
Very Good – Excellent	<ul style="list-style-type: none"> • 80 – 100% Native Flora composition • Vegetation structure intact or nearly so • Cover/abundance of weeds less than 5% • Minor signs of disturbance
Fair – Good	<ul style="list-style-type: none"> • 50 – 80% Native Flora composition • Vegetation structure modified or nearly so • Cover/abundance of weeds 5 – 20% • Disturbance influence moderate
Poor	<ul style="list-style-type: none"> • 20 – 50% Native Flora composition • Vegetation structure completely modified • Cover/abundance of weeds 20 – 60% • Disturbance incidence high
Very Poor	<ul style="list-style-type: none"> • 0 – 20% Native Flora composition • Vegetation structure disappeared • Cover/abundance of weeds 60 – 100% • Disturbance incidence very high

Categories of Threatened Species
(Environment Protection and Biodiversity Conservation Act 1999, Section 179)

Category Code	Category
1	Extinct – Taxa which are known only to survive in cultivation, in captivity or as a naturalised population, well outside their past range; or they have not been recorded in their known and/or expected habitat, at appropriate seasons, anywhere in their past range, despite exhaustive surveys over a time frame appropriate to their life cycle and form.
2	Critically Endangered – Taxa which are facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
3	Endangered – Taxa which are not critically endangered and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
4	Vulnerable – Taxa which are not endangered and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
5	Conservation Dependant – A species that is the focus of a specific conservation program; the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Categories of Threatened Ecological Communities

DEFINITIONS OF STATUS OF THREAT TO ECOLOGICAL COMMUNITIES	
Category 1 Presumed Totally Destroyed	An ecological community which has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.
Category 2 Critically Endangered	An ecological community which has been adequately surveyed and found to have been subject to a major contraction in area and/or which was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.
Category 3 Endangered	An ecological community which has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
Category 4 Vulnerable	An ecological community which has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community which is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.
Category 5 Data Deficient	An ecological community for which there is inadequate data to assign it to one of the above categories and/or which is not yet evaluated with respect to status of threat. (Usually an ecological community with poorly known distribution or biology that is suspected to belong to any of the above categories. These ecological communities have a high priority for survey and/or research)
Category 6 Lower Risk	A community which has been adequately surveyed and evaluated and available information suggests that it does not qualify for one of the above categories of threat.

IUCN Categories for Threatened Fauna

IUCN Category	Description
Extinct	Taxa not definitely located in the wild during the past 50 years
Extinct in the Wild	Taxa known to survive only in captivity
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term future
Near Threatened	Taxa that risk becoming Vulnerable in the wild
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a Conservation Dependent taxon would be classed as Vulnerable or more severely threatened
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information
Least Concern	Taxa that are not Threatened

Department of Conservation and Land Management Fauna Priority categories

Conservation Code	Category
P1	Taxa with few, poorly known populations on threatened lands
P2	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands
P3	Taxa with several, poorly known populations, some on conservation lands
P4	Taxa in need of monitoring

Braun Blanquet Scale for estimating cover-abundance of plant species.

Braun-Blanquet Cover Abundance Scale	
0.1	solitary, with small cover (occurs once)
0.5	few, with small cover (<1%)
1	numerous, but less than 5% cover, or scattered with cover up to 5%
2	any number, with 5-25% cover
3	any number, with 25-50% cover
4	any number, with 50-75% cover
5	any number, with >75% cover

Vegetation Classification (Muir, 1977)

LIFE FORM / HEIGHT CLASS	CANOPY COVER			
	DENSE 70 – 100%	MID-DENSE 30 – 70 %	SPARSE 10 – 30%	VERY SPARSE 2 – 10 %
Trees > 30 m Trees 15 – 30 m Trees 5 – 15 m Trees < 5 m	Dense Tall Forest Dense Forest Dense Low Forest A Dense Low Forest B	Tall Forest Forest Low Forest A Low Forest B	Tall Woodland Woodland Low Woodland A Low Woodland B	Open Tall Woodland Open Woodland Open Low Woodland A Open Low Woodland B
Mallee Tree Form Mallee Shrub Form	Dense Tree Mallee Dense Shrub Mallee	Tree Mallee Shrub Mallee	Open Tree Mallee Open Shrub Mallee	Very Open Tree Mallee Very Open Shrub Mallee
Shrubs > 2 m Shrubs 1.5 – 2 m Shrubs 1.0 – 1.5 m Shrubs 0.5 – 1.0 m Shrubs 0.0 – 0.5 m	Dense Thicket Dense Heath A Dense Heath B Dense Low Heath C Dense Low Heath D	Thicket Heath A Heath B Low Heath C Low Heath D	Scrub Low Scrub A Low Scrub B Dwarf Scrub C Dwarf Scrub D	Open Scrub Open Low Scrub A Open Low Scrub B Open Dwarf Scrub C Open Dwarf Scrub D
Mat plants Hummock Grasses Bunch grass > 0.5 m Bunch Grass < 0.5 m Herbaceous spp.	Dense Mat Plants Dense Hum. Grass Dense Tall Grass Dense Low Grass Dense Herbs	Mat Plants MidDense H Gr Tall Grass Low Grass Herbs	Open Mat Plants Hum. Grass Open Tall Grass Open Low Grass Open Herbs	Very Open Mat Plants Open Hum. Grass Very Open Tall Grass Very Open Low Grass Very Open Herbs
Sedges > 0.5 m Sedges < 0.5 m	Dense Tall Sedges Dense Low Sedges	Tall Sedges Low sedges	Open Tall Sedges Open Low Sedges	Very Open Tall Sedges Very Open Low Sedges
Ferns Mosses, Liverworts	Dense Ferns Dense Mosses	Ferns Mosses	Open Ferns Open Mosses	Very Open Ferns Very Open Mosses

