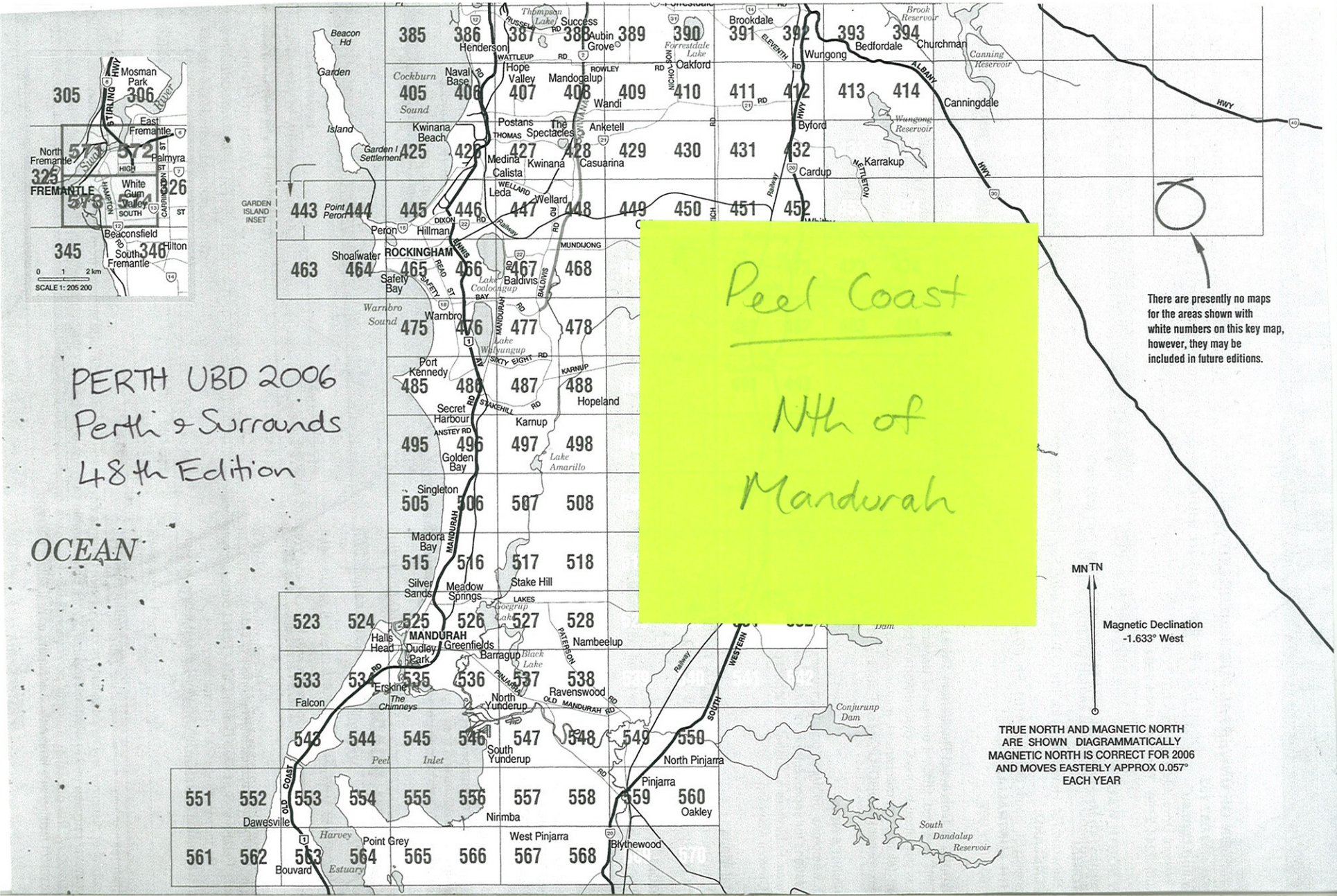

Peel Coast
Nth of Mandurah
PERTH UBD 2006
Perth & Surrounds
48th Edition
OCEAN
There are presently no maps for the areas shown with white numbers on this key map, however, they may be included in future editions.
GARDEN ISLAND INSET
MN TN
Magnetic Declination
-1.633° West
TRUE NORTH AND MAGNETIC NORTH ARE SHOWN DIAGRAMMATICALLY
MAGNETIC NORTH IS CORRECT FOR 2006
AND MOVES EASTERLY APPROX 0.057°
EACH YEAR
SCALE 1: 205 200
FREMANTLE
ROCKINGHAM
MANDURAH
Mosman Park
East Fremantle
North Fremantle
Palmyra
White Gum Valley
Beaconsfield
South Fremantle
Hilton
Henderson
Success
Aubin Grove
Brookdale
Wungong
Bedfordale
Churchman
Canningdale
Oakford
Hope Valley
Mandogalup
Wandi
Byford
Karrakup
Cardup
Kwinana Beach
Postans
The Spectacles
Anketell
Medina
Calista
Kwinana
Casuarina
Leda
Wellard
Peron
Hillman
Shoalwater
Safety Bay
Baldivis
Warnbro
Port Kennedy
Secret Harbour
Karnup
Hopeland
Golden Bay
Singleton
Madora Bay
Silver Sands
Meadow Springs
Stake Hill
Halls Head
Dudley Park
Greenfields
Barragup
Nambeelup
Falcon
Erskine
The Chimneys
North Yunderup
Ravenswood
South Yunderup
North Pinjarra
Pinjarra
Oakley
Dawesville
Ninmba
West Pinjarra
Blythewood
Bouvard
Point Grey
Harvey Estuary
Peel Inlet
Conjurunp Dam
South Dandalup Reservoir
Brook Reservoir
Canning Reservoir
Wungong Reservoir

ENTERED ON GIS

Name: Foreshore Management Plan Madora
Date: 25/05/2006
Capture Author: Thomas Leong

Comments:
Polygon
Created to match documented study area with acceptable level of accuracy

Accuracy Levels:

- High = Document contained visual and or described spatial references easily captured, resulting in little or no polygon boundary errors
