YANCHEP SUN CITY

FLORA AND VEGETATION ASSESSMENT ST ANDREWS LOCAL STRUCTURE PLAN

VERSION 2

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REPORT NO: 2005/230

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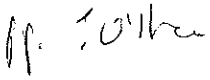
Checked by: Signed: 

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1. INTRODUCTION

1.1 Purpose and Scope

ATA Environmental was commissioned by Yanchep Sun City to undertake a flora and vegetation assessment within the St Andrew's Local Structure Plan (LSP) area. The boundary of the LSP subsequently changed after the survey but is similar to the area surveyed for the purpose of this report. The new boundary excludes the area south of Yanchep Beach Road. The scale of the surveys undertaken is in accordance with the Environmental Protection Authority's (EPA) *Guidance Statement for Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51* (2004).

This report includes:

- Mapping of vegetation types (and condition using the Bush Forever condition rating) using a combination of recent aerial photography and field surveys to ground-truth;
- A list of all native and non-native plant species recorded within non-permanent quadrats of 10m x 10m dimension within representative vegetation types, as well as opportunistic recordings of plant species present at the time of the survey;
- A list of significant species recorded on Department of Environment and Conservation's (DEC) database occurring in the vicinity of each site. The location of any significant species (DRF and Priority) identified on site will recorded using a GPS; and
- A description of the vegetation types and vegetation condition, and vegetation conservation significance.

2. EXISTING ENVIRONMENT

2.1 Location

The study area comprises approximately 670ha of land adjacent to the Yanchep townsite and identified initially as the St Andrew's Local Structure Plan area, as shown in Figure 1.

The study area is situated approximately 50km north of the Perth Central Business District and mainly comprises cleared land and areas of remnant native vegetation. The study area is bounded by the Mitchell Freeway road reserve and Yanchep National Park to the east, Lot 303 Two Rocks Road to the west, Bush Forever Site 289 to the south and the proposed alignment of Toreopango Avenue to the north.

2.2 Geological and Physiographic Context of Study Area

2.2.1 Climate

The Yanchep-Two Rocks area experiences a warm mediterranean climate with hot dry summers and mild wet winters. Air temperatures are similar to those experienced in Perth, where mean daily maximum temperatures vary from 30°C in summer to 17.5°C in winter, and mean daily minimum temperatures vary from 18.5°C in summer to 9.1°C in winter (Bureau of Meteorology, 2005).

Rainfall in the area occurs mostly during the winter months, with monthly totals during this period occasionally in excess of 100mm. Monthly rainfall of up to 50mm may occur in the remaining months. Previous long-term records indicate that the average annual rainfall is around 670mm collected from a private residence in Yanchep. This is low when compared to an average annual rainfall of 843mm derived from data collected since 1985 at the Wanneroo Post Office. The reason for this disparity is potentially due to mild drought conditions prevailing at the time of data collection.

Winds are an important climatic factor in the Yanchep-Two Rocks area as much of the landscape in the study area has been constructed by aeolian (wind driven) deposition and is particularly susceptible to the erosive powers of the wind if the natural vegetation is removed. During the summer months winds blow from the east to south-east in the morning (4am to midday) and from the south-west in the afternoon (1pm to 6pm), due to the local sea breeze. Alternatively, winter is characterised by north-westerly storm winds that back to the west and south-west, interspersed with calmer periods. These storms are related to the passage of low-pressure systems which attack the south-west portion of the state due to the northerly location of the anticyclone system. Major storms during winter, involving 70km/h winds for periods of 6 hours to 24 hours, occur 2-10 times per year.

Occasionally, in the period summer to autumn, tropical cyclones migrate further southwards than normal and may bring gale force winds to the Yanchep-Two Rocks coastline. During these events winds up to 130km/h are often experienced.

2.2.2 Landform and Geology

The coastal land from Two Rocks to the Moore River features two major geological units which are expressed by a variety of conspicuous landforms. The Tamala Limestone is the older geological unit and extends from the vicinity of Wanneroo Road in the east, out to sea to the west where it outcrops as a series of reefs.

On land, the Tamala Limestone forms a series of rounded ridgelines and intervening depressions known as the Spearwood Dune System. These features are aligned roughly south-east to north-west and are most obvious a few kilometres inland from the coast. In one valley between these ridges, caves and depressions are common. Some of these depressions are filled with water (e.g. Loch McNess).

The Tamala Limestone is covered over much of the region by Safety Bay Sand. This is a younger geological unit than the Tamala Limestone and is still actively accumulating along the coastline. It forms a large variety of landforms known as the Quindalup Dune System. The most conspicuous of these landforms are tall dunes which are either covered with vegetation or consist of loose mobile sand. Wind action is slowly moving the areas of mobile sand inland.

Some of the oldest of the Quindalup Dunes extend a long way inland as long crescentic ridges. These ridges were originally formed by wind action but they are now stable and are slowly converting to limestone. Another conspicuous landform in the Yanchep-Two Rocks area are isolated conical hills.

2.3 Biological Context of Study Area

2.3.1 Bioregional Data

Western Australia supports 53 biogeographical subregions. These bioregions are defined on the basis of geology, landform, vegetation, fauna and climate. The study area is located in the Swan Coastal Plain subregion of the Swan Coastal Plain bioregion (McKenzie *et al.*, 2003). The Swan Coastal Plain subregion is composed of colluvial and Aeolian sands, alluvial river flats, coastal limestone. Heath and/or Tuart woodlands on limestone, *Banksia* and Jarrah-*Banksia* woodlands on Quaternary marine dunes of various ages, Marri on colluvials and alluvials (McKenzie *et al.*, 2003).

3. FLORA AND VEGETATION

3.1 Methodology

Ms Cassyanna Gray, an experienced botanist from ATA Environmental conducted a flora and vegetation survey of the St Andrews Structure Plan area on 5 October to 7 October 2005. The survey was required to update previous flora and vegetation surveys that have been undertaken within the site (Alan Tingay & Associates, 1992 and ATA Environmental, 2001).

The survey was undertaken to determine if any of the significant species identified by the Department of Conservation and Land Management (DEC) actually occur or are likely to occur on the site. This was based on sampling within non-permanent quadrats of 10m x 10m dimension within representative vegetation types, as well as a opportunistic recordings of plant species present at the time of the survey. This method complies with the EPA's guidelines for flora surveys as outlined in Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004a) and *Terrestrial Biological Surveys as an Element of Biodiversity Protection Position Statement No. 3* (EPA, 2002).

The survey was conducted using vehicle access wherever possible. Areas not accessible by vehicle were traversed on foot. The major vegetation types were previously identified and delineated using a colour aerial photograph in ATA Environmental's (2001) *Yanchep Southern Precinct Flora and Vegetation Assessment* report. The Spring 2005 survey included verification of the previous vegetation mapping as well as more detailed data collection in accordance with Guidance Statement No. 51.

Prior to conducting the field survey, a search of the DEC Declared Rare and Priority Flora database was conducted to identify significant flora that could potentially occur in the survey area was undertaken. This investigation encompassed a review of the following databases:

- DEC's *'Threatened (Declared Rare) Flora'* database; and
- DEC's *'Declared Rare and Priority Flora List'* which contain species that are Declared Rare (Conservation code R or X for those presumed to be extinct) poorly known (Conservation codes 1, 2 or 3) or require monitoring (Conservation Code 4).

The results of the DEC database search are presented below in Table 1.