Appendix Eight: Revegetation Species

Foreshore Management Plan: Mindarie – Quinns Rocks

Following is a list of species available for possible revegetation planting from APACE WA. These species are currently found within the study area and are therefore suitable for use.

Species	Common Name	Vegetation Type	Size (m)	Flowering
<i>Acacia cochlearis</i>	Rigid Wattle	17	2	Aug – Sept
<i>Acacia cyclops</i>	Red Eyed Wattle	2,3,5,6,7,11,12	3	Sept – Jan
<i>Acacia lasiocarpa</i>	Dune Moses	2	1	Jun – Oct
<i>Acacia pulchella</i>	Prickly Moses	14,15,15,4,1,2,3,4,6,7,14,15,16	2	Jun – Oct
<i>Acacia rostellifera</i>	Summer Scented	15	2	Aug – Oct
<i>Acacia saligna</i>	Coojong	4	6	Aug – Oct
<i>Acanthocarpus preissii</i>	Prickle Lily	1,2,3,4,6,7,14,15,16	0.4	Apr – Oct
<i>Bossiaea eriocarpa</i>	Common Brown Pea	2,9	0.5	Jul – Oct
<i>Calocephalus brownii</i>		1	0.5	All Year
<i>Calothamnus quadrifidus</i>	One-Sided Bottlebrush	2,9,11,12	2	Aug – Dec
<i>Conostylis aculeata</i>	Prickly Conostylis	3,12,14,15	0.5	Sept – Oct
<i>Dianella revoluta</i>	Flax Lily		1	Jun - Aug
<i>Dryandra sessilis</i>	Parrot Bush	3,4,9,11,13	4	May – Nov
<i>Dryandra lindleyana</i>	Ruby Saltbush	2,3	1	May - Sept
<i>Eremophila glabra</i>	Tar Bush	3,7	0.5	Jul – Jan
<i>Frankenia pauciflora</i>	Sea Heath	2,6,8	0	All Year
<i>Gompholobium tomentosum</i>	Yellow Pea	2	0.5	Aug – Dec
<i>Grevillea priessii</i>		3,11,12,13	3	Aug - Nov
<i>Hakea lissocarpa</i>	Honey Bush		1.5	Jun – Dec
<i>Hakea prostrata</i>	Harsh Hakea	3,11	3	Aug – Nov
<i>Hakea trifurcata</i>	Two-Leaf Hakea		2	Jul – Oct
<i>Hardenbergia comptoniana</i>	Native Wisteria	2,3,4,5,7,9,12,13,14,15,16,17	Climb	Jun – Sep
<i>Hemiandra pungens</i>	Snake Bush	14.15.17	Low	All Year
<i>Hovea trisperma</i>	Common Hovea	11	0.5	Jun – Sept
<i>Isolepis nodosa</i>	Knotted Club-Rush	2,7	1	Nov – Mar
<i>Lepidosperma gladiatum</i>	Coastal Sword-Sedge	3,6,7,18	1	Nov – Jan
<i>Lepidosperma squamatum</i>		13	2	Aug - Nov
<i>Melaleuca systena</i>	Coastal Honey Myrtle	12,13,14,15	1	Sept – Dec
<i>Melaleuca cardiophylla</i>	Umbrella Bush	3,6,9,12,13,14,15	1.5	Jul – Jan
<i>Melaleuca huegelii</i>	Chenille Honey Myrtle	2,4,7,13	3	Nov – Jan
<i>Melaleuca lanceolata</i>	Rottneest Tea Tree	5	5	Oct – Mar