- Acceptable = Document contained visual and or described spatial references with complex boundaries, resulting in minor boundary errors
- Low = Document contained little or no visual and or described spatial references, resulting in polygon boundary errors

Attributes
Partial copy of section 2 of original document, values entered for attributes below cannot be taken as accurate

Report Info – Captured without problems
Custodial/Contact – Captured without problems
Content – Captured without problems

No File SB Cab

H & N PERRY

FORESHORE MANAGEMENT PLAN MADORA

UBD 2006
Map 515 G/P 1-11

SB Tile ?

Location ? Madora = suburb ?
Need previous report
Alan Tingay + Assoc 1998
full ref ?

ALAN TINGAY & ASSOCIATES

MARCH 2000

REPORT NO: 2000/32

2. EXISTING ENVIRONMENT

2.1 Topography

The foreshore comprises a sandy beach about 50m wide, incipient dune (1m high by 4m wide), primary dune (up to 10m high and 30 m wide) and inland beach ridges. The maximum height of the primary dune is approximately 10 metres AHD (see Figure 2).

2.2 Vegetation

A description of the coastal vegetation at Madora has previously been undertaken by Alan Tingay & Associates (1998).

The property contains a mixture of cleared areas, severely degraded vegetation up to some native vegetation in good condition. Most of the remaining native vegetation has been affected by grazing, trampling, weeds, and off-road vehicle tracks. Frequent burning has also led to further degradation and weed invasion.

A description of the native vegetation follows.

- Incipient Dune

  The low incipient dune located at the back of the sandy beach is being colonised by the annual herb *Cakile maritima* with some clumps of *Spinifix longifolius* (rather than *S. hirsutus* normally associated with such mobile sand areas).

