coffey environments
SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

YANCHEP CITY STRUCTURE PLAN VEGETATION AND FAUNA MANAGEMENT STRATEGY

Prepared for:

Yanchep Beach Joint Venture
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1 INTRODUCTION

1.1 Background

The proponent, Yanchep Beach Joint Venture (YBJV) is proposing to develop a 621ha parcel of land known as the Yanchep City Structure Plan (YCSP) (previously St Andrews Local Structure Plan) area for the purposes of residential, industrial and city centre development. The study site (Figure 1) is located approximately 50km north of Perth, within the Yanchep-Two Rocks (YTR) locality and forms part of the YTR District Structure Plan (DSP) area.

The Yanchep Beach Joint Venture was formed to progress the planning of the study site as a future primary regional centre for the Northwest corridor.

The YTR area was the subject of the City of Wanneroo Town Planning Scheme (TPS) No.1 Amendment 787 which required the preparation of an Environmental Review (ER). The TPS Amendment 787 requested to rezone the YTR area from 'Rural' and 'Residential' to 'Urban Development,' 'Centre' and 'Industrial Development.'

The TPS Amendment 787 and Environmental Review were formally assessed by the Environmental Protection Agency (EPA) under Section 48 of the *Environmental Protection Act 1986*. The EPA recommended that the rezoning be gazetted subject to a number of environmental conditions detailed in Ministerial Statement 538 (2000).

As a result of the approved amendment, the environmental conditions relating to Vegetation and Fauna Management incorporated into Schedule 12 of the City of Wanneroo District Planning Scheme (DPS) No. 2 state:

1.2.1 Regionally significant vegetation ('Bush Forever' sites) which surrounds the amendment area (as shown in Figure 1 of the Minister's Statement) shall be protected from indirect and direct impacts associated with the development of the amendment area by the following:

- *Clear delineation of regionally significant areas of vegetation from the amendment area through the use of dual use paths, public open space areas and the like.*
- *Control of off-road vehicle use and dumping of rubbish.*
- *Fire management.*
- *Promotion of community awareness of bushland protection.*

The YTR DSP also includes a requirement at the Local Structure Plan stage for a '*Vegetation Management Strategy, which, where appropriate will include a vegetation survey, fauna survey, fauna habitat survey, highlight the areas of vegetation and habitat to be retained and highlight opportunities for existing vegetation to be retained in the landscape through measures such as local seed provenance and retention in Public Open Space.*'

1.2 Purpose and Scope

Coffey Environments has been commissioned by YBJV to prepare a Vegetation and Fauna Management Strategy (VFMS) for the YCSP area in accordance with the environmental conditions of the City of Wanneroo DPS No.2 and the YTR DSP. This VFMS has been prepared to provide details on management strategies for the study site which are as follows:

- Seed collection;
- Native vegetation clearing procedures including the protection of vegetation to be retained;
- Fauna management including a fauna trapping and relocation program prior to construction;
- Rehabilitation of Public Open Space (POS) areas cleared during construction;
- Weed management;
- Dieback management; and
- Fire management measures.

Coffey Environments (formerly ATA Environmental) has previously undertaken environmental investigations within the YTR area as part of the preparation of the ER for TPS Amendment 787 and during the preparation of the YTR DSP.

1.3 Local Structure Plan

The purpose of the YCSP is to facilitate development of a City Centre second only in size to Perth's CBD, providing a focus for the northern portion of the Northwest Corridor, and minimising urban sprawl into areas not previously identified for urban development. The total area of development is 621.98ha. The Local Structure Plan for this site (YCSP) conforms to the YTR DSP (Roberts Day, 2008), which has been approved by the City of Wanneroo and has received final endorsement by the WAPC with conditions. The project will take a staged approach to development with the timeline for development over several years.

The land use philosophy is to provide a predominance of residential, office, commercial, retail and, to aid description and administration, the project area has been divided into a number of precincts defined by a range of considerations, including physical characteristics; proposed land use character; key roads; and context within the YCSP area (Figure 2). A summary of the key land use outcomes defined by the Structure Plan includes:

- A 107 ha city centre core, comprising a mix of residential and non-residential land uses;
- Incorporation of light rail, a station and associated Transit Oriented Development precinct;
- Health and tertiary education campuses;
- In excess of 8,000 dwelling units, one high school, two public primary schools and one private K-12 school;
- Service industry, mixed use and business precincts; and
- Approximately 64ha of POS and drainage.

The vision for the YCSP is to create a development with a strong sense of place and identity that is compatible with both its coastal location and being a major regional centre. The incorporation of sustainable design principles is an over-riding objective, with tree and vegetation retention in several major POS areas a key priority wherever possible. The YCSP includes approximately 61ha of POS areas excluding drainage (11% excluding City Centre Zone) (Appendix C). The hierarchy of POS will:

- Establish significant green-link corridors incorporating retention of landform, vegetation and habitat;
- Provide a showcase for a variety of environmental features and practices to assist in community education and foster a sense of community pride, ownership and responsibility for the local environment; and

- Provide a diversity of visual and recreational opportunities and experiences.