Appendix Eight

<i>Myoporum insulare</i>	Blueberry Tree	2,17	2	Aug – Nov
<i>Olearia axillaris</i>	Coastal Daisy Bush	1,3,4,6,7,9, 11,14,15,17	1.5	Mar – Aug
<i>Petrophile serruriae</i>		3,11	1	Aug – Nov
<i>Rhagodia baccata</i>	Berry Salt Bush	1,2,4,5,9,11, 12,14,15	0.5	Mar – Jun
<i>Santalum acuminatum</i>	Quandong	7	5	Nov – Mar
<i>Scaevola crassifolia</i>	Thick Leaved Fan	1,2,5,16	0.5	Nov – Jan
<i>Spinifex longifolius</i>	Long Leaved Spinifex	6	0.5	Jul – Jan
<i>Spyridium globulosum</i>	Basket Bush	2,3,4,7,9,11, 14,15,17	3	Jun – Sept
<i>Templetonia retusa</i>	Cockies Tongues	2,3,5,7,8,14,15	2	Apr – Sept
<i>Threlkeldia diffusa</i>	Wallaby Salt Bush	1,7,8,14,15	0.5	Aug – Jan

Appendix Nine: Trails Master Plan

Foreshore Management Plan: Mindarie – Quinns Rocks



FEATURE REFERENCE

- ABORIGINAL HERITAGE FEATURE**
- 1 Gnaragara Lake (Artefact)
 - 2 Gnaragara Aboriginal Cemetery (Skeletal material / burial)
 - 3 Little Badgenup Swamp (Artefact)
 - 4 Gnaragara Lake (Artefact)
 - 5 Murray's Cave (Artefact)
 - 6 Gnaragara Scarred Tree (Modified Tree)
 - 7 Wanneroo Scarred Tree (Modified Tree)
 - 8 Lake Joondalup (Mythological)
 - 9 Lake Mariginiup
 - 10 Gnaragara Lake (Mythological / Historical)
 - 11 Landsdale (Artefact)
 - 12 Shaw Road Wanneroo (Modified Tree)
 - 13 Gnaragara Site
 - 14 Gnaragara Site (Skeletal material / burial)
 - 15 Gnaragara Site (Modified Tree)
 - 16 Gnaragara Site (Skeletal material / burial)
 - 17 Gnaragara Site (Ceremonial)
 - 18 Doogarch (Mythological)
 - 19 Dunstons Quarry (Artefact)
 - 20 Tamala Park Trees (Modified Tree)
 - 21 Honey Possum Site (Mythological)
 - 22 Karli Spring (Mythological)
 - 23 Orchestra Shell Cave (Engraving & Artefact)
 - 24 Nowergup Lake (Mythological)
 - 25 Pipindinny Lake (Mythological)
 - 26 Mindarie Burial Mound (Skeletal materials / Burial)
 - 27 Scarred Tree (Modified Tree)
 - 28 Tamala Park Campsite (Mythological)
 - 29 Tamala Park Waterhole (Mythological)
 - 30 Yanchep Beach (Artefact)
 - 31 Smokebush Waterhole (Artefact)
 - 32 Wagard Spring (Ceremonial / Mythological)
 - 33 Limestone Reef (Mythological)
 - 34 Yanchep Beach (Mythological)

LEGEND

- | | | |
|---|--|---|
| ALIGNMENTS
BOUNDARY | LAND USES
URBAN / INDUSTRIAL | PROPOSED THEMED TRAILS
COASTAL AND MARINE TRAILS |
| SUBURB ALIGNMENT | RURAL / (FUTURE) URBAN | CENTRAL TRAILS |
| PRIMARY REGIONAL ROAD | PARKS / STATE FOREST | INLAND TRAILS |
| SECONDARY REGIONAL ROAD | LAKES / WATER BODIES | PROPOSED TRAILS
<i>(Refer Themes for colour of trail)</i>
PEDESTRIAN TRAIL |
| MAJOR TOWN CENTRE | ABORIGINAL HERITAGE FEATURE | CYCLE TRAIL |
| MINOR TOWN CENTRE | | BRIDLE TRAIL |
| PROPOSED PRECINCTS | | PEDESTRIAN / CYCLE TRAIL |
| PROPOSED MEETING POINTS
<i>(Include facilities / interpretative signage etc)</i> | | MULTI-USE TRAIL
<i>(Pedestrian / Cycle / Bridal)</i>
DRIVE TRAIL |
| | | DIVE / BOAT TRAIL |

city of wanneroo
Trails Masterplan Stage 1

MASTERPLAN
Fig.12

Scale 1 : 40 000 @ A0 (This Plan is Diagramatic Only)

Prepared by

ecospace

July 2003



Appendix Ten: Submissions Summary

Foreshore Management Plan: Mindarie – Quinns Rocks

The following includes the submissions made during the public comment period between the 1st March and the 22nd April, 2004. Seven submissions were received during the Public Comment Period and an additional three were made during the Public Information Session held on the 31st march, 2004.