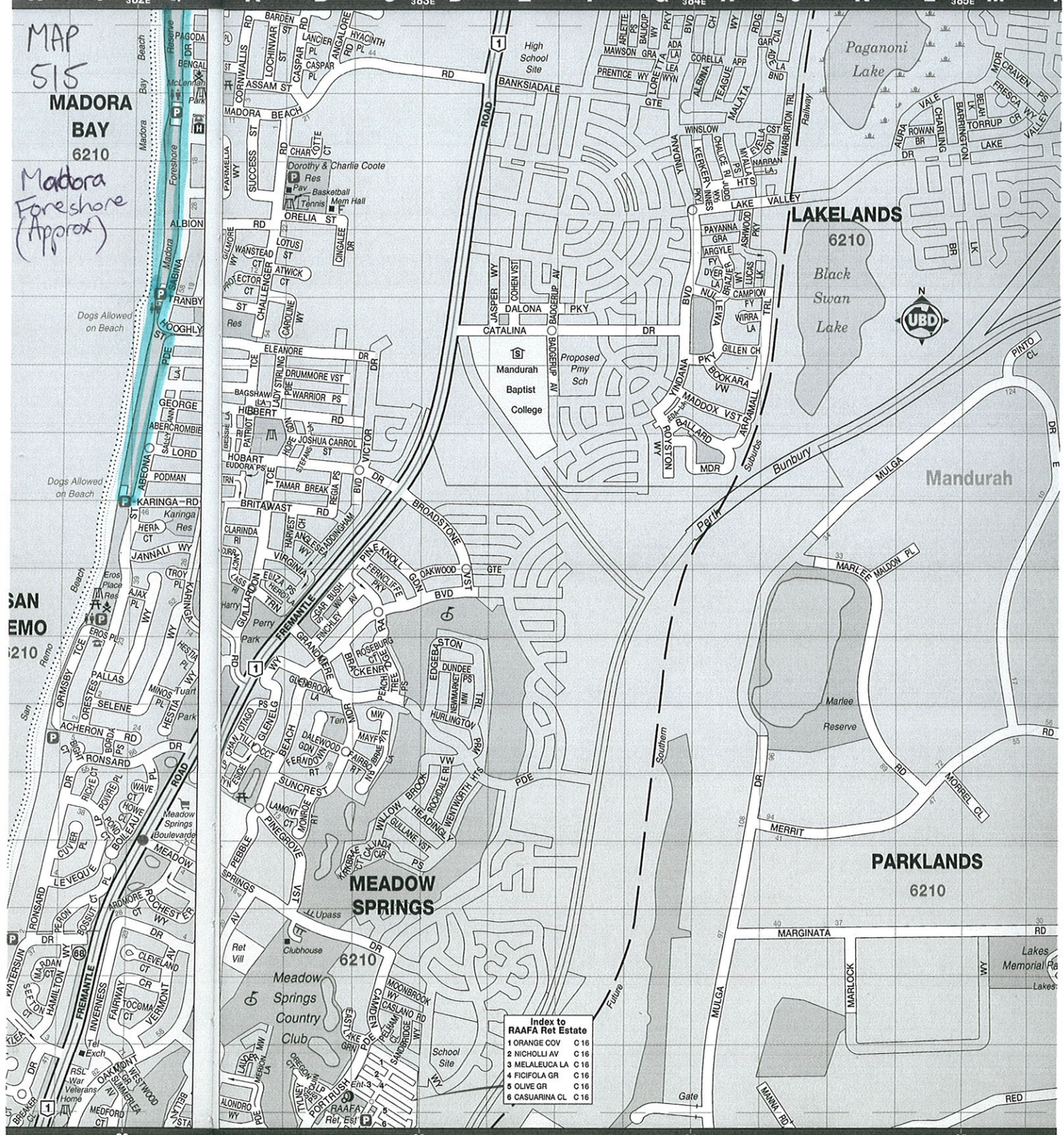
- Primary Dunes

  A band of recent beach ridge dunes situated inland from the foredunes comprises of various Heath and Shrubland associations usually dominated by *Olearia axillaris*. Common associations are *Olearia axillaris/Scaevola crassifolia* Shrubland, *Spyridium globulosum/Olearia axillaris* Shrubland, *Spyridium globulosum/Myoporum insulare* Shrubland, *Acacia rostellifera/Olearia axillaris* Shrubland and *Lepidosperma gladiatum* Sedgeland.

- Inland Plain

  The low dune ridges and swales on the eastern side of the foreshore reserve are part of the beach ridge plain formation which supports *Acacia rostellifera* Shrubland and Heath with some dense *Acacia rostellifera* Thickets. Other species are *Hemiandra pungens, Conostylis candicans, Lomandra maritima, Acanthocarpus preissii* and *Schoenus grandiflorus*.

JOINS MAP 506



JOINS MAP 526

CAR PARK ..... P
COLLEGE - PRIVATE C
COLLEGE - PUBLIC C
CYCLEWAY .....
DISTANCE FROM GPO 28
EMERGENCY TELEPHONE ..

EXPRESS POST BOX .....
FIRE STATION ..... F
GOLF COURSE .....
GUIDES .....
HOSPITAL .....
HOTEL ..... H

INFORMATION CENTRE i
LIBRARY .....
LOOKOUT 180 , 360 .....
MASONIC CENTRE .....
MEMORIAL / MONUMENT .....
MOTEL ..... M

ONE-WAY TRAFFIC ROUTE ..
PICNIC AREA .....
PLACE OF WORSHIP .....
PLAYGROUND .....
POLICE STATION .....
POST OFFICE .....