TABLE 1
SIGNIFICANT FLORA RECORDED IN THE VICINITY OF THE STUDY AREA

Species	Conservation Status	Preferred Habitat	Flowering Period
Acacia benthamii	2	Typically on limestone breakaways	Aug-Sep
Astroloma microcalyx	3	White or brown sand or loam, limestone, laterite. Coastal areas.	Jun-Sep
Comesperma acerosum	3	Sand over limestone, lateritic gravelly soils. Sandplains, lateritic ridges.	Sep-Dec
Conostylis bracteata	3	Sand, limestone. Consolidated sand dunes.	Aug-Sept
Conostylis pauciflora subsp. *euryrhipis*	3	White, grey or yellow sand. Consolidated dunes.	Aug-Oct
Eucalyptus argutifolia	DRF	Shallow soils over limestone. Slopes or gullies of limestone ridges, outcrops.	Mar-Apr
Grevillea evanescens	1	Brown Spearwood sand.	
Haloragis aculeolata	2	Black sand or clay over limestone. Winter-wet areas.	Sep-Dec
Hibbertia spicata subsp. *leptotheca*	3	Sand. Near-coastal limestone ridges, outcrops & cliffs.	Jul-Oct
Lasiopetalum membranaceum	3	Sand over limestone.	Sep-Dec
Lepidium pseudotasmanicum	4	Loam, sand.	Feb/Dec
Sarcozona bicarinata	3	White sand	Aug
Stylidium maritimum	3	White or black sand. Limestone outcrops in low coastal heath, consolidated sand dunes among low heath.	Oct-Nov
Thomasia triloba	3	Sandy gravel over laterite, loamy soils, clay, limestone	Oct-Nov

3.2 Vegetation Types

3.2.1 General Description

Approximately 240ha of native vegetation occurs within the study area. This represents about 35% of the study area.

Quindalup Dune vegetation is not common in the study area and is restricted to long dune ridges and occasional conical dunes. The most extensive Quindalup Dune vegetation type in the Yanchep-Two Rocks area is the *Melaleuca systena* Heath on Q1 dunes. Although restricted in distribution in the study area, the Q1 vegetation type extends from close to the coast up to 6km inland to the north of the Two Rocks townsite. In the study area the Q1 vegetation type is restricted to narrow ridges, intermixed with Spearwood vegetation types. The main vegetation in the study areas occurs on Spearwood dune soils.

The shallow sand over limestone and outcropping limestone vegetation types are mainly distributed in the central and eastern portion of the study area. In the study area the *Dryandra sessilis* Heath occurs on flat areas of limestone and low hills while the tall jagged limestone hills support *Melaleuca huegelii* and Mallee eucalypt species.

The deeper sand over limestone vegetation types are located in the central and eastern regions of the study area and include the Banksia Woodlands and isolated stands of Tuart trees. There is a distinct transition between the vegetation found on the limestone and the deeper sands.

The vegetation types found within the Local Structure Plan area are shown in Figure 3 and described below.

Old Quindalup Dune Heath

***Melaleuca systena* Closed Heath (Ms)**

The vegetation characteristic of this soil type occurs on rolling parabolic dunes generally with convex slopes. The Q1 soils are the most extensive Quindalup dune soils in the Yanchep-Two Rocks area, extending up to 6km inland in places. The flanks and crests are dominated throughout by the Ma association which commonly includes *Conostylis candicans, Hibbertia racemosa, Diplopeltis huegelii, Phyllanthus calycinus* and *Gastrolobium nervosum*. No other species is routinely co-dominant with *Melaleuca systena* but in some places some species assume equal importance and occur scattered throughout the Ma association. No quadrats were recorded for this vegetation type.

***Acacia saligna* (As) / *Xanthorrhoea preissii* (AsXp) Open Scrub to Tall Shrubland**

On some dune slopes, flat areas and swales of the Q1 dunes the Ma association is covered by a sparse to dense cover of *Acacia saligna* and/or *Xanthorrhoea preissii* up to 2.5m tall. The soil type covered by this association is both Q1 and Qs soils which is generally dark brown sand and probably indicates the proximity of the Tamala Limestone to the surface. The common species of the As / AsXp unit are similar to that of the Ma association with *Conostylis candicans, Diplopeltis huegelii* and *Melaleuca systena* but differ slightly with the inclusion of the two dominant species *Acacia saligna* and *Xanthorrhoea preissii* as well as the inclusion of *Lepidosperma squamatum* and *Rhagodia baccata*. These areas appear to have a higher number of introduced species due to either the increased nutrients of the soil type, higher moisture availability or increased grazing pressure. No quadrats were recorded for this vegetation type due to the degraded condition of the vegetation.

Limestone Heath Types

***Dryandra sessilis* Heath to Closed Heath (Ds)**

The limestone heaths dominated by *Dryandra sessilis* are by far the most widespread vegetation type throughout the area. *Dryandra sessilis* can be the sole dominant species or can be found associated with other dominants including *Hibbertia hypericoides, Acacia pulchella, Hakea trifurcata, Calothmnus quadrifidus* (DsCq) and mixtures of these co-dominants. These associations tend to occur mainly on the lower, mid and upper slopes of limestone rises and hills. Where the limestone abuts areas of deeper sand, occasional emergent *Banksia* and Tuart trees occur. However, usually the transition from Ds to *Banksia* Woodland is more abrupt.

Common understorey species include *Melaleuca systena, Mesomelaena pseudostygia, Hibbertia hypericoides, Xanthorrhoea preissii, Desmocladus flexuosa, Conostylis candicans*

and *Hybanthus calycinus.* This vegetation type corresponds to Quadrats 6, 8, 10, 11, 13, 16 and 17.

***Calothamnus quadrifidus* Closed Heath (Cq)**

The *Calothamnus quadrifidus* Closed Heath (Cq) generally occurs intermixed with the Ds Heath associations. It occurs on blackish sand over limestone with very little limestone outcropping. The main distribution is towards the eastern region of the study area adjacent to the existing quarry site. This vegetation type corresponds to Quadrats 1 and 2.

***Melaleuca huegelii* Open Heath to Heath (Mh)**

The top of most limestone hills and rises contain a *Melaleuca huegelii* Heath association. The soil type typically contains abundant limestone with very little sand present. The exposed limestone is more weathered than that exposed in the Ds Heath. This association is generally limited in the study area and usually occurs as small patches less than 0.1ha in size. Several larger areas occur, particularly north of the old limestone quarry where the association covers approximately 1ha. The *Melaleuca huegelii* shrubs are normally about 0.5m tall but may be as tall as 1.6m. Two other species which could be considered indicators for this association where *Trymalium ledifolium* and *Acacia truncata*. Also common, but not indicators, were *Desmocladus flexuosa, Dryandra lindleyana, Templetonia retusa* and *Melaleuca systena*. No quadrats were recorded for this vegetation type due to the small area the vegetation covers.

Sand Over Limestone Vegetation

***Banksia attenuata* Low Open Forest (Ba)**

The Ba vegetation type includes a variety of different associations based mainly on the dominance of four low tree species, *Banksia attenuata, B. menziesii, Eucalyptus todtiana* and *Allocasuarina fraseriana*. While there is a range of understorey shrub types there is no clear division into distinct groupings.

Banksia associations are distributed inland on the property mainly in the eastern half. They occur as large areas such as in the central and northern region of the site or intermixed with limestone vegetation or occasionally as small stands throughout valleys in the older Quindalup Dunes.

The understorey vegetation is usually dominated by *Hibbertia hypericoides* with *Mesomelaena pseudostygia, Xanthorrhoea preissii, Macrozamia riedlei* and *Sowerbaea laxiflora*. This vegetation type corresponds to Quadrats 3, 4, 5, 7, 14 and 15.

***Eucalyptus gomphocephala* Woodland to Open Forest (Eg)**

Tuart trees occur on a wide range of soil types but in the study area they are restricted to deep brown / yellow sand over limestone. The Tuart Woodlands were recorded from two locations in the study area including the central northern region of the site and at the southeastern corner of the site. Common understorey species include *X. preissii, Desmocladus flexuosa, Dryandra lindleyana, Hakea prostrata* and *Rhagodia baccata*. The creeper *Hardenbergia comptoniana* is frequent among the trees and large shrubs. No quadrats were recorded for this vegetation type due to the degraded condition of the vegetation.

***Eucalyptus marginata* Woodland (Em)**

Only one portion of *Eucalyptus marginata* (Jarrah) Woodland (Em) occurs in the study area and is located in the south-eastern corner of the site. The Jarrah trees attain a height of

15m-18m over a low shrub understorey. Occasionally *Banksia menziesii* is also present as mid-canopy strata. Some common *Banksia* Woodland species are in the understorey including *X. preissii, Macrozamia fraseri* and *Mesomelaena psuedostygia* while other *Banksia* Woodland indicators are notably absent including *Sowerbaea laxiflora* and *Caladenia flava*. Three species which appeared to be confined to this association are *Eremaea beaufortioides, Eremaea* sp. A and *Acacia stenoptera*. Other commonly occurring species are *Stirlinga latifolia, Patersonia occidentalis, Petrophile macrostachya* and *Bossiaea eriocarpa*. This vegetation type corresponds to Quadrat 18.