Sub No.	Submitter	Submission Details	Comment and Recommendations
1.	DIA (Department of Indigenous Affairs)	<p>a. The DIA advised that the absence of any registered sites in the area may indicate that the area has not been subjected to any Aboriginal heritage surveys. They strongly recommended that an archaeological and anthropological survey of the development area be conducted prior to any works commencing.</p> <p>b. If proposed works are to impact upon any Aboriginal sites, Section 18 consent to use the land will need to be sought from the Minister for Indigenous Affairs.</p>	<p>Plan amended accordingly. A recent letter from the DIA, separate to their submission, states that specific mythological associations have recently been confirmed at two places within the area. Reference to the requirement to consult relevant elders / undertake ethnographic and archaeological surveys will be added to the Plan.</p> <p>Noted.</p>
2.	EPA (Environmental Protection Authority)	<p>a. Development at Lot 211 (No 2) Quinns Rd should be undertaken in accordance with EPA advice provided 9 May 2002. (regarding vegetation and groundwater quality) and 29 March 2001 (regarding Bush Forever, sewerage, stormwater drainage and coastal setbacks).</p> <p>b. Refer any proposals that would be likely, if implemented, to have a significant impact on the environment to the EPA, particularly in the development of the proposal documentation for the Ocean Drive upgrade.</p>	<p>Noted.</p> <p>Noted. The proposal documentation for the Ocean Drive upgrade, when complete, will be assessed to see if implementation is likely to result in a significant impact. It will be referred to the EPA accordingly.</p>
3.	DPI (Department for Planning and Infrastructure)	<p>a. Move information under the heading 'Bush Forever' in Section 2.8 to the beginning of Section 2.8.</p>	<p>Plan amended accordingly.</p>

Sub No.	Submitter	Submission Details	Comment and Recommendations
		<p>b. The Bush Forever Office supports the recommendation for development associated with the upgrade of Ocean Drive and the construction of a dual use path should preferentially take place on the eastern side of Ocean Drive to avoid clearing regionally significant vegetation, which may threaten the integrity of the dunes.</p> <p>c. <i>Ammophila arenaria</i> (listed in Table 6.4) is not native and is identified in the State of Western Australia (2003) <i>Coastal Planning and Management Manual</i> as a species that should not be planted. The use of <i>Ammophila arenaria</i> for stabilising foredunes is not recommended.</p> <p>d. The reference to <i>Melaleuca acerosa</i> on page 80 of the plan should be replaced with <i>Melaleuca systema</i>, as the species is now known.</p> <p>e. Section 2.2 (Climate Change) should reference the Statement of Planning Policy No. 2.6 (State Coastal Planning Policy), which provides guidance in</p>	<p>Not upheld. The ‘draft’ concept design for the Ocean Drive road reserve upgrade proposes to upgrade the existing footpath on the eastern side of the road reserve to 1.5 m wide and provide a new shared path (formerly known as a dual use path) on the western side. Provision of the shared path on the western side will allow safer utilisation by all users, avoid conflict with numerous cross-overs to private properties, and be consistent with other dual use paths along the foreshore. The design will account for and ensure the integrity of the dunes and associated vegetation on the western side. Plan Amended to reflect the latest draft concept proposals for the paths.</p> <p>Plan amended accordingly.</p> <p>Plan amended accordingly.</p> <p>Plan amended accordingly.</p>

Sub No.	Submitter	Submission Details	Comment and Recommendations
		<p>determining suitable setbacks for coastal developments.</p> <p>f. The use of diagrams illustrating the predicted rates of movement would alleviate the confusing wording of Sections 2.3 and 2.4.</p> <p>g. A section dealing with marine flora and fauna should be included in Section 2.9 (Fauna and Flora Habitat) as some users of the coast and its adjacent marine areas can impact quite heavily on marine habitats.</p> <p>h. A section on the new State Sustainability Strategy should be incorporated under Section 4.2.2 State Policy.</p> <p>i. Other processes that can provide input into this Plan are the Swan Regional Natural Resources Management Plan (Swan Catchment Council, draft 2004) and the Dialogue with the City (DPI ongoing).</p> <p>j. Although placement of brush on dunes is a recognised method of stabilisation it must be stated that local indigenous species will be used. The use of other non-indigenous species is not recommended.</p> <p>k. The Coastal Asset Management Branch of the DPI is undertaking a metropolitan boating strategy which would likely address many of the</p>	<p>Not upheld. The addition of diagrams is not considered necessary.</p> <p>Not upheld. The marine area is outside the scope of this Plan.</p> <p>Plan amended accordingly.</p> <p>Noted.</p> <p>Plan amended accordingly.</p> <p>Noted.</p>