ROUNDABOUT .....
SCHOOL - PRIVATE ..... S
SCHOOL - PUBLIC ..... S
SCOUTS .....
SERVICE STATION .....
SHOPPING CENTRE .....

SWIMMING POOL .....
TELEPHONE .....
TOILETS .....
TRAFFIC LIGHT .....
WEIGHBRIDGE ..... W
WINERIES .....

ENTERED ON GIS

Name: Pt Lot 1002 Seawind Drive, Silver Sands – Foreshore Management Plan
Date: 25/05/2006
Capture Author: Thomas Leong

Comments:
Polygon
Created to match documented study area with high level of accuracy

Accuracy Levels:

- High = Document contained visual and or described spatial references easily captured, resulting in little or no polygon boundary errors
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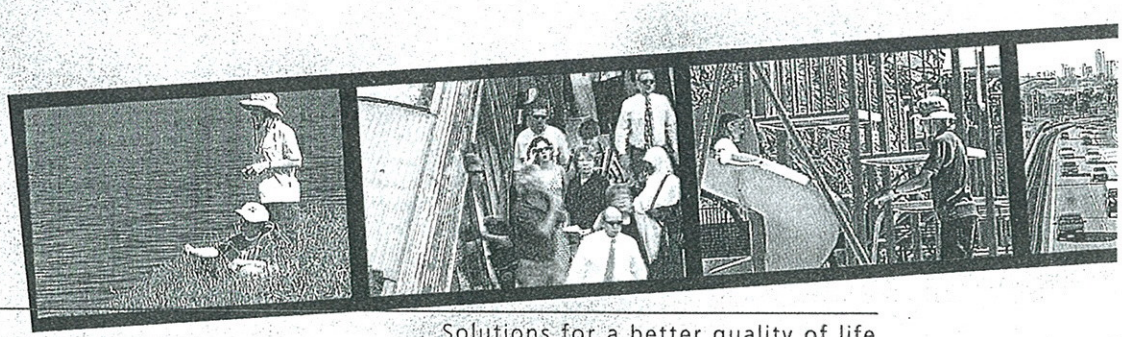

Solutions for a better quality of life

(Map 730)

UBD 2006
Map 515 M16

SB Tile ?

Need Maps

DEVELOPMENT SERVICES APPROVED
SppList? No
Vegn Map-2 comm
Cond Map-G-COS
DATE 18/5/04
G17/5/04
CITY OF MANDURAH

Pt Lot 1002 Seawind Drive, Silver Sands
Foreshore Management Plan

BSD CONSULTANTS

1. INTRODUCTION

In January 2004, BSD Consultants were appointed by Chadland Estates Pty Ltd to undertake a botanical survey in the area of foreshore reserve directly fronting the proposed subdivision known as Pt Lot 1002 Seawind Drive, Silver Sands.

As part of this project, BSD Consultants were also commissioned to develop a Foreshore Management Plan (FMP) for the area in accordance with the subdivision conditions set out by the Western Australian Planning Commission in November 2003. The FMP is to be prepared to the satisfaction of the City of Mandurah.

Pt Lot 1002 Seawind Drive is approximately 2 kilometres north of Mandurah and approximately 60 kilometres south of Perth (**Figure 1**). The site surveyed was approximately 9191m^2 of vegetation to the west of Pt Lot 1002 Seawind Drive within the foreshore reserve, managed by the City of Mandurah.

The FMP was prepared and released to City of Mandurah in March 2004. The approval by the council was subject to community consultation and technical review and was subsequently endorsed by at the ordinary council meeting of 18th May 2004 with minor changes recommended, reflected in this document.

1.1 EXISTING ENVIRONMENT

1.1.1 Climate

The Swan Coastal Plain has a Mediterranean climate with hot dry summers and mild wet winters. Winter precipitation varies between 600-1000mm per year with five to six dry months per year (Beard 1990).

1.1.2 Landforms and Soils

The Swan Coastal Plain is generally flat, approximately 20 – 30kms wide and consists of a series of geomorphic entities running parallel to the coastline. The northern part of the Plain is formed from either fluviatile or aeolian depositional material.

The Swan Coastal Plain consists of the Pinjarra Plain and three dune systems of differing ages of deposition whose soils are at different stages of leaching and formation (Quindalup, Spearwood and Bassendean). The coastal plain itself is low lying, often swampy with sandhills and therefore the soils predominately consist of recent sands or swampy deposits (Beard 1990).

The Coastal Belt consists of the Quindalup and Spearwood quaternary Dune Systems. The Quindalup Dune System lies closest to the land/ocean interface and is young and formed of both fixed and mobile sand dunes that lie in a north-south orientation.