The proposed development will result in the loss of approximately 312 ha of fauna habitat. Given the type and density of the development there will be limited opportunity to retain intact vegetation due to the requirement for extensive subdivision earthworks and the provision of POS areas.

However, wherever appropriate, POS areas will provide an opportunity to retain fragments of intact vegetation. An overall approach in the open space design will be to minimise areas of irrigated grass and to retain areas of coastal heath, *Banksia* woodland and natural and planted stands of Tuart trees. The extensive earthworks required for the site and in particular a YCSP area with a very large city centre, areas of tertiary education that requires more or less flat land, greatly reduces the amount of vegetation able to be retained. Where possible native vegetation has been retained in POS labelled 'Landform and Vegetation Retention' (Figure 3). Rehabilitation will be undertaken in Landform and Vegetation Retention POS areas which contain degraded or good condition native vegetation and in some streetscapes, where practical. The rehabilitation will focus on using *Banksia* and other species to provide supplementary feeding habitat for Carnaby's Black-Cockatoo and to provide habitat for smaller mammals and reptile species. Other POS areas will be designed for active and passive recreation for the community.

The mix of Public Open Space types is in accordance with the City of Wanneroo's Public Open Space Local Planning Policy 4.3 (City of Wanneroo, 2010) which promotes a variety of POS designs that reflect the local character of the area as well as providing spaces for local people. The POS areas conserve some of the natural areas of vegetation, high points and ridgelines that will be accessible to the local population. The areas of native vegetation retained in POS areas complement the large amount of native vegetation retained immediately to the north-east and east of the YCSP area within Yanchep National Park. The future location of the Mitchell Freeway and northern railway limit the ability to link natural corridors to the National Park.

In addition to its approach to the natural landscape, the YCSP incorporates a strong sustainability focus through its intent to create a compact transit-based urban centre, with car-dependence minimised for residents, visitors and workers. The YCSP will provide a centre for employment, retail and entertainment opportunities.

2 DESCRIPTION OF STUDY SITE

2.1 Location

The development area comprises Lot 302 and 505 Yanchep Beach Road, Yanchep; Lot 309 Shearwater Avenue, Two Rocks; Part Lot 310 and Part Lot 311 Toreopango Avenue, Two Rocks; Lot 904 Rail Reserve; Part Lot 903 Rail Reserve; Part Toreopango Avenue Road Reserve and Part Shearwater Avenue Road Reserve. The regional location of the study site is shown in Figure 1.

The study site is bounded by the Mitchell Freeway Road Reserve and Yanchep National Park to the east; Yanchep Beach Road to the south and the Marmion Avenue extension to the west. The northern boundary is as established in an existing approved plan of subdivision (WAPC 131632).

2.2 Climate

The YTR area experiences a warm Mediterranean climate with hot dry summers (ranging between 17.4°C – 31.8°C) and mild wet winters (ranging between 8.0°C – 17.8°C), similar to that experienced in Perth (Bureau of Meteorology, 2008). Rainfall in the area occurs mostly during winter with the average monthly rainfall being 138.67mm in winter and 37.13mm for the remaining months (Bureau of Meteorology, 2008).

Wind is an important climatic factor that has characterised the landscape with Aeolian (wind-driven) depositions in the YTR area. In summer, the area is affected by local sea breezes predominantly from the southwest. In winter, the YTR area experiences major storms characterised by north-westerly winds that back to the west and south west, and interspersed with calmer periods (ATA, 2007a).

2.3 Topography and Landform

The YCSP area is located on the western portion of the Swan Coastal Plain. Wind and wave action has formed the typically undulating landscape associated with near coastal areas and the study site generally comprises of gently undulating landform containing valleys and ridges. A number of ridges run across the YCSP area and are identified as Significant Natural Features in the YTR DSP (Roberts Day, 2008). Two ridges run perpendicular to the coast - the southern ridge has elevations up to 45m Australian Height Datum (AHD) while the northern ridge has elevations up to 35m AHD. Flatter areas exist between these ridges with low points of approximately 20-25m AHD. A number of conical hills with elevations of up to 50m AHD occur in the north and east of the study site adjacent to a basin area with low points of 20-25m AHD. Topography is presented in Figure 4.

2.3.1 Karstic Terrain

The term "karst" is used to describe landscapes that are commonly characterised by closed depression (sinkholes), subterranean drainage and both horizontal and vertical caves. The scale of these features can vary from millimetres to hundreds of metres or more and can include small underground voids or cavities, caves, dolines, collapsed caves and sculpting of limestone surfaces.