Sub No.	Submitter	Submission Details	Comment and Recommendations
		comments on p.103.	
4.	FESA (Fire & Emergency Services Authority of WA)	<p>a. Amend the sixth and seventh paragraphs of section 6.4.2 as follows:</p> <p><i>The study area is in a gazetted Emergency Services Levy Category 1 fire district and as such is under the control of the Fire and Emergency Services Authority (FESA). The primary response team for fires within the study area is the Joondalup Fire and Rescue Station. Extra resources are also available from Fire and Rescue Stations located within the Fire Services Perth North Coastal Region. As a last resort the resources of the City of Wanneroo Volunteer Bush Fire Brigade are also available upon request from the Fire and Rescue Station.</i></p> <p><i>The City of Wanneroo Volunteer Bush Fire Brigade comprises three brigades with approximately 110 volunteer roster members. The current vehicle fleet consists of 6 Light Tanker 4 x 4 Appliances, 2 Heavy Duty 4 x 4 Appliances, 1 Support 4 x 4 Appliance and a mobile bus which is fitted out as an Incident Control Vehicle. Other resources of the City of Wanneroo are also available on request, as an example earth moving machinery etc.</i></p> <p>b. Amend the ninth paragraph of section 6.4.2 as follows:</p>	<p>Plan amended accordingly.</p> <p>Plan amended accordingly.</p>

Sub No.	Submitter	Submission Details	Comment and Recommendations
		<p><i>Property owners in the City of Wanneroo are required to clear fire breaks by the 15th day of November each year and maintain them until the following April. On the 16th day of November each year Council's Rangers/Fire Control Officers conduct fire break inspections on all vacant land and rural properties.</i></p> <p>c. Amend the seventh paragraph of section 6.4.3 as follows:</p> <p><i>Fire suppression requires trained, experienced staff, with suitable equipment, who are available within a short response time to fight fires. Fire suppression activities have the potential to degrade the environment through the unplanned construction of firebreaks and tracks, which lead to erosion, destruction of vegetation, and the proliferation of tracks. Fire suppression must therefore be integrated with effective ignition and fuel reduction programmes.</i></p> <p>d. Amend the sixteenth paragraph of section 6.4.3 as follows:</p> <p><i>An Urban Bushland Fire Plan should be developed for the <u>Quinns</u> – Mindarie foreshore in consultation</i></p>	<p>Plan amended accordingly.</p> <p>Plan amended accordingly.</p>

Sub No.	Submitter	Submission Details	Comment and Recommendations
		<p>with the Fire and Emergency Service Authority (FESA), stakeholders and the City of Wanneroo Rangers. The Plan should incorporate response and recovery strategies, list key contacts and map the locations of hydrants, fire access tracks, infrastructure, nearby dwellings and biodiversity assets.</p>	
5.	Quinns Rocks Environmental Group (QREG)	<p>a. South-westerly winds, rather than south-easterlies, are important in dune building and erosion.</p> <p>b. The meaning of priority categories on Table 7.2 should be defined. For example Recommendation 3 is a Medium Priority in this table, yet in Table 1 it is a High Priority in the first year of plan implementation.</p> <p>c. North Mindarie Beach sector should be subject to a vegetation survey.</p> <p>d. The vegetation community and vegetation condition maps exclude the North Mindarie Beach sector. Complete maps should be included in the final management plan.</p> <p>e. Japanese Pepper (<i>Schinus terebinthifolius</i>) is a significant weed that is not included in Table 2.1. It has a Moderate weed rating in the Environmental Weeds Strategy (CALM 1999).</p> <p>f. Weeds that should be addressed in the Plan include Japanese Pepper Tree (<i>Schinus terebinthifolius</i>),</p>	<p>Plan amended accordingly.</p> <p>Plan amended accordingly.</p> <p>Not upheld. The North Mindarie Beach sector was subject to a survey in 2003.</p> <p>Not upheld. The North Mindarie Beach sector was surveyed by BBG in 2003. The inclusion of maps was beyond the scope of this Plan due to various constraints, as agreed at the start of the project.</p> <p>Plan amended accordingly.</p> <p>Table 6.2 lists weeds that are high priority or widespread moderate</p>

Sub No.	Submitter	Submission Details	Comment and Recommendations
		<p>Geraldton Carnation Weed (<i>Euphorbia terracina</i>), Fennel (<i>Foeniculum vulgare</i>), <i>Eucalyptus platypus</i>, <i>Melaleuca lanceolata</i>, and Fleabane (<i>Conyza</i> sp). Japanese Pepper Tree and Geraldton Carnation Weed should be priority species, but are not listed in Table 6.2.</p> <p>g. Weed control should be integrated with restoration to enhance the integrity of bushland ecosystems. A more detailed works program is needed to define what will be done where. Monitoring of the effectiveness of weed control methods should be included.</p> <p>h. Seeds or cuttings for rehabilitation work should be sourced locally to maintain local provenance.</p> <p>i. Post fire weed control (High Priority in the First Year) in Section 7 should not only be done in Kinsale Park but include any recently burnt areas such as Lot 211.</p> <p>j. <i>Acacia littorea</i> is included in the flora list (Appendix 3) but is not found around Perth. A similar species does occur here, <i>Acacia truncata</i>, which has been recorded by QREG in the foreshore reserves. There are some species listed in the Kinsale Park Management Plan (City of Wanneroo, 1995) which are not included within the list prepared by <i>ecoscape</i>.</p>	<p>priority according to the Environmental Weed Strategy of WA. Of these species listed only Geraldton Carnation Weed is of high priority and has been added to the table. Japanese Pepper has also been added in recognition of concerns with this species.</p> <p>Noted. Weed control is already integrated with restoration. The level of detail is sufficient.</p> <p>Noted. This is already stated in the Plan.</p> <p>Plan amended accordingly.</p> <p>Plan amended accordingly. Species list based on 2003 survey only.</p>