1.1.3 Regional Overview of Vegetation

The foreshore reserve lies on the Swan Coastal Plain Subregion of the Drummond Botanical Subdistrict within the Southwestern Botanical Province as described by Beard (1990). Flora composition of the Swan Coastal Plain Subregion has been described by Beard (1990) as predominantly consisting of *Banksia* Low Woodlands on leached sands with *Melaleuca* swamps where ill-drained and Woodlands of *Eucalyptus* spp. on less leached soils.

Beard (1990) describes an open grass community as the first stable vegetation community on a foredune. **Cakile maritima* and **Arctotheca populifolia* are ephemeral species of the area and *Spinifex longifolius*, *Spinifex hirsutus*, **Tetragonia decumbens* and **Ammophila arenaria* are perennial colonisers. In the area on the peak and behind foredunes, species such as **Tetragonia decumbens, Isolepis nodosa, Scaevola crassifolia, Lepidosperma gladiatum* and *Olearia axillaris* occur.

Previous soil-based vegetation mapping for the region by Heddle *et al.* (1980) describes the vegetation complex as Quindalup Complex with associated vegetation mosaic of woodland or open forest of tuart-jarrah-marri or woodland of jarrah with Banksia species. Heddle *et al.* (1980) describes the vegetation of the Quindalup Complex as consisting predominantly of *Angianthus cunninghamii, *Arctotheca populifolia, Atriplex isatidea, *Cakile maritima, Carpobrotus virescens, *Pelargonium capitatum, Spinifex longifolius* and *Tetragonia implexicoma* in the strand and foredune alliance.

The Quindalup Complex vegetation of the mobile and stable dune alliance consists of *Acacia cyclops, Anthocercis littorea, Lepidosperma gladiatum, Myoporum insulare, Nitraria billardierei, Olearia axillaris, Scaevola crassifolia, Scaevola nitida, Spyridium globulosum* and *Westringia rigida*.

2. BOTANICAL SURVEY

The botanical survey was undertaken with the aim to produce a comprehensive flora list of the species present in the foreshore reserve adjacent to Pt Lot 1002 Seawind Drive, Silver Sands as well as reporting on the vegetation communities present and the condition of the vegetation on site.

2.1 METHODS

The flora survey was undertaken on 15th January 2004 by a botanist from BSD Consultants. The area surveyed was relatively small therefore the entire area was traversed by foot and recordings made of species present and the dominance in the stratum. The informal paths in the area were also followed to ascertain the level of degradation and erosion caused and the potential for rehabilitation.

All plant specimens collected during the field survey (i.e. voucher specimens believed to be Rare or Priority) were dried, pressed and then sorted in accordance with the requirements of the Western Australian State Herbarium. Identification of specimens occurred through comparison with named material and through the use of taxonomic keys. Where necessary, other botanists or plant taxonomists with specialist skills were consulted. Nomenclature of species used in this report follows current usage (Western Australia Herbarium 1998-2003).

The flora survey and assessment was carried out with direction from the following Environmental Protection Authority (EPA) guidance and position statements:

- EPA Position Statement No. 2 - Environmental Protection of Native Vegetation in Western Australia (EPA 2001a).
- EPA Position Statement No. 3 - Terrestrial biological surveys as an element of biodiversity protection (EPA 2001b).
- EPA Guidance statement No. 10 - Level of assessment for proposals affecting natural areas within the System 6 Region and Swan Coastal Plain portion of the System 1 Region (EPA 2003a).
- EPA Guidance statement No. 51 - Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia (EPA 2003b).

The vegetation communities occurring on this site were described in detail. The use of a standard data collection form ensured the data was collected in a systematic and consistent manner. For each species recorded, the average height and dominance within the community were noted.

Aerial photography was used to extrapolate and map vegetation communities in combination with running notes made during the course of the survey. Vegetation condition was also recorded at the site through running notes made while traversing the project area.

2.1.1 Limitations

This survey was undertaken during January 2004 and therefore is limited in the timing of the survey. Foredunes do not historically support many native ephemeral species however it is likely that more exotic species would have been identified had the survey been undertaken during Spring. It is estimated that 95% of the flora species occurring on site were collected.

Many of the grasses were identified from dead seeded specimens. Dead specimens of **Ehrharta calycina* were found on site in small quantities however it is inferred that this species would have a much higher dominance on site had the survey been undertaken during the optimal season for growth.

2.2 FLORA

A total of 30 taxa were identified in the area, comprising 19 families and 28 genera. This species representation is typical of the foredune of the Quindalup Vegetation Complex. 14 weed species were identified on site, indicating the degraded condition of the foreshore reserve.

Species of flora or fauna acquire Declared Rare or Priority conservation status where populations are restricted geographically or threatened by local processes. The Department of Conservation and Land Management (CALM) recognise these threats and subsequently apply regulations towards population protection and species conservation. CALM enforce regulations under the *Wildlife Conservation Act 1950* to conserve Declared Rare species and protect significant populations. Priority Flora species are potentially rare or threatened and are classified in order of threat.

No Declared Rare Flora, Priority Flora or other significant species were identified pursuant to the *Wildlife Conservation Act 1950* (CALM 2003) or the *Environment Protection and Biodiversity Conservation Act 1999*.

2.3 VEGETATION COMMUNITIES

In a natural state, the site would support two vegetation communities being the vegetation occurring on a foredune and sheltered side of the Quindalup Dune System. Vegetation suited to this harsh environment is naturally salt-tolerant, often succulent or with rough vegetation and shallow matting root systems to protect again the strong winds. Vegetation community mapping is presented in Figure 3.

Vegetation Community 1
Open Grassland of *Spinifex longifolius* with **Cakile maritima*, **Tetragonia decumbens*, **Oenothera drummondii* and **Euphorbia paralias*.

Vegetation Community 2
Low Heath of *Scaevola crassifolia*, *Lepidospema gladiatum*, *Spinifex longifolius* and *Olearia axillaris* over a Herbland of *Acanthocarpus preissii*, **Tetragonia decumbens*, **Lagurus ovatus*, **Bromus diandrus*.

Vegetation Community 1 is a typical representation of the species found on a foredune area. A large number of introduced species were found in association with the foredune.

Vegetation Community 2 is representative of vegetation commonly found in the sheltered dune area however annual grasses dominate the understorey.

A dominance of introduced species, particularly grasses, was found in the understorey of the adjacent POS and proposed development site. It is possible that the area originally supported an *Acacia saligna* shrubland however the understorey has been heavily colonised by annual and invasive grasses to the detriment of native understorey species. The community, as it is, poses a risk to the foreshore reserve adjacent by maintaining so many introduced grasses and effectively feeding the seedbank.

2.4 VEGETATION CONDITION

Vegetation condition was rated according to the vegetation condition scale commonly used in the Perth Metropolitan Region (Government of WA 2000) and is depicted in **Figure 4.**

Table 1: Vegetation Condition Scale (Taken from Bush Forever (Government of WA 2000))

Vegetation Condition	Definition
Pristine (1)	Pristine or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing
Good (4)	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

In general, the vegetation condition ranged from 6 'Completely Degraded' to 4 'Good'. The majority of the area was ranked 5 'Degraded' due to the presence of multiple disturbance such as invasive grasses, annual grasses, uncontrolled tracks and reduced native species cover. Areas of less disturbance such as dune rises and some deep swales were rated 4 'Good' condition, as the disturbance was not as severe.

Areas rated 6 'Completely Degraded' were in association with tracks and the seaward dune area, Foredunes are commonly sparsely vegetated however disturbance was present.

2.5 INTRODUCED SPECIES

The area supports many introduced species due to the unrestricted access and lack of intensive management. Close to half of the species on the site (14 of 30) were identified as introduced species. Weed species were commonly from the Poaceae family (grasses), Asteraceae family (daisies) and Euphorbiaceae family (spurges).

The presence of annual grasses such as **Bromus diandrus* and **Lagurus ovatus* in an area is facilitated by a loss of native vegetation cover from trampling or tracks. Invasive grasses such as **Ehrharta calycina* (Perennial Veldt Grass) and **Cynodon dactylon* (Couch grass) are competitive to the detriment of native vegetation.

In a coastal setting, the line between native and introduced species is less defined. Species on the foredune such as **Euphorbia paralias* (Sea spurge), **Cakile maritima* (Sea rocket) and **Tetragonia decumbens* (Sea spinach) are specialist foredune colonisers and play an important role in dune stabilisation in combination with native species. Generally as the environment becomes less intense, native species dominate to the exclusion of these species.

Garden escapes are a major contributor to introduced species on the Swan Coastal Plain. On site, **Gazania linearis*, **Osteospermum ecklonis*, **Pelargonium capitatum* are common garden species which have invaded the foreshore reserve.