A karst assessment was undertaken as part of the YTR DSP process for Stages 1-3 of the DSP, which included the YCSP area. The assessment indicated that from a geotechnical engineering perspective existing karst features that may underlie the study site are considered to be at sufficient depth to not create an engineering risk for development (Coffey Geotechnics, 2007). However, a small area in the southeast portion of the YCSP area is described by Coffey Geotechnics (2007) as requiring assessment of the

"presence of near surface loose sand zones or voids within shallow limestone" for input into engineering design as part of normal geotechnical investigations undertaken at subdivision stage.

2.4 Geology and Soils

The YCSP area is composed of Quaternary continental sediments (Churchward & McArthur, 1980). Two major dune systems are present - the Quindalup Dune System and the Spearwood Dune System.

2.4.1 Quindalup Dune System

The Quindalup Dune System extends along the modern shoreline of the Swan Coastal Plain, from Geographe Bay in the south to Dongara in the north. This dune system is the geomorphologic expression of the Safety Bay Sand geological unit. The Quindalup Dunes extend inland in a series of large-scale, elongated and coalescent parabolic dunes, whose arms and faces measure several kilometres in length. It is the youngest of the dune systems in the area and consequently abuts or rests on the Spearwood Dune System (Alan Tingay & Associates and Dr Adrian Peck, 1991). In the YCSP area the Quindalup Dune System is present along the number of parabolic dunes that extend across the subject area. The main soil type (LS_4) consists of calcareous sand (Safety Bay Sand) which is pale yellowish-brown, weakly cemented and highly permeable (Gozzard 1982).

2.4.2 Spearwood Dune System

The Spearwood Dune System is the geomorphic expression of the Tamala Limestone geological unit and covers the majority of the study area. The main soil types include quartz sand (S_7) derived from the Tamala limestone that is pale olive-yellow and moderately permeable and limestone (LS_1) that is light yellowish-brown, weakly cemented and highly permeable. Both soil types are compatible with the construction of roads and urbanisation (Gozzard, 1982).

Originally the material comprising the dunes was calcareous throughout, but leaching has removed carbonate from upper horizons to be precipitated below, forming a hard calcertised cap (Alan Tingay & Associates and Dr Adrian Peck, 1991). Material remaining in upper horizons is mainly brown to yellow sand and this covers much of the limestone within the study area, to depths often greater than 1m.

2.5 Vegetation

A flora and vegetation assessment of the YCSP area was undertaken in October 2005 (ATA Environmental 2007a). The boundary of the YCSP subsequently changed after the survey but is similar to the area surveyed. The new boundary excludes the area south of Yanchep Beach Road (Figure 5). Approximately two thirds of the YCSP area contains native vegetation belonging to three vegetation complexes: the Old Quindalup Dune Heath, Limestone Heath and Sand over Limestone Vegetation (ATA Environmental, 2007a). The 2005 survey results are considered valid for this report as no clearing activities have occurred on the site since the survey was carried out.

Quindalup Dune vegetation is widespread in the immediate surrounding area though within the YCSP area is restricted to long dune ridges and occasional conical dunes intermixed with Spearwood vegetation types. The main vegetation in the YCSP area occurs on Spearwood dune soils. The shallow sand over limestone and outcropping vegetation types are mainly distributed in the central and eastern regions of the study site. *Dryandra sessilis* (now *Banksia sessilis*) Heath occurs on flat areas of limestone and low hills while the tall jagged limestone hill support *Melaleuca huegelli* and Mallee eucalypt species. The deeper sand over limestone vegetation types are located in the central and eastern regions of the study site and

include the Banksia Woodlands and isolated stands of Tuart trees. There is a distinct transitions between the vegetation found on limestone and the deeper sands.

Eight vegetation associations were identified within the YCSP area (ATA Environmental, 2007a). The distribution of these vegetation associations is shown in Figure 6 and described below:

- Ar — *Acacia rostellifera* Closed Heath
- ArDs — *Acacia rostellifera* Closed Heath with scattered *Dryandra sessilis* (now *Banksia sessilis*)
- As — *Acacia saligna* Open Scrub to Shrubland
- AsXp — *Acacia saligna / Xanthorrhoea preissii* Open Scrub to Tall Shrubland
- Ms — *Melaleuca systena* Closed Heath
- Ds — *Dryandra sessilis* (now *Banksia sessilis*) Heath to Closed Heath
- DsCq — *Dryandra sessilis* (now *Banksia sessilis*) and *Calothamnus quadrifidus* Heath to Closed Heath
- Cq — *Calothamnus quadrifidus* Closed Heath
- Mh — *Melaleuca huegelii* Open Heath to Heath
- Ba — *Banksia attenuata* Low Open Forest
- Eg — *Eucaluptus gomphocephala* Woodland to Open Forest
- Pl — Plantation
- C — Cleared

2.5.1 Young Quindalup Dune Heath

***Acacia rostellifera* Closed Heath (Ar)** – *Acacia rostellifera* frequently occurs in near pure sands (ATA, 2001) and is located in the north western portion of the YCSP area.

2.5.2 Old Quindalup Dune Heath

***Acacia rostellifera* Closed Heath with scattered *Dryandra sessilis* (now *Banksia sessilis*) (ArDs)** – *Acacia rostellifera* with pockets of *Dryandra sessilis* (now *Banksia sessilis*). This vegetation type occurs just north of Yanchep Beach Road and another area in the north western portion of the subject area.

***Melaleuca systena* Closed Heath (Ms)** – This vegetation is characteristic of soil types occurring on rolling parabolic dunes generally with convex slopes. The flanks and crests are dominated throughout by the Ms association which commonly includes *Conostylis candicans, Hibbertia racemosa, Diplopeltis huegelii, Phyllanthus calycinus* and *Gastrolobium nervosum.*

***Acacia saligna* (As) / *Xanthorrhoea preissii* (AsXp) Open Scrub to Tall Shrubland** – This vegetation is characteristic of Q1 and Q2 soils which is generally dark brown sand and is indicative of the probable proximity of the Tamala Limestone to the surface. On some dunes, flat areas and swales of the Q1 dunes the Ms association is covered by a sparse to dense cover of *Acacia saligna* and / or *Xanthorrhoea preissii* up to 2.5m tall. The common species of the As / AsXp unit are similar to that of the Ms 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*.

2.5.3 Limestone Heath

***Dryandra sessilis* (now *Banksia sessilis*) (Ds) / *Calothamnus quadrifidus* (DsCq) Heath to Closed Heath** – The Ds association is one of the most widespread vegetation associations throughout the YCSP area, occurring mainly on the western side of the study site. *Dryandra sessilis* (now *Banksia sessilis*) can be the sole dominant species or can be found associated with other dominants including *Hibbertia hypericoides, Acacia pulchella, Hakea trifurcata, Calothamnus 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.*

***Calothamnus quadrifidus* Closed Heath (Cq)** – This vegetation association is generally intermixed with the Ds Heath associations. It occurs on blackish sand over limestone with very little limestone outcropping. It is mainly distributed toward the eastern side of the YCSP area.

***Melaleuca huegelii* Open Heath to Heath (Mh)** – This vegetation association is found on the top of most limestone hills and rises, and is generally limited to small patches less than 0.1ha in size within the YCSP area. It is characteristic of soil that typically contains abundant limestone with very little sand present. Two other species which could be considered indicators for this association are *Trymalium ledifolium* and *Acacia truncata*. Also common, but not indicators, were *Desmocladus flexuosa, Dryandra lindleyana* (now *Banksia lindleyana), Templetonia retusa* and *Melaleuca systena*.

2.5.4 Sand over Limestone

***Banksia attenuata* Low Open Forest (Ba)** – This Ba vegetation association includes a variety of different associations based mainly on the dominance of four low tree species including *B.attenuata, B.menziesii, Eucalyptus todtiana* and *Allocasuarina fraseriana. Banksia* associations are widespread through the YCSP area occurring in large areas or intermixed with limestone vegetation. Occasionally small stands exist through the valleys in the older Quindalup dunes.

***Eucalyptus gomphocephala* Woodland to Open Forest (Eg)** – There is one small area of the Eg vegetation association in the YCSP area. 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.

2.5.5 Floristic Community Types

The vegetation associations identified in the YCSP area can be related to Floristic Community Types (FCTs) as described by Gibson *et al.* (1994). The FCTs identified in the YCSP area include the following:

- 24 – Northern Spearwood shrublands and woodlands
- 28 – Spearwood *Banksia attenuata* or *Banksia attenuata-Eucalyptus* Woodlands
- 29b – *Acacia* Shrublands on taller dunes

Gibson (*et al.*, 1994) provides the following description of the FCTs 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 subgroup FCT 29b corresponds to only a small portion of vegetation within the study area. 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.

Vegetation surveys undertaken in 1992 (Alan Tingay & Associates), 2001 and 2005 (ATA Environmental) have not identified any FCTs in the YCSP area which are listed as Threatened Ecological Communities (TECs) (ATA Environmental, 2007a). However, two Priority Ecological Communities (PECs) recommended for listing as Threatened are present in the YCSP area and comprise FCTs 24 and 29b. Consideration will be given to retaining PEC vegetation in good condition or better within POS areas identified to retain vegetation. According to the existing POS plan (Appendix C) both FCTs 24 and 29b are contained within several POS areas.

A map of Floristic Community Types is presented as Figure 8.

2.6 Vegetation Complexes

Two vegetation complexes occur within the study site (Heddle *et al.*, 1980). The Quindalup Complex is predominant with small portions of the Cottesloe Complex – North occurring in the eastern extent of the study site. Neither complex is considered regionally significant and is above the recommended Bush Forever 10% minimum threshold for vegetation complex conservation (Government of Western Australia, 2000).