Sub No.	Submitter	Submission Details	Comment and Recommendations
		<p>k. The vegetation map (Map 1) shows <i>Acacia littorea</i>, <i>Melaleuca huegelii</i> and <i>Scaevola anchlussifolia</i> open low heath on Lot 211 behind the Quinns Rocks Caravan Park. From QREG's observations, the dominant species in the area covered by this plant community are <i>Acacia xanthina</i> and <i>Melaleuca cardiophylla</i>. This is significant because <i>Acacia xanthina</i> is restricted to limestone ridges and does not appear to be well represented in reserve on this part of the coast. Also, this occurrence of <i>Melaleuca cardiophylla</i> is near the southern extent of its distribution.</p> <p>l. Map 1 shows <i>Melaleuca lanceolata</i>-<i>Acacia Cyclops</i> low closed forest near the northern part of the Mindarie Keys marina. This area was apparently cleared during construction work for the marina, and the plants now here were planted or seeded in. <i>Melaleuca lanceolata</i> can be an environmental weed and planting in or next to bushland is opposed. The species should be removed from Table 6.5.</p>	<p>Not upheld. <i>Acacia littorea</i> misidentification has been replaced with <i>Acacia truncata</i>. While <i>Melaleuca cardiophylla</i> is present, <i>Melaleuca Huegelii</i> var. <i>huegelii</i> is maintained as the dominant species for this vegetation community.</p> <p>Plan amended accordingly.</p>

Sub No.	Submitter	Submission Details	Comment and Recommendations
		<p>m. The vegetation along Kinsale Drive (from Kinsale Park to the sharp bend in the road) is degraded, in that it includes non-local species seeded in following excessive clearing following construction works for Mindarie Keys. This should be identified on the condition map (Map 2) and the area should be progressively rehabilitated.</p> <p>n. 'Minimal clearing' of bushland in Bush Forever sites should be changed to 'no clearing'. Ecologists have advised that a minimum of 20 or 30% of ecosystems should be retained to maintain most of the biodiversity within them. Given that Bush Forever only covers 18% of bushland remaining within the metropolitan region of the Swan Coastal Plain, it is imperative that the remaining bushland is protected.</p> <p>o. The planned upgrade of Ocean Drive and construction of a dual use path should be planned to avoid encroachment west of the existing road verge. The coastal vegetation should be kept intact to maintain the dune. The position put in the draft Plan (for development to preferentially take place on the eastern side of Ocean Drive where possible) is strongly supported.</p>	<p>Plan amended accordingly.</p> <p>Not upheld. The clearing of bushland within Bush Forever sites will be avoided wherever possible. However, clearing of small areas may be unavoidable in some circumstances due to the narrowness of the road reserve.</p> <p>As per 3b.</p> <p>Noted. A conservation fence is to be put up</p>

Sub No.	Submitter	Submission Details	Comment and Recommendations
		<p>p. The QREG is concerned that the vegetation transition from Quindalup to Spearwood dunes will be lost as vegetation is cleared for development of Lot 211. Earthworks for the first stage of the development have already encroached into the bushland, and the group urges the immediate construction of a temporary fence to prevent further encroachment. The fencing and rehabilitation of the area is supported, with any planting of degraded areas at the fringes of the bushland to use locally indigenous species.</p> <p>q. The Plan should prioritise a list of key resident fauna and develop recovery plans where appropriate. The Plan should also note that it is important to leave dead or fallen trees in place as they provide important fauna habitat.</p> <p>r. Control of feral animals (including cats and foxes) is crucial for management. A recommendation to assess the population of rabbits, their impacts and control options should be added.</p> <p>s. Provision of opportunities for visitors to gain an understanding of local native fauna should be an objective in Section 6.6.4. This could be done via interpretation signs in these reserves that would also promote their role as a conservation area for native fauna.</p>	<p>along the eastern boundary as part of the Lot 211 development.</p> <p>Noted. Although desirable, fauna surveys and recovery plans are outside the scope of this Plan. A note regarding dead or fallen trees has been added.</p> <p>Not upheld. A study of rabbit populations, impacts and control methods for the whole of the City would be more appropriate.</p> <p>Noted. Included in 'Access and Recreation'.</p>