3.2.2 Vegetation Condition

The condition of the vegetation was assessed using the scale of Keighery published in Bush Forever (Government of WA, 2000) and is mapped in Figure 4. Keighery's condition rating scale ranges from Pristine (which the vegetation exhibits no visible signs of disturbance) to Completely Degraded (where the vegetation structure in no longer intact and without native plant species). A description of the vegetation condition ratings applicable to the survey area are outlined below.

Very Good (VG) 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 (G) Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate. 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 (D) 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 some very aggressive weeds at high density, partial clearing, dieback and grazing.

Completely Degraded (CD) The structure of this vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described "parkland cleared" with the flora comprising weed or crop species with isolated native trees or shrubs.

The condition of the vegetation in the study area ranges from Very Good to Completely Degraded (totally cleared), as shown in Figure 4. Approximately 100ha of the study area has been totally cleared for agriculture or degraded as a result of associated activities.

Apart from the effect of clearing, the main impact on the native vegetation is grazing by stock. The lack of fencing around areas of native vegetation means that cattle are allowed to graze freely. Although the grazing intensity varies, there is evidence of grazing over most of the area, even in the most remote, least accessible terrain and vegetation types. The highest grazing pressure is in the islands of remnant vegetation among the cleared pasture areas. In particular those vegetation types which provide shade and are easily accessible to cattle are most degraded with a large reduction in understorey shrub density and a high number of introduced species.

While broad boundaries have been drawn on the map, these areas also include smaller sections of different categories. The boundaries are often gradational and not as definitive as mapped. The categories are subjective and open to interpretation by the observer.

3.2.3 Floristic Community Types

The vegetation associations identified in the study area can be related to Floristic Community Types (FCTs) as described by Gibson *et al*., (1994). A study initiated by the City of Wanneroo to investigate the conservation values of remnant vegetation in the region provides further information regarding the FCTs present in the study area (Trudgen, 1996). The FCTs identified in the study area include the following:

24 Northern Spearwood shrublands and woodlands

28 Spearwood *Banksia attenuata* or *Banksia attenuata-Eucalyptus* Woodlands

29a Coastal Shrublands on shallow sands

29b *Acacia* Shrublands on taller dunes

Gibson (*et al*., 1994) provides the following description of the Floristic Community Types found in the study area.

FCT 24 and 28 are restricted to the Spearwood Dune system. FCT 24 includes heaths or heaths with scattered Tuart (*Eucalyptus gomphocephala*) occurring on the deeper soils north from Woodman Point. Within the study area FCT 24 corresponds to the vegetation associations dominated by *Melaleuca huegelii, M. systena* or *Dryandra sessilis* on the skeletal soil on ridge slopes and ridge tops. FCT 28 is largely made up of the *Banksia* woodlands and has been recorded from Thompson's Lake north to Seabird.

FCT 29 is largely restricted to the Quindalup System and contains two distinct subgroups. FCT 29a and FCT 29b correspond to only a small portion of vegetation within the study area. FCT 29a comprises mostly heaths on shallow sands over limestone close to the coast. These communities do not have a single dominant but important species include, *Spyridium globulosum, Rhagodia baccata* and *Olearia axillaris.* This community occurs between Seabird and Garden Island. FCT 29b is dominated by *Acacia* Shrublands or mixed heaths of the larger dunes and ranges from Seabird to south of Mandurah. There is no consistent dominant in FCT 29b, however species such as *Acacia rostellifera, Acacia lasiocarpa* and *Melaleuca systena* are important.

3.2.4 Conservation Significance of Vegetation

Vegetation Complexes

Vegetation Complexes are a broad level of vegetation description which is based on the underlying geomorphology and rainfall (Heddle *et a*l., 1980).

At this level, the majority of the vegetation within the St Andrews Local Structure Plan area is classified as being in the Quindalup Complex. Small portions of the eastern extent of the study area comprise the Cottesloe Complex – North.

The Quindalup Complex extends in an almost continuous thin strip along the coast from Dongara in the north to Busselton in the south. There is considerable variation in the vegetation that comprises the Quindalup Complex both at the local and regional level. The Cottesloe Complex – North adjoins the Quindalup Complex at its eastern extent and extends

south towards the Perth Metropolitan area where a transition occurs to Cottesloe Complex – Central and South.

The vegetation complexes present within the St Andrews Structure Plan area are described as follows (Heddle *et a*l., 1980):

- Quindalup Complex – Coastal dune complex consisting mainly of two alliances – the strand and foredune alliance and the mobiles and stable dune alliance. Local variations include the low closed forest of *M. lanceolata – Callitris preissii* and the closed scrub of *Acacia rostellifera*; and

- Cottesloe Complex - North – Predominantly low open forest and low woodland of *Banksia attenuata – B. menziesii – E. todtiana*; closed heath on the Limestone outcrops.

According to Bush Forever (Government of Western Australia) there is approximately 48% of the original extent of the Quindalup Complex and 70% of the Cottesloe Complex-North remaining, of which 20% and 64% is protected under the Bush Forever Strategy, respectively. Both complexes are above the minimum threshold of 10% of the pre-European extent of vegetation complexes recommended in Bush Forever, and are therefore not considered to be regionally significant.

Floristic Community Types

The vegetation surveys undertaken in 1992, 2001 and 2005 have not identified any Floristic Community Types (FCTs) in the LSP area listed as Threatened Ecological Communities (TECs) (English and Blyth, 1997). The study area however, does support two communities recommended for listing as Threatened. These comprise FCTs 29a and 29b, as shown in Table 3.

The *Melaleuca huegelii* vegetation occurring on the tops of some limestone hills is similar to the TEC FCT 26a, *Melaleuca huegelii – Melaleuca systena* shrublands of limestone ridges. Quadrat data collected suggest that the stands of *Melaleuca huegelii*, correspond to FCT 24 rather than 26a. This is due to the absence of typical species usually recorded from FCT 26a.

TABLE 3
CONSERVATION STATUS OF FLORISTIC COMMUNITY TYPES RECORDED IN THE STUDY AREA

Floristic Community Type		**Reservation Status**	**Conservation Status**
24	Northern Spearwood Shrublands and Woodlands	Well Reserved	Susceptible
28	Spearwood *Banksia attenuata* or *Banksia attenuata* - *Eucalyptus* Woodlands	Well Reserved	Low Risk
29a	Coastal Shrublands on shallow sands	Poorly Reserved	Susceptible
29b	*Acacia* Shrublands on taller dunes	Poorly Reserved	Susceptible

Vegetation Associations

Stands of Tuart trees are present within the St Andrews Local Structure Plan area with the large majority being planted approximately 10-15 years ago. Consideration should be given to retaining some stands of Tuarts for aesthetic and habitat reasons.

3.3 Flora

A total of 114 plant species were recorded within the site during the October 2001 and October 2005 flora surveys. The list includes 114 native species and 34 introduced (weed) species. The dominant families were Proteaceae (*Banksia* family – 15 native taxa), Asteraceae (Daisy family – 13 taxa; four introduced), Myrtaceae (Eucalypt family – 12 native taxa) and Papilionaceae (Pea family – 12 taxa; three introduced).

A list of the flora species recorded within the survey area during the October 2005 assessment is provided in Appendix 1. The floristic data collected from each quadrat is provided in Appendix 2.

3.3.1 Conservation Significance of Flora

A search of the DEC's Declared Rare and Priority database was undertaken prior to the site investigation. No Declared Rare or Priority Flora species are known to occur in the study area or were recorded within the study area during the October 2005 survey. The timing of the survey was considered optimal for the identification of significant flora species listed on the DEC database search as potentially occurring within the site.

6. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions have been made regarding the flora and vegetation assessment of the St Andrew Local Structure Plan Area:

- The condition of the vegetation in the study area ranges from totally cleared Very Good to Completely Degraded. Approximately 100ha of the study area has been totally cleared for agriculture or degraded as a result of associated activities;

- A total of 114 plant species were recorded within the site during the October 2005 survey. The list includes 61 native species and 22 introduced (weed) species;

- No Declared Rare or Priority Flora species were recorded within the study area during the October 2006 site visit. The timing of the survey was considered optimal for the identification of significant flora species listed on the DEC database search as potentially occurring within the site;

- Three dominant vegetation groupings were identified within the study area during the Spring 2005 flora and vegetation assessment (ATA Environmental, 2001). These included the Old Quindalup Dune Heath, Limestone Heath and Sand over Limestone Vegetation;

- No TECs were identified as occurring within the study area during the October 2005 survey. However, the study area does support two communities recommended for listing as Threatened; and

- Stands of Tuart trees are present within the St Andrews Local Structure Plan area with the large majority being planted approximately 10-15 years ago. Consideration should be given to retaining some stands of Tuarts for aesthetic and habitat reasons.

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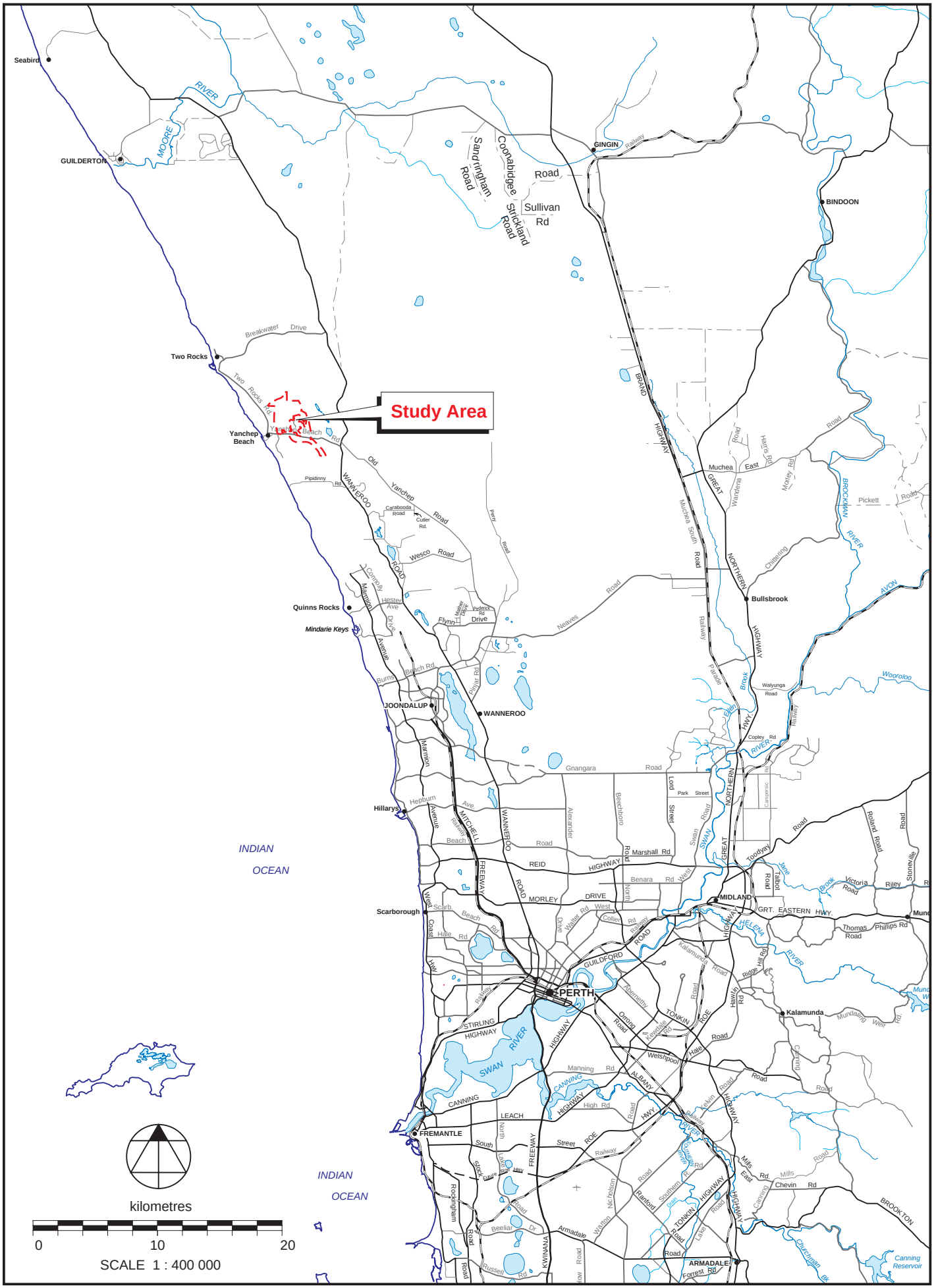
FIGURES



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ST ANDREWS LOCAL STRUCTURE PLAN
VEGETATION SURVEY

REGIONAL LOCATION

FIGURE 1

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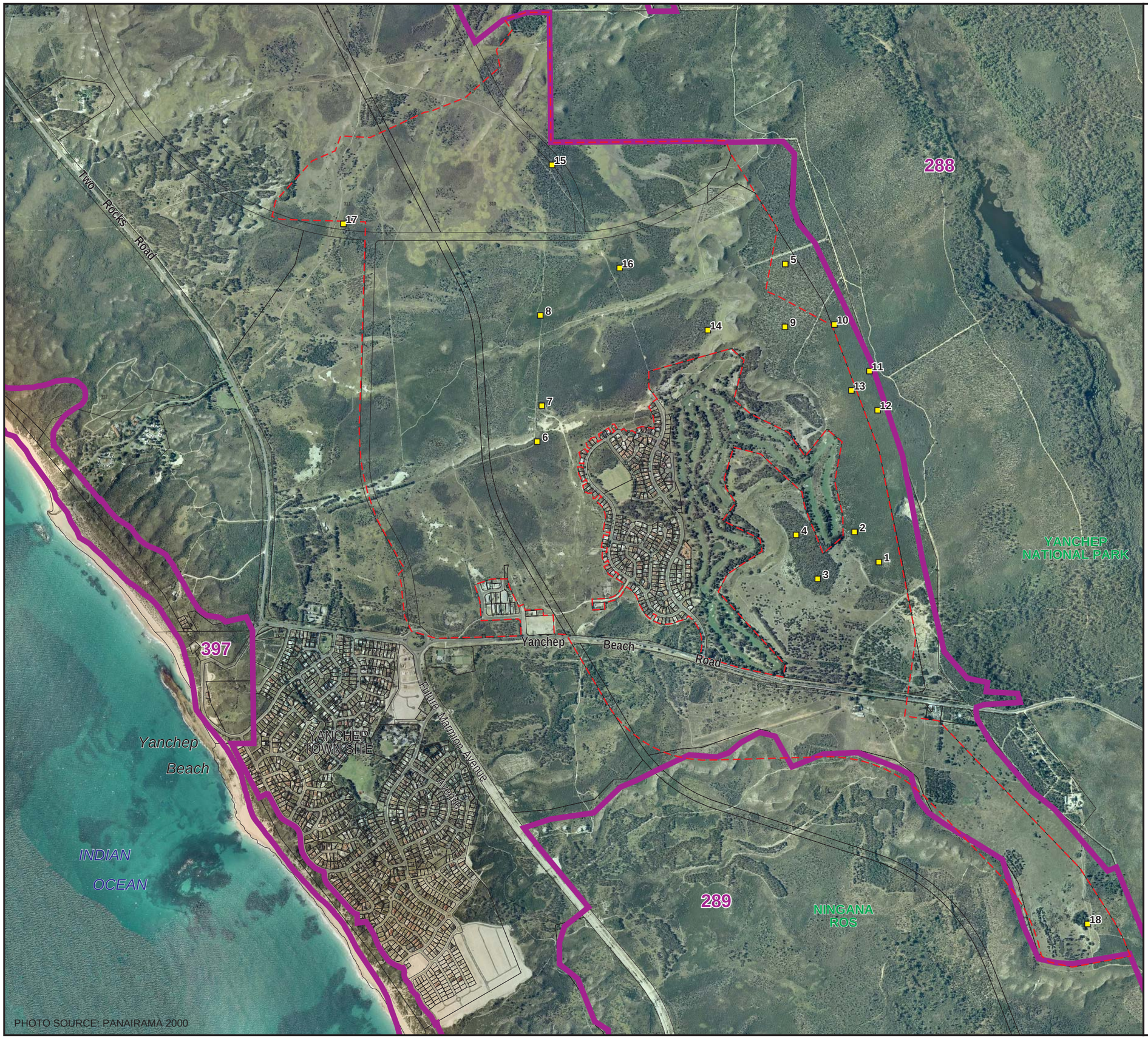
DATUM: MGA

YSC-2005-006/VEAS/25_230f2.dgn



metres

0 250 500 750 1000

SCALE 1 : 20 000 @ A3

LEGEND

- Study Area Boundary
- Cadastral Boundary
- Bush Forever Site Boundary
- Vegetation Quadrat

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ST ANDREWS LOCAL STRUCTURE PLAN
VEGETATION SURVEY

STUDY AREA

FIGURE 2

PRINTED: Thu 25 Oct 07

YSC-2005-006/VEAS/25_230f3.dgn DATUM: MGA DRAWN BY: EDS 19-01-06 CHECKED BY: CG 19-01-06

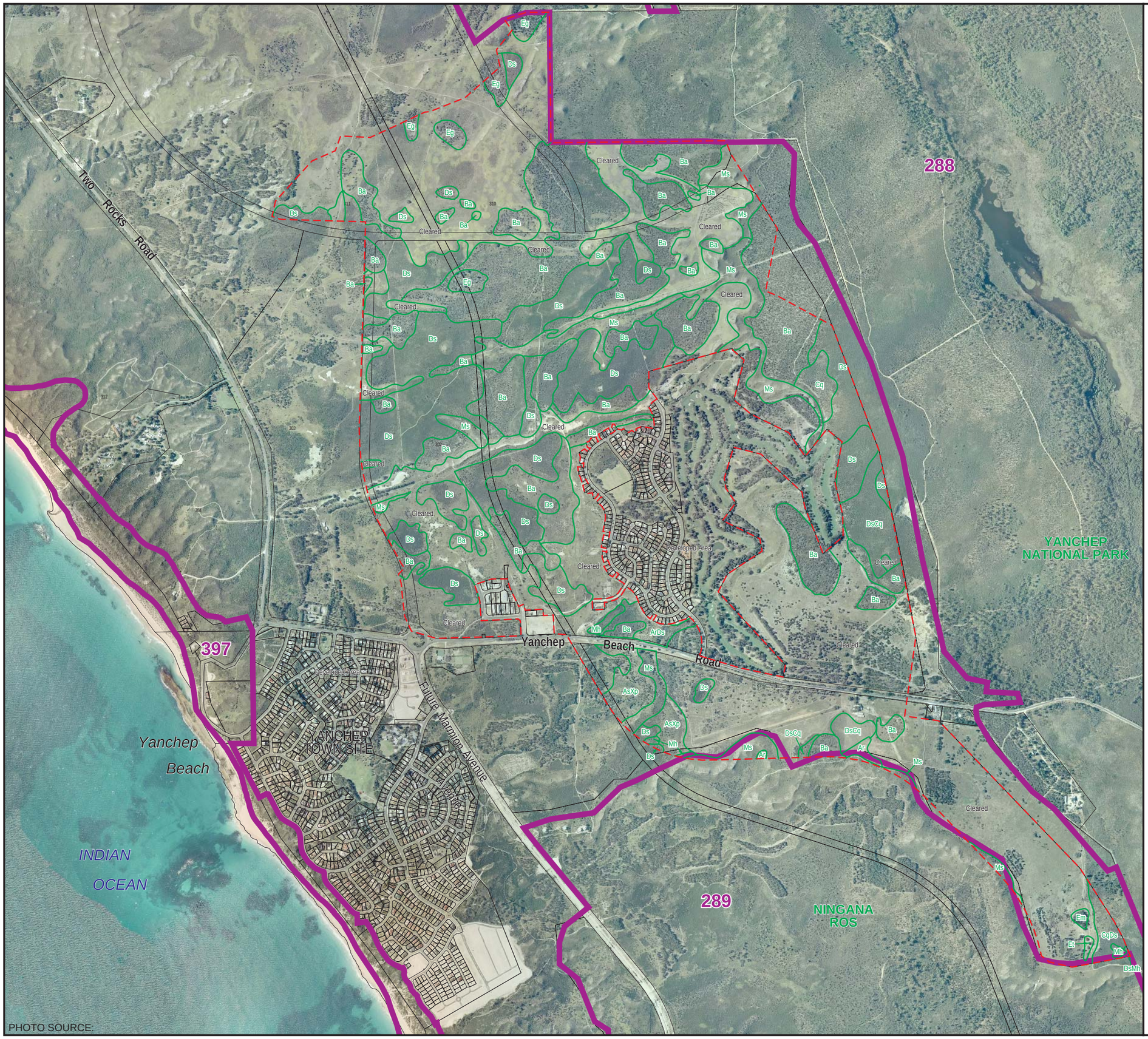

PHOTO SOURCE:

metres

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SCALE 1 : 20 000 @ A3

LEGEND

Study Area Boundary
Cadastral Boundary
Bush Forever Site Boundary

QUINDALUP VEGETATION COMPLEX
Young Quindalup Dune Heath

Ar *Acacia rostellifera* Closed Heath

Old Quindalup Dune Heath

Ms *Melaleuca systena* Closed Heath
ArDs *Acacia rostellifera* Closed Heath with scattered *Dryandra sessilis*
AsXp *Acacia saligna* and *Xanthorrhoea preissii* Tall Shrubland

COTTESLOE - NORTH VEGETATION COMPLEX
Limestone Heath Types

Ds *Dryandra sessilis* Heath to Closed Heath
DsCq/CqDs *Dryandra sessilis* and *Calothamnus quadrifidus* Heath to Closed Heath
Cq *Calothamnus quadrifidus* Closed Heath
DsMh *Dryandra sessilis* and *Melaleuca huegelii* Open Heath to Heath
Mh *Melaleuca huegelii* Open Heath to Heath

Sand over Limestone

Ba *Banksia attenuata* Low Open Forest
Eg *Eucalyptus gomphocephala* Woodland to Open Forest
Em *Eucalyptus marginata* Woodland
Et *Eucalyptus todtiana* Woodland

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ST ANDREWS LOCAL STRUCTURE PLAN
VEGETATION SURVEY

VEGETATION TYPES

FIGURE 3

PRINTED: Thu 25 Oct 07

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metres

0 250 500 750 1000

SCALE 1 : 20 000 @ A3

LEGEND

- Study Area Boundary
- Cadastral Boundary
- Bush Forever Site Boundary

VEGETATION CONDITION

P **Pristine**
Pristine or nearly so, no obvious signs of disturbance

E **Excellent**
Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive

VG **Very Good**
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.

G **Good**
Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate. 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.

Deg **Degraded**
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.

CD **Completely Degraded**
The structure of the vegetation is no longer intact and the areas is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.

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ST ANDREWS LOCAL STRUCTURE PLAN
VEGETATION SURVEY
VEGETATION CONDITION
FIGURE 4

APPENDICES

APPENDIX 1

FLORA LIST

APPENDIX 1
FLORA SPECIES LIST

Note**: * -** denotes introduced species

FAMILY	SPECIES
GYMNOSPERMS	
ZAMIACEAE	*Macrozamia fraseri*
MONOCOTYLEDONS	
ANTHERICACEAE	*Sowerbaea laxiflora*
	Thysanotus patersonii
	Tricoryne elatior
ASPHODELACEAE	**Asphodelus fistulosus*
CENTROLEPIDACEAE	*Centrolepis drummondiana*
COLCHICACEAE	*Burchardia congesta*
CYPERACEAE	*Isolepis cernua*
	**Isolepis marginata*
	Isolepis nodosa
	Mesomelaena pseudostygia
DASYPOGONACEAE	*Acanthocarpus preissii*
	Lomandra hermaphrodita
	Lomandra maritima
HAEMODORACEAE	*Anigozanthos humilis*
	Conostylis aculeata
	Conostylis candicans subsp. *calcicola*
	Conostylis setigera
	Haemodorum laxum
IRIDACEAE	**Gladiolus caryophyllaceus*
	**Homeria flaccida*
	Orthrosanthus laxus
	Patersonia occidentalis
	**Romulea rosea*
ORCHIDACEAE	*Caladenia flava*
	Microtis media subsp. media
	**Monadenia bracteata*
POACEAE	**Aira caryophyllea*
	Austrostipa compressa
	**Avena fatua*
	**Briza maxima*

FAMILY	SPECIES
	**Briza minor*
	**Bromus diandrus*
	**Lagurus ovatus*
	**Lolium rigidum*
	**Vulpia bromoides*
RESTIONACEAE	*Desmocladus fasciculatus*
	Desmocladus flexuosus
XANTHORRHOEACEAE	*Xanthorrhoea preissii*
DICOTYLEDONS	
AIZOACEAE	***Carpobrotus edulis*
APIACEAE	*Daucus glochidiatus*
	Homalosciadium homalocarpum
	Trachymene pilosa
ASTERACEAE	*Actinobole uliginosa*
	**Arctotheca calendula*
	Brachyscome iberdifolia
	Helichrysum tepperi
	**Hypochaeris glabra*
	Lagenophera huegelii
	Millotia myosotidifolia
	Olearia axillaris
	Olearia rudis
	Podotheca angustifolium
	Podotheca gnaphalioides
	**Sonchus oleraceus*
	**Ursinia anthemoides*
BRASSICACEAE	**Brassica tournefourtii*
	**Rhaphanus rhaphanistrum*
CAMPANULACEAE	**Wahlenbergia capensis*
CARYOPHYLLACEAE	**Parentucellia latifolia*
	**Petrorhagia dubia*
	**Petrorhagia velutina*
CASUARINACEAE	*Allocasuarina humilis*
	Allocasuarina fraseriana
CHENOPODIACEAE	*Rhagodia baccata*
CRASSULACEAE	**Crassula glomerata*
DILLENIACEAE	*Hibbertia hypericoides*
	Hibbertia racemosa

FAMILY	SPECIES
DROSERACEAE	*Drosera erythrorhiza*
	Drosera sp.
EPACRIDACEAE	*Conostephium pendulum*
	Leucopogon parviflorus
	Leucopogon propinquus
	Lysinema ciliatum
EUPHORBIACEAE	**Euphorbia peplus*
	**Euphorbia terracina*
	Phyllanthus calycinus
	Poranthera microphylla
GERANIACEAE	**Erodium botrys*
	**Pelargonium capitatum*
GOODENIACEAE	*Goodenia caerulea*
	Lechenaultia linarioides
	Scaevola canescens
	Scaevola repens
	Scaevola thesioides
LAMIACEAE	*Hemiandra pungens*
LAURACEAE	*Cassytha* sp.
LORANTHACEAE	*Nuytsia floribunda*
MIMOSACEAE	*Acacia cyclops*
	Acacia lasiocarpa
	Acacia pulchella
	Acacia rostellifera
	Acacia saligna
	Acacia stenoptera
	Acacia truncata
MYRTACEAE	*Calothamnus quadrifidus*
	Eremaea beaufortioides
	Eremaea sp.
	Eucalyptus decipiens
	Eucalyptus foecunda
	Eucalyptus gomphocephala
	Eucalyptus marginata
	Eucalyptus todtiana
	Kunzea ericifolia
	Leptospermum spinescens
	Melaleuca huegelii
	Melaleuca systena
PAPILIONACEAE	*Bossiaea eriocarpa*
	Gompholobium tomentosum
	Hardenbergia comptoniana

FAMILY	SPECIES
	Hovea trisperma
	Jacksonia hakeoides
	Jacksonia ?spinosa
	Kennedia prostrata
	**Lupinus cosentinii*
	Nemcia capitata
	Templetonia retusa
	**Trifolium campestre*
	**Trifolium* sp.
POLYGALACEAE	*Comesperma confertum*
PORTULACACEAE	*Calandrinia liniflora*
	Calandrinia sp.
PRIMULACEAE	**Anagallis arvensis*
PROTEACEAE	*Banksia attenuata*
	Banksia meziesii
	Conospermum stoechadis
	Dryandra lindleyana
	Dryandra sessilis
	Grevillea thelmanniana
	Hakea costata
	Hakea lissocarpha
	Hakea prostrata
	Hakea ruscifolia
	Hakea trifurcata
	Petrophile macrostachya
	Petrophile serruriae
	Stirlingia latifolia
	Synaphea sp.
RHAMNACEAE	*Spyridium globulosum*
	Trymalium ledifolium
RUTACEAE	*Philotheca spicata*
SOLANACEAE	*Anthocercis ilicifolium*
STYLIDIACEAE	*Stylidium brunonianum*
	Stylidium calcaratum
	Stylidium sp.
VALERIANACEAE	**Centranthus macrosiphon*
VIOLACEAE	*Hybanthus calycinus*
Native species	114
Introduced species	34
Total species	148

APPENDIX 2

QUADRAT DATA

QUADRAT Q1
373072E 6509375N
Condition: Good

QUADRAT Q1 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Dryandra sessilis	85	1.8
Spyridium globulosum	5	1.8
Rhagodia baccata	2	1.5
Calothamnus quadrifidus	2	1.4
Melaleuca systena	2	0.9
**Homeria flaccida*	20	0.8
Hakea lissocarpha	<1	0.7
Hibbertia hypericoides	5	0.6
Sowerbaea laxiflora	<1	0.6
**Avena fatua*	20	0.5
Leucopogon parviflorus	<1	0.5
Phyllanthus calycinus	<1	0.5
**Briza minor*	20	0.3
Hardenbergia comptoniana	1	Creeper

QUADRAT Q2
372942E 6509537N
Condition: Good

QUADRAT Q2 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Xanthorrhoea preissii	4	2
Dryandra sessilis	90	1.8
Acacia rostellifera	5	1.8
Spyridium globulosum	2	1.5
Melaleuca systena	3	0.9
**Homeria flaccida*	2	0.6
Calothamnus quadrifidus	<1	0.6
Hibbertia hypericoides	3	0.3
**Avena fatua*	5	0.3
**Briza minor*	80	0.2

QUADRAT Q3
372744E 6509285N
Condition: Very Good

QUADRAT Q3 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Banksia menziesii	10	4
Banksia attenuata	5	4
Xanthorrhoea preissii	5	1.5
Hakea prostrata	2	1.2
Hibbertia hypericoides	30	1
Acacia pulchella	<1	1
Jacksonia hakeoides	<1	0.6
Leucopogon parviflorus	<1	0.4
Mesomelaena pseudostygia	2	0.3
**Wahlenbergia capensis*	<1	0.3
**Homeria flaccida*	<1	0.3
Podotheca gnaphalioides	5	0.2
**Ursinia anthemoides*	5	0.2
**Petrorhagia dubia*	<1	0.2
Sowerbaea laxiflora	<1	0.2
**Briza minor*	1	0.2
**Arctotheca calendula*	1	0.1
**Anagallis arvensis* subsp. *caerulea*	<1	0.05
**Trifolium campestre*	<1	0.05

QUADRAT Q4
372628E 6509521N
Condition: Good

QUADRAT Q4 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Banksia attenuata	10	5
Banksia menziesii	6	5
Xanthorrhoea preissii	12	1.6
Hibbertia hypericoides	10	1
**Brassica tournefortii*	<1	0.6
Burchardia congesta	<1	0.4
Mesomelaena pseudostygia	5	0.3
**Briza minor*	5	0.3
Podotheca gnaphalioides	15	0.3
**Homeria flaccida*	1	0.3
Sowerbaea laxiflora	<1	0.3
**Briza maxima*	1	0.3
**Arctotheca calendula*	5	0.2
**Ursinia anthemoides*	5	0.2
**Petrorhagia dubia*	<1	0.2
**Hypochaeris glabra*	<1	0.1
**Anagallis arvensis* subsp. *caerulea*	<1	0.05
**Trifolium campestre*	1	0.05

QUADRAT Q5
372570E 6510976N
Condition: Very Good to Good

QUADRAT Q5 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Banksia attenuata	15	4
Banksia menziesii	5	4
Xanthorrhoea preissii	10	1.5
Macrozamia fraseri	5	1.4
Hibbertia hypericoides	7	0.8
**Avena fatua*	3	0.8
Sowerbaea laxiflora	<1	0.8
Burchardia congesta	<1	0.7
Mesomelaena pseudostygia	8	0.5
Orthrosanthus laxus	<1	0.4
Podotheca gnaphalioides	3	0.2
**Petrorhagia dubia*	<1	0.2
**Hypochaeris glabra*	1	0.1
Trachymene pilosa	1	0.1
**Ursinia anthemoides*	2	0.1
**Briza minor*	<1	0.1
**Trifolium campestre*	1	0.05
**Anagallis arvensis* subsp. *caerulea*	<1	0.05
Calandrinia sp.	<1	0.01

QUADRAT Q6
371237E 6510022N
Condition: Good

QUADRAT Q6 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Dryandra sessilis	40	1.8
Spyridium globulosum	2	1.6
Acacia pulchella	5	1.2
Melaleuca systena	5	1
Hakea lissocarpha	4	0.9
Hibbertia hypericoides	10	0.9
Austrostipa compressa	5	0.8
**Gladiolus caryophyllaceus*	<1	0.8
Calothamnus quadrifidus	1	0.8
Phyllanthus calycinus	1	0.7
**Pelargonium capitatum*	<1	0.7
**Asphodelus fistulosus*	10	0.6
Conospermum stoechadis	1	0.6
**Lagurus ovatus*	20	0.3
Mesomelaena pseudostygia	1	0.3
**Sonchus oleraceus*	<1	0.3
Goodenia caerulea	<1	0.3
Conostylis setigera	<1	0.3
**Rhaphanus rhaphanistrum*	<1	0.2
Desmocladus fascicularis	<1	0.2
Lomandra hermaphrodita	1	0.1

SPECIES	% COVER	HEIGHT (M)
**Anagllis arvensis* subsp. *caerulea*	4	0.05
**Trifolium campestre*	2	0.05
Hardenbergia comptoniana	<1	creeper

QUADRAT Q7
371262E 6510215N
Condition: Good

QUADRAT Q7 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Banksia attenuata	10	3
Banksia menziesii	10	3
Xanthorrhoea preissii	6	1.4
Macrozamia fraseri	1	1.2
Hibbertia hypericoides	30	1
**Gladiolus caryophyllaceus*	<1	0.8
Burchardia congesta	<1	0.8
**Bromus diandrus*	5	0.8
Acacia pulchella	1	0.7
Comesperma confertum	<1	0.6
Conostephium pendulum	<1	0.6
Sowerbaea laxiflora	<1	0.6
**Briza maxima*	10	0.5
Lomandra hermaphrodita	<1	0.5
Gompholobium tomentosum	1	0.4
**Avena fatua*	2	0.4
**Sonchus oleraceus*	<1	0.4
Anigozanthos humilis	<1	0.3
Mesomelaena pseudostygia	2	0.3
Jacksonia hakeoides	1	0.3
**Ursinia anthemoides*	5	0.2

SPECIES	% COVER	HEIGHT (M)
**Carprobrotus edulis*	<1	0.1
**Hypochaeris glabra*	3	0.1
Petrorhagia dubia	<1	0.1
Desmocladus fascicularis	2	0.1
**Trifolium campestre*	<1	0.05

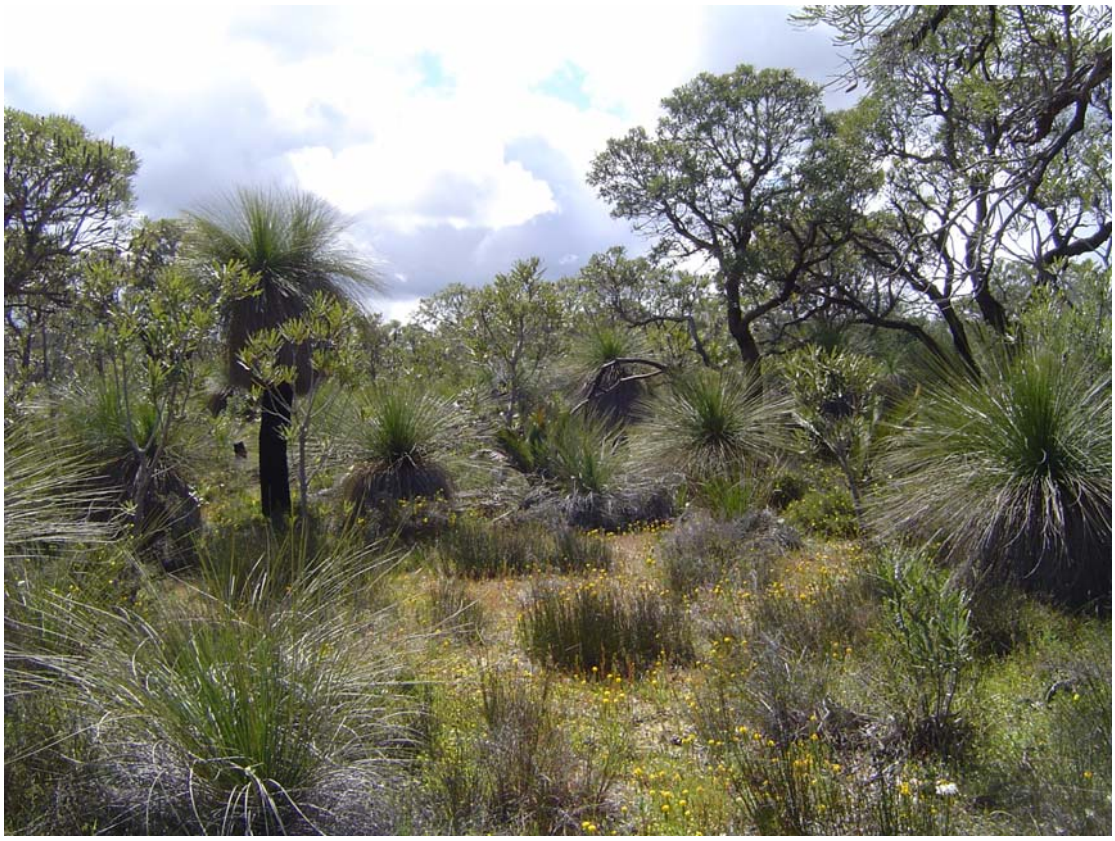
QUADRAT Q8
371254E 6510700N
Condition: Very Good to Good

QUADRAT Q8 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Acacia pulchella	8	1.5
Dryandra sessilis	20	1.1
Olearia rudis	3	1
Conospermum stoechadis	1	0.9
Hibbertia hypericoides	5	0.9
Calothamnus quadrifidus	10	0.8
Phyllanthus calycinus	5	0.8
Melaleuca systena	5	0.8
Mesomelaena pseudostygia	1	0.5
**Avena fatua*	2	0.4
Conostylis candicans subsp. *calcicola*	5	0.3
**Sonchus oleraceus*	<1	0.3
Goodenia caerulea	<1	0.3
Scaevola thesioides	<1	0.3
**Petrorhagia dubia*	1	0.2
Podotheca gnaphalioides	<1	0.2
Dryandra lindleyana	<1	0.2
**Hypochaeris glabra*	1	0.1
Daucus glochidiatus	1	0.1
Desmocladus fascicularis	<1	0.1

SPECIES	% COVER	HEIGHT (M)
**Arctotheca calendula*	<1	0.1
Millotia myosotidifolia	2	0.05
**Trifolium campestre*	1	0.05
Hardenbergia comptoniana	<1	creeper
Thysanotus patersonii	<1	creeper

QUADRAT Q9
372568E 6510639N
Condition: Very Good



QUADRAT Q9 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Banksia attenuata	15	5
Banksia menziesii	5	5
Xanthorrhoea preissii	15	1.8
Macrozamia fraseri	3	1.2
**Gladiolus caryophyllaceus*	<1	0.8
Hibbertia hypericoides	10	0.5
Burchardia congesta	<1	0.5
**Homeria flaccida*	<1	0.5
Mesomelaena pseudostygia	15	0.4
Anigozanthos humilis	<1	0.3
**Asphodelus fistulosus*	<1	0.3
Synaphea sp.	<1	0.3
**Avena fatua*	1	0.3
Podotheca gnaphalioides	5	0.2
**Ursinia anthemoides*	1	0.2
**Hypochaeris glabra*	<1	0.1
**Arctotheca calendula*	<1	0.1
Trachymene pilosa	<1	0.1
**Petrorhagia dubia*	<1	0.1
**Trifolium campestre*	5	0.05
**Anagallis arvensis* subsp. *caerulea*	1	0.05

SPECIES	% COVER	HEIGHT (M)
Drosera erythrorhiza	<1	prostrate

QUADRAT Q10
372834E 6510651N
Condition: Very Good to Good

QUADRAT Q10 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Dryandra sessilis	40	2
Xanthorrhoea preissii	5	2
Hakea trifurcata	2	1.3
Conospermum stoechadis	5	1
**Gladiolus caryophyllaceus*	<1	0.6
Hibbertia hypericoides	20	0.5
**Homeria flaccida*	<1	0.5
Sowerbaea laxiflora	1	0.3
**Arctotheca calendula*	1	0.2
Podotheca gnaphalioides	4	0.2
Austrostipa compressa	<1	0.2
**Hypochaeris glabra*	10	0.1
Dryandra lindleyana	<1	0.1
**Ursinia anthemoides*	1	0.1
**Anagallis arvensis* subsp *caerulea*	1	0.05
Trachymene pilosa	2	0.05

QUADRAT Q11
373022E 6510401N
Condition: Very Good to Good

QUADRAT Q11 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Dryandra sessilis	20	1.8
Acacia rostellifera	4	1.8
Spyridium globulosum	5	1.8
Melaleuca huegelii	1	1.6
Leucopogon parviflorus	<1	1.3
Calothamnus quadrifdus	4	1
Hakea trifurcata	1	0.9
Trymalium ledifolium	1	0.7
Burchardia congesta	<1	0.6
Melaleuca systena	5	0.6
Hibbertia hypericoides	30	0.5
**Hypochaeris glabra*	1	0.5
Philotheca spicatum	<1	0.5
Desmocladus fascicularis	<1	0.2
**Sonchus oleraceus*	<1	0.1
Caladenia flava	<1	0.1
**Anagallis arvensis* var. *caerulea*	1	0.05
Daucus glochidiatus	<1	0.05
**Trifolium campestre*	<1	0.05
Trachymene pilosa	<1	0.05

QUADRAT Q12
373066E 6510191N
Condition: Good

QUADRAT Q12 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Melaleuca huegelii	30	1.5
Dryandra sessilis	5	1.5
Xanthorrhoea preissii	1	1.2
Templetonia retusa	1	0.5
Melaleuca systena	8	0.5
Hakea trifurcata	<1	0.5
Stylidium sp.	1	0.4
Austrostipa compressa	<1	0.3
Scaevola thesioides	<1	0.3
Desmocladus fascicularis	<1	0.1
**Anagallis arvensis* subsp. *caerulea*	5	0.05
**Hypochaeris glabra*	1	0.05
**Trifolium campestre*	1	0.05
Daucus glochidiatus	<1	0.05
Trachymene pilosa	<1	0.05
Drosera sp climbing	<1	Creeper

QUADRAT Q13
372925E 6510297N
Condition: Very Good to Good

QUADRAT Q13 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Dryandra sessilis	90	2
Spyridium globulosum	2	1.6
Hakea trifurcata	1	1.5
Calothamnus quadrifidus	8	1.3
Burchardia congesta	<1	0.6
Hibbertia hypericoides	10	0.5
Austrostipa compressa	<1	0.3
**Arctotheca calendula*	<1	0.2
**Hypochaeris glabra*	5	0.1
**Anagallis arvensis* var. *caerulea*	5	0.05
Trachymene pilosa	<1	0.05
**Trifolium campestre*	1	0.05
Daucus glochidiatus	<1	0.05
Drosera erythrorhiza	<1	Prostate

QUADRAT Q14
372154E 6510621N
Condition: Good to Degraded

QUADRAT Q14 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Banksia attenuata	30	5
Xanthorrhoea preissii	10	1..4
Melaleuca systena	8	1.3
**Homeria flaccida*	30	0.8
**Gladiolus caryophyllaceus*	<1	0.6
Austrostipa compressa	1	0.6
**Euphorbia terracina*	3	0.5
**Rhaphanus rhaphanistrum*	2	0.5
Phyllanthus calycinus	1	0.5
**Asphodelus fistulosus*	1	0.5
Lomandra maritima	<1	0.5
Jacksonia hakeoides	<1	0.3
**Arctotheca calendula*	5	0.1
**Carpobrotus edulis*	5	0.1
**Romulea rosea*	1	0.1
Desmocladus fascicularis	<1	0.1
**Hypochaeris glabra*	2	0.1
**Ursinia anthemoides*	<1	0.1

QUADRAT Q15
371317E 6511509N
Condition: Good to Degraded

QUADRAT Q15 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Banksia attenuata	40	5
Acacia rostellifera	2	1.7
Xanthorrhoea preissii	10	1.6
Melaleuca systena	3	1
Hakea prostrata	3	1
Acacia saligna	<1	0.7
**Avena fatua*	5	0.7
**Homeria flaccida*	<1	0.6
Austrostipa compressa	40	0.5
**Lolium rigidum*	2	0.5
Conostylis candicans subsp. *calcicola*	<1	0.3
**Arctotheca calendula*	5	0.2
**Rhaphanus rhaphanistrum*	1	0.2
**Romulea rosea*	1	0.1
**Carpobrotus edulis*	2	0.1
**Pelargonium capitatum*	<1	0.1

QUADRAT Q16
Condition: Very Good to Good

QUADRAT Q16 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Dryandra sessilis	10	1.5
Acacia pulchella	60	1.2
Calothamnus quadrifidus	1	1.2
Scaevola thesioides	5	1
**Gladiolus caryophyllaceus*	<1	1
**Asphodelus fistulosus*	1	0.5
**Euphorbia terracina*	20	0.5
Austrostipa compressa	5	0.5
Melaleuca systena	<1	0.5
**Pelargonium capitatum*	5	0.3
Conostylis candicans subsp. *calcicola*	<1	0.2
**Petrorhagia dubia*	<1	0.1
**Hypochaeris glabra*	1	0.1
Trachymene pilosa	<1	0.1
**Anagallis arvensis* subsp. *caerulea*	5	0.05
**Sonchus oleraceus*	4	0.05

QUADRAT Q17
370197E 6511192N
Condition: Good to Degraded

QUADRAT Q17 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Dryandra sessilis	50	2
Xanthorrhoea preissii	2	1.6
Acacia pulchella	5	1.3
Melaleuca systena	15	1
Hibbertia hypericoides	3	1
Allocasuarina humilis	<1	1
**Avena fatua*	10	0.8
Austrostipa compressa	20	0.8
**Gladiolus caryophyllaceus*	<1	0.8
**Lolium rigidum*	<1	0.8
Hakea prostrata	2	0.5
Mesomelaena pseudostygia	2	0.5
**Briza maxima*	10	0.3
**Euphorbia terracina*	<1	0.3
Hakea lissocarpha	<1	0.3
Goodenia caerulea	<1	0.3
**Briza minor*	<1	0.3
**Homeria flaccida*	<1	0.3
**Romulea rosea*	<1	0.1
**Ursinia anthemoides*	<1	0.1
**Anagallis arvensis*	2	0.05
**Trifolium campestre*	1	0.05

SPECIES	% COVER	HEIGHT (M)
Trachymene pilosa	<1	0.05
Daucus glochidiatus	<1	0.05
Drosera erythrorhiza	<1	prostrate
Cassytha sp.	<1	creeper

QUADRAT Q18
374193E 6507431N
Condition: Good to Degraded

QUADRAT Q18 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Eucalyptus marginata	15	8
Xanthorrhoea preissii	30	1.8
**Avena fatua*	5	0.8
**Gladiolus caryophyllaceus*	<1	0.7
Austrostipa compressa	1	0.7
**Lupinus cosentinii*	<1	0.5
**Sonchus oleraceus*	<1	0.3
Sowerbaea laxiflora	<1	0.3
**Arctotheca calendula*	5	0.2
Hibbertia hypericoides	1	0.2
**Anagallis arvensis* subsp. *caerulea*	5	0.2
**Ursinia anthemoides*	<1	0.2
Hakea lissocarpha	<1	0.2
**Carpobrotus edulis*	2	0.1
**Hypochaeris glabra*	<1	0.1
Caladenia flava	<1	0.1
**Isolepis marginata*	3	0.05
Desmocladus fascicularis	<1	0.05
**Pelargonium capitatum*	<1	0.05
Hardenbergia comptoniana	<1	creeper