Quindalup Complex

This coastal dune complex consists mainly of two alliances, the strand and foreshore alliance, and the mobile and stable dune alliance. There is considerable variation in the vegetation that comprises the Quindalup Complex both at the local and regional level. Local variations include low closed forest of *Melaleuca lanceolata – Callitris preissii* and the closed scrub of *Acacia rostellifera*. The Quindalup Complex extends in an almost continuous thin strip from Dongara in the north to Busselton in the south. Approximately 48% of the original complex extent remains, 20% is protected under the Bush Forever Strategy.

Cottesloe Complex – North

The Cottesloe Complex – North adjoins the Quindalup Complex at its eastern extent and extends south towards the Perth Metropolitan area. This complex consists predominantly of low open forest and low woodland of *Banksia attenuata – B.menziesii – E. todtiana*; closed Heath on Limestone outcrops. Approximately 70% of the original complex extent remains, 64% is protected under the Bush Forever Strategy.

2.7 Significant Vegetation

No TECs have been recorded within the YCSP area however two PECs have been identified and are recommended for listing as Threatened. These include:

- FCT24 – Northern Spearwood shrublands and woodlands; and
- FCT29b – *Acacia* Shrublands on taller dunes.

There are large areas of vegetation within the YCSP area which are identified as Significant Natural Features in the YTR DSP (Roberts Day, 2008). Large areas of *Banksia sessilis* Heath (Ds) and *B. attenuata* (Ba) Low Open Forest are present on-site and have been identified in the YTR DSP for their potential use by Carnaby's Black Cockatoos. A small area of natural Tuart trees (*Eucaluptus gomphocephala*) also exists within the YCSP area (Figure 6).

The vegetation complexes present within the YCSP area include the Quindalup Complex and the Cottesloe Complex–North. According to Bush Forever (Government of WA, 2000) 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% respectively is protected under the Bush Forever Strategy. 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.

At a regional level, no Bush Forever Sites exist within the YCSP area however the subject area is located in close proximity to Bush Forever Site 288 Yanchep National Park and Adjacent Bushland. The existing freeway reserve is located at the interface between the eastern boundary of the YCSP area and the Bush Forever Site.

2.8 Vegetation Condition

The condition of the vegetation in the study site has been rated according to the scale published in Bush Forever (Government of Australia, 2000). The scale ranges from Pristine to Completely Degraded as shown in Table 1.

TABLE 1: VEGETATION CONDITION RATING SCALE.

Condition Rating	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structured caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate. Foe example, the 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	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

Condition Rating	Description
	presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely degraded or almost completely without native species. These areas are often described as 'parkland cleared' with the flor composing weed or crop species with isolated native trees or shrubs.

The condition of the vegetation found at the study site ranges from Very Good to Completely Degraded (Figure 7). Approximately 100ha of the subject area has been previously cleared for agricultural purposes and other parts of the subject area contain completely degraded natural vegetation (including plantations). Historically, the study site has been cleared or degraded as a result of agricultural and plantation land use practices and grazing of stock. Evidence of grazing occurs in most areas including remote least accessible terrain and vegetation types. Areas easily accessible for grazing are most degraded with a large reduction in understorey shrub density and a high number of introduced species.

The remainder of the subject area (approximately 370 ha) is covered by vegetation of Degraded to Very Good condition.

2.9 Flora

The vegetation and flora assessments undertaken by ATA Environmental in October 2001 and 2005 identified a total of 148 species including 114 native and 34 introduced species. The dominant families with the greatest representation included the Proteaceae *Banksia* Family with 15 native species; the Daisy (Asteraceae) Family with 13 native and four introduced species; the Eucalypt (Myrtaceae) Family with twelve native species and the Pea (Papilionaceae) Family with twelve native and three introduced species.

A full species list from the 2005 study (ATA Environmental, 2007a) is included in Appendix A.

A search of the DEC's (formerly Department of Conservation and Land Management) Declared Rare and Priority database was undertaken as part of previous investigation by Coffey Environments of the study site. The list of significant flora recorded in the vicinity of the ATA Environmental (2007a) study area is provided in Appendix B.

None of the species listed as significant (Declared Rare or Priority) by the DEC were recorded during the October 2005 survey (ATA Environmental, 2007a).

2.10 Vertebrate Fauna

2.10.1 Fauna Investigations

Alan Tingay & Associates conducted a Fauna Assessment in 1991 of the previous 7000 ha Yanchep Sun City Estate (which includes the 621 ha YCSP area). The Fauna Assessment included intensive systematic trapping, active searching, transect surveys, night spotting and opportunistic observations.

A Level 2 Vertebrate Fauna Assessment was conducted for the Yanchep Sun City Estate (Southern Precinct) by ATA Environmental in 2005 (ATA Environmental, 2007b) in accordance with the EPA's *Guidance Statement No 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*, June 2004. Figure 5 shows the study area for this assessment which is the same as the October 2005 vegetation survey study area.

The Level 2 assessment involved undertaking an on-site fauna survey in addition to a desktop study. The on-site survey was conducted in November 2005 and included a ten day fauna trapping program, avifauna surveys, spot-lighting for nocturnal reptiles and mammals, bat surveys and non-systematic searches.

A search of the DEC Threatened and Priority Species database was undertaken to identify potential Scheduled and Threatened species, and Priority species in the region. A search of the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)* database was also undertaken. Based on the results of the database searches, a total of four scheduled species and four priority listed species have also been predicted to occur or recorded in the region.

2.10.2 Significant Fauna

In Western Australia, all native fauna species are protected under the Western Australia *Wildlife Conservation Act 1950 (WC Act).* Fauna considered rare, threatened with extinction or have a high conservation value are specially protected under the WC Act. In addition, some species of fauna are covered under the 1991 ANZECC Convention, while certain birds are listed under the Japan and Australian Migratory Bird Agreement (CAMBA).

Threatened or Priority species listed under the *Wildlife Conservation Act* or DEC's database that may potentially occur in the region are listed in Table 2. Included are two Schedule 1 species, two Schedule 4 species and four priority listed species. Schedule 1 species include fauna which are rare or likely to become extinct and are declared to be fauna in need of special protection. Schedule 2 species include fauna which are presumed to be extinct and are declared to be fauna in need of special protection.

The only species of particular conservation interested under the EPBC Act likely to be found in the area are the Carnaby's Black Cockatoo and the Rainbow Bee-eater. The Graceful Sun-moth has potential to occur on good quality vegetation on the parabolic Quindalup dunes that wind through part of the site. The Chuditch has been recorded in the region but is unlikely to inhabit the study area due to a lack of suitable habitat and lack of recent records.

TABLE 2: SPECIES LISTED AS BEING SIGNFICANT VERTEBRATE FAUNA BY THE COMMONWEALTH OR STATE GOVERNMENTS AND PREDICTED TO OCCUR OR RECORDED IN THE YANCHEP AREA.

Species*	**Status under *Wildlife Conservation Act***	**Status under *Commonwealth EPBC Act***	**Potential to be found in the YSC Estate (Southern Precinct) study area**
Calyptorhynchus latirostris (Carnaby's Black-Cockatoo)	Schedule 1	Endangered	Recorded during 1991 & 2005 surveys
Synemon gratiosa (Graceful Sun-moth)	Schedule 1	Endangered	Recorded in region and potentially in the study area
Dasyurus geoffroii (Chuditch)	Schedule 1	Vulnerable	Recorded in region but unlikely to be in the study area
Falco peregrinus (Peregrine Falcon)	Schedule 4		Recorded in region but not in study area
Morelia spilota imbricata (Carpet Python)	Schedule 4		Recorded in region but not in study area
Phascogale tapoatafa tapoatafa	Priority 3		Recorded in region but unlikely to

(Southern Brush-tailed Phascogale)			be in the study area
Neelaps calonotos (Black-striped Snake)	Priority 3		Recorded during 2005 survey
Macropus irma (Western Brush Wallaby)	Priority 4		Recorded during 2005 survey
Isoodon obesulis fusciventer (Southern Brown Bandicoot)	Priority 5		Recorded in region but not in the study area
Merops ornatus (Rainbow Bee-eater)		Migratory	Recorded during 2005 survey

**excludes marine and coastal species as these were not included within the 2005 survey (ATA Environmental, 2007b)*

Below is a brief description of the preferred habitat of species listed in Table 2 and Coffey Environments' assessment of the likelihood of these species being found at the YSC Estate (Southern Precinct).

Carnaby's Black Cockatoo *(Calyptorhynchus latirostris)* – This species inhabits the southwest of Western Australia. Its preferred habitat is *Banksia* and Eucalypt woodland where it preferentially feeds on plants of the Proteaceae family. In winter, flocks can be found in heaths. Carnaby's Black-Cockatoo have been previously recorded in the region and utilise the subject area for feeding but is not known to breed in the area due to the lack of suitable breeding hollows on the subject land.

Note, the *EPBC* Act was made effective as of July 2000. Ministerial approval for the subject area was made for the proposed zoning changes (Amendment 787) in April 2000. Given this approval was granted prior to the legislation coming into being the proponent will not be required to make a referral of the YCSP under the EPBC Act.

Graceful Sun-moth *(Synemon gratiosa)* - The Graceful Sun-moth (GSM) is a small day-flying moth endemic to southwest Western Australia, and is currently only known from the Swan Coastal Plain between Quinns Rocks and south to Mandurah.

The Graceful Sun-moth is known to occur in two of the vegetation types contained within the subject area. These include *Banksia* woodland on deep sands where the GSM breeds on *Lomandra hermaphrodita*, and open areas of herbland, heathland and shrubland on Quindalup soils (sand and limestone) close to the coast where it breeds on *Lomandra maritima*. Both *Lomandra* species occur on the site, however a GSM survey has not been carried out to determine whether this species is present onsite. GSM were recorded on parabolic dunes containing *Lomandra maritima* in the adjacent Yanchep National Park during the 2010 GSM surveys (DEC, 2010). The development of the YCSP area has State environmental approval and the proponent has legal advice that, given Ministerial Statement 538 was granted prior to the EPBC Act legislation coming into effect, the proponent will not be required to make a referral of the YCSP for this matter under the EPBC Act. Nevertheless, if GSM were to be found on the site, a licence to take GSM will be required for any area GSM habitat that will be cleared.

The principle areas that GSM might occur on the site are expected to be the parabolic dunes containing dense *Lomandra maritima*. Three areas of POS have been retained in the YCSP which contain parabolic dunes (POS Areas 1, 9A and 15 – Appendix C).

Chuditch *(Dasyurus geoffroii)* – This species formerly ranged over nearly 70% of Australia but now has a patchy distribution through the Jarrah forest and mixed Karri / Marri / Jarrah forest of south-west Western Australia. Chuditch inhabit sclerophyll forest, dried woodland or mallee shrubland and den in hollow logs and burrows. This species is considered to be unlikely to occur in the YCSP area as they are generally not found in the coastal dunes or abutting forests.

Peregrine Falcon *(Falco peregrinus)* – This species is found across most of Australia, but only occurs in low densities and has a wide and patchy distribution. It favours hilly or mountainous terrain and open woodlands. Due to its wide distribution it may be found on site but would not rely on the YCSP area for survival. The loss of habitat is unlikely to have an impact on this species.

Carpet Python *(Morelia spilota imbricata)* – This species is found across the south-west of Western Australia, north to Geraldton and Yalgoo, and east to Kalgoorlie, Fraser Range and Eyre. It inhabits forest, heath, or wetland areas and shelters in hollow logs or in branches of large trees. This species is widespread within the south-west but is not in high densities across its distribution. It may occur occasionally in the YCSP area but would not rely on the area for survival.

Brush-tailed Phascogale *(Phascogale topoatafa topoatafa)* – This species has a preference for dry sclerophyll forests and woodland with sparse ground cover. No data exists to suggest it is likely to be found on coastal dunes, and therefore in the YCSP area.

Black-striped Snake *(Neelaps calonotos)* – This species inhabits dunal areas supporting heathlands and *Banksia* /Eucalypt woodlands, ranging in distribution on the Swan Coastal Plain between Mandurah and Lancelin. This species was recorded in *Banksia* woodland in the Yanchep Sun City Estate (Southern Precinct) study area but would not rely on the area for survival.

Western Brush Wallaby *(Macropus irma)* – This species is distributed across the south-west of Western Australia from north of Kalbarri to Cape Arid. The optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open shrub thickets. This species was recorded during the 2005 survey and has been reported in surrounding areas including Neerabup National Park.

Southern Brown Bandicoot *(Isoodon obesulus fusciventer)* – This species has a preferred habitat of dense scrub and undergrowth. It will often feed in adjacent forest and woodland and in areas of pasture and cropland lying close to dense cover. It is likely that this species may be found in low numbers within the YCSP area in habitats with dense understorey including the closed heath or dense shrublands.

Rainbow Bee-eater *(Merops ornatus)* – This species is distributed across much of mainland Australia and is thinly distributed in the most arid regions of central and Western Australia, occurring mainly in open forests and woodlands, shrublands and in various cleared or semi-cleared habitats including farmland and areas of human habitation. This species may be found on site but would not rely on the YCSP area for survival due to the many other suitable foraging and breeding sites in the general vicinity.

2.10.3 EPA Position Statement No. 3 and Guidance Statement No. 56

EPA Position Statement No.3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection and* Guidance Statement No.56 *Guidance for the Assessment of Environmental Factors; Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* indicate that field data survey should be used to assess the impact of the development on species and ecosystems.

Vertebrate fauna assemblages within the Yanchep Sun City Estate (Southern Precinct) study area are similar to that contained within the Swan Coastal region including surrounding National Parks and Conservation Reserves. Species assemblages present or likely to visit the YCSP area would also be present or likely to visit other similarly vegetated areas in the region. It is considered that vertebrate fauna species have a range of alternative roosting and foraging sites in the surrounding areas and will not be significantly impacted by the development of the YCSP area with the exception of Carnaby's Black-Cockatoo.

3 MANAGEMENT ACTIONS

3.1 Retention of Vegetation

3.1.1 Public Open Space

Of the 621ha YCSP area (included approximately 312 ha good quality native vegetation), a total of 63.59ha have been allocated for the provision of POS in the YCSP area. A total of 64 POS areas have been identified on the POS Provision plan (Appendix C). Some of the individual POS areas link up to form the greenbelts and linear parks. The size of each POS area identified on the POS Provision plan is also provided in Appendix C.

Approximately 25ha of the nearly 64ha of POS have been allocated to the Landform and Vegetation Retention category of POS (Figure 3 – Landscaping Concept Plan). The 25ha is located in six POS area, ie Area 1, 9A, 15, 20, 52 and 59.

These six POS areas contain a mixture of native vegetation in condition ranging from Very Good to Degraded. The largest of the POS areas that will retain native vegetation (POS Area 1) is 6.5ha in size and will protect a mixture of *Banksia* woodland and *Melaleuca systena* heathlands on a tall hill. The area of *Banksia* woodland is mapped as Degraded but actually includes a good stand of Banksia trees over a poor understorey dominated by weeds. The Banksia trees provide foraging habitat for Carnaby's Cockatoo despite the poor understorey. The trees also provide some aesthetic value compared to the abundance of heath plants throughout the site. Better quality *Banksia* woodlands were not able to be protected in many circumstances due to their location in high density development areas or the need for a vast amount of earthworking for development.

Plantations of Tuarts have also been retained in two of the Landform and Vegetation Retention category POS areas due to their aesthetic value and fauna habitat value despite the fact they are planted.

POS Area 9A is relatively large at 9.0ha and has been included to retain the parabolic dune landform as well as a registered Aboriginal heritage site on the top of the dune. While the two POS areas that protect portions of the east-west parabolic dune (9A and 15) do not contain high quality native vegetation they contain enough remnant natural vegetation to warrant rehabilitation.

The remainder of the POS areas and subject area are highly likely to be cleared and earth-worked as part of the development (TBB, 2007). Where possible, individual POS areas such as Area 48 on the eastern boundary will not be earthworked and therefore have the opportunity to retain stands of native vegetation or individual trees.

Table 3 summarises the six Landform and Vegetation Retention POS areas. Their locations are shown in Appendix C.

TABLE 3: POS TYPES AND THEIR KEY LANDSCAPE FEATURES

POS Number (Area)	POS Type (Name)	Described Intention
1 (6.5ha)	Landform and Vegetation Retention	• Significant high (focal) point and existing landform retained • Ocean views and internal views towards future development retained from high point • Pockets of very good to degraded quality vegetation • Section of *Banksia attenuata* woodland able to be retained for Carnaby's Cockatoo habitat. • *Melaleuca systena* retained on hill – potential Graceful Sun-moth habitat.
9A (9ha)	Landform and Vegetation Retention	• Site of Indigenous significance • Significant avenues of mature Tuart trees to be retained • Retention of landform and vegetation – ridgeline and dunal landscape able to be retained → no earthworks • Significant high points with expansive ocean views retained along ridgeline
15 (2.7ha)	Landform and Vegetation Retention	• High points along ridgeline retained with ocean views • Significant ridgeline and vegetation buffer provides natural screening to the adjacent residential development • Portion of ridgeline retained in current POS concept design • Degraded ridgeline to be revegetated • Very good vegetation either side of ridgeline – not able to be retained due to proposed development and earthworks
59 (1.6ha)	Landform and Vegetation Retention	• *Banksia attenuata* in Very Good condition to be retained adjacent to playing fields.
52 (1.4ha)	Landform and Vegetation Retention	• Significant mature trees to be retained → densely planted groves of Gum trees • Very good quality mature tree vegetation in open parkland setting
20 (3.7ha)	Landform and Vegetation Retention	• Mix of Plantation Tuarts and Good condition *Acacia rostellifera/Banksia sessilis*. • Planted and native vegetation on a relatively flat site – provides Entry Statement for development and reinforces natural character.

3.1.2 Identifying Trees / Vegetation to be retained

There will be an opportunity to retain individual trees at the subdivision stage when detailed designs are developed. Vegetation that is to be retained within the development site will provide habitat for a variety of fauna that exist on site or will colonise the area after construction is completed. This level of detail will be refined in a Landscape and Vegetation Management Plan undertaken prior to subdivision, which will include a map of the trees to be retained with spatial reference points.

3.2 Clearing Protocols

Prior to clearing, the subject area Manager will undertake the following actions:

Management Actions

M01 Clearly identify the location and limit of clearing of vegetation within all work areas on site (surveyed and pegged/fenced off) and delineated on appropriate plans. These plans will be supplied to contractors and personnel prior to the commencement of clearing.

M02 Clearly mark any trees to be retained outside of the POS areas providing a 2m buffer, with high visibility flagging tape so that they are recognised by clearing contractors prior to the commencement of any clearing.

3.2.1 Advice to Clearing Contractors

Prior to clearing commencing, the subject area Manager will require clearing contractors to undertake the following actions:

Management Actions

M03 Be properly inducted by the subject area supervisor and engineer in a site walk-over which will include the identification of trees/vegetation to be retained, identification of trees/ vegetation to be cleared and the potential presence of Threatened and/or Priority fauna in vegetation to be cleared. The induction will explain procedures, clarify any queries and the scope of work, highlight areas of significance, discuss the methods to be employed and provide contact details for any further enquiries (TBB, 2007).

M04 Inform all site personnel of on-site management practices with regards to weed management and dieback management strategies.

3.2.2 Clearing Works

The subject area Manager will require contractors