Sub No.	Submitter	Submission Details	Comment and Recommendations
		<p>t. Lot 211: the plan for car parking east of the new access road (see Figure 3.1) adjacent to bushland is of concern. Car parking backing onto bushland may allow rubbish dumping and inappropriate access.</p> <p>u. Where a high intensity recreation zone abuts a conservation zone, appropriate fencing should be installed. Map 5 does not show a fence between the development on Lot 211 and the adjoining Bush Forever Site 397, even though it is recommended in the Plan.</p> <p>v. The proposed upgraded playground on Quinns Beach North should be fenced off not only from the beach but also from the adjoining road, to prevent children from running into traffic.</p> <p>w. Limestone cliffs south of Quinns Rocks are an important natural feature, but require public access to be managed. The draft Plan does not refer to hazards associated with the limestone cliffs. The Plan should recommend monitoring of coastal cliffs every two years or after major storm events.</p>	<p>Noted. A conservation fence is to be put up along the eastern boundary adjacent to the car park as part of the Lot 211 development.</p> <p>Noted. Appropriate fencing is already planned for all areas where high intensity recreation abuts conservation areas. Map 5 Amended accordingly.</p> <p>Noted. To be addressed at the design stage separate to this Plan.</p> <p>Plan amended accordingly. A recommendation to monitor the cliffs will be incorporated. Signage is already recommended within the Plan, and cliff hazards are marked on Map 5. The City undertook a detailed survey of limestone cliff hazards in 1998. No cliffs were removed due to lack of policy and native title issues, but fencing and signage warning the community of dangers was undertaken. The City continues to monitor the state of fencing and signage and to our knowledge all identified cliff hazards are not accessible from land.</p>

Sub No.	Submitter	Submission Details	Comment and Recommendations
		<p>x. Fire prevention should be a priority in managing the conservation zone</p> <p>y. Local community groups, including the Quinns Rocks Environmental Group, should be involved in the development of the fire control working plan.</p> <p>z. All drainage outlets within the foreshore reserves should be identified and mapped as part of an integrated approach to weed control. This should be a high priority. QREG has identified weed spread around stormwater outlets adjacent to Kinsale Drive (north of Calderea Close) and off Long Beach Promenade (near Beaumarks Court). Remedial action is needed to control water flow and weed seed spread, while protecting existing native vegetation.</p>	<p>Noted. Effective weed control will reduce the fire hazard. Fire prevention will be an aspect of community education.</p> <p>Plan amended accordingly. The Plan already refers to consultation with stakeholders, which includes community groups, who will be involved in discussions as appropriate. Add reference to community groups.</p> <p>Noted. Identification and mapping of drainage outlets was outside the scope of this Plan, but could be the subject of a further study. Stormwater drainage will be considered as part of the proposed Ocean Drive upgrade.</p>
6.	Natural Area Management and Services	a. Revegetation and weed control should be built into the capital works project of widening Ocean Drive.	Noted.

Sub No.	Submitter	Submission Details	Comment and Recommendations
		<p>b. There were urgent management recommendations made in the 2003 BBG report, 'Foreshore Vegetation Survey and Management Recommendations – Mindarie, Yanchep and Two Rocks'.</p> <p>c. The best bushland occurs within North Mindarie/ Long Beach Park. However, management of this bushland is not included in the costings in Table 6.7 (only tracks etc).</p> <p>d. <i>S. Hirstus</i> is missing from foreshore rehabilitation list (Table 6.4) and species list (Appendix 8), despite being a 'main foreshore item'.</p> <p>e. It is unrealistic for volunteers to perform dune rehabilitation and herbicide application.</p> <p>f. There is a need to control 4x4 access from South.</p>	<p>Noted. The recommendations in this Plan incorporate in a more specific manner the general recommendations made in the BBG report (summary in FMP page 167).</p> <p>Noted. As the North Mindarie sector had recently been surveyed by BBG, it was not surveyed again (beyond scope of Plan). Costs for rehabilitation of bare areas and blowouts were considered separately in Table 6.8 (Recommendation No.28).</p> <p>Plan amended accordingly.</p> <p>Not upheld. Volunteers often perform dune rehabilitation, and herbicide use by volunteers is not recommended in the Plan.</p> <p>Noted.</p>
7.	Local resident	<p>a. The focus of the management of the foreshore should be on how to stop erosion and give the City of Wanneroo residents and others a world-class beach recreational area. The bulk of the plan seems to be concerned with the ecosystems of Quinns Beach and the concern expressed for the flora and</p>	<p>Noted. The coastal vegetation (together with associated fauna) is a Bush Forever site (regionally significant vegetation) and must therefore be protected as far as possible. The recreational use of the foreshore has not been neglected, and</p>

Sub No.	Submitter	Submission Details	Comment and Recommendations
		<p>fauna seems excessive. Insufficient importance has been given to the future management of the increased recreational population growth.</p> <p>b. The location of the dual use path on the eastern side of Ocean Drive appears to contradict the City's objective of providing a safe recreational use of the beach area. Even where there is currently a footpath, pedestrians walk on the road on the western side to gain ocean views. Also, if erosion occurs, it would be better that the dual use path is lost and the road maintained.</p> <p>c. Placement of the dual use path, car parking and kiosks on the eastern side will create a highly dangerous situation where Ocean Drive must be crossed to access the beach. The only planned pedestrian crosswalk is for the Kiosk.</p> <p>d. Query why Plan states Ocean Drive is to be upgraded /widened 'in response to development at Jindalee.'</p> <p>e. Ocean Drive is described as a dangerous "Third World road", lacking lines marking traffic divisions, lighting, footpaths, parking and seats to contemplate the ocean view. Proposed a 'radical solution' that the City should consider making Ocean Drive a one-way road travelling north from Quinns Road to Tapping Way (and have Tapping Way revert back to its original</p>	<p>regular reviews of the Plan will assess the growth in beach usage and adjust the recommendations accordingly.</p> <p>As per 3b.</p> <p>The placement of car parking and kiosks to the west of Ocean Drive is not possible without clearing vegetation and possibly destabilising the dunes. The dual use path will be located to the west of Ocean Drive (see 3b).</p> <p>Noted. This is not the reason. Plan Amended accordingly.</p> <p>Noted. Beyond scope of this Plan. A draft concept plan for a proposed upgrade to Ocean Drive has been prepared by Technical Services. This project is currently on hold (subject to funding as part of the 2004/2005 Capital Works Budget).</p>

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		<p>configuration or become a one way road travelling south to Robinson Avenue). This would enable angled car parking next to the dual use path on the western side, so beachgoers could move from their cars to the dual use path and never have to cross the road. If beachgoers and local traffic were the only road users, a safe, quiet village atmosphere could be created.</p> <p>f. A heritage covenant should be placed over the beach environs – so that any infrastructure, kiosks, toilet blocks, seats, lighting, fences, alterations etc be built to reflect Old Quinns past (1950s). New buildings should incorporate a heritage façade.</p> <p>g. If the road is to be modified on the eastern side, the power lines should be sunk at the same time.</p> <p>h. The need for additional lighting is noted. Underground power should be considered, and attractive individually designed City of Wanneroo poles/shades.</p> <p>i. Beach facilities (toilet, outside shower, change areas, animal watering facilities) are desperately needed. The recommendation for a composting toilet rather than one connected to sewerage is questioned.</p>	<p>Not upheld. Beyond scope of this Plan. A similar policy is being considered as part of the Old Quinns Rocks Residential Planning Study.</p> <p>Power lines are not planned to be modified during the proposed Ocean Drive upgrade, given the associated costs for both Council and adjacent landowners. If sinking the power lines is considered appropriate a separate submission could be considered in the future following consultation with affected landowners.</p> <p>Noted.</p> <p>Noted. A composting toilet was recommended to minimise maintenance costs. The need for other facilities will be considered in the review of the Plan.</p>

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		<p>j. The City could find a more attractive alternative to the fencing recommended along Ocean Drive (post, rail and ringlock), for example limestone block pillars at intervals.</p> <p>k. The Mary Street car park is too small for the demand on hot days, and this problem is exacerbated by poor parking habits. The area could be marked in some way (even if it must be bituminised) to gain the maximum parking for the area.</p> <p>l. The limitation of R20 zoning for Ocean Drive would be most unfair, restricting the modest development plans already in place.</p> <p>m. The City of Wanneroo should project well into the future and avoid the situation of the North Beach / Waterman area, which has to be upgraded each decade to cope with increased population and the need for additional vehicular management.</p>	<p>Not upheld. The fencing recommended is cost effective, meets requirements for conservation fencing and is not unattractive.</p> <p>Noted. This car park is to be formalised as part of the Ocean Drive Upgrade Project, subject to project funding being approved by Council (part of 2004/2005 Capital Works Budget).</p> <p>Noted, beyond scope of this Plan. Relates to the Old Quinns Rocks Residential Planning Study.</p> <p>Noted.</p>
8.	Local resident (public information session)	The location of groyne #3 should be shown on the plans (maps).	Plan amended accordingly.
9.	Local resident (public information session)	The extent of Quinns Dog Beach should be defined, as there is currently no limit/section isolating the dog beach.	Not upheld. Map 4 identifies the dog beach in sufficient detail.
10.	Local resident (public information session)	Inquired whether there were plans for future development of North Mindarie Beach area.	Advised that there were no plans for future development of this area (which is part of Bush Forever Site 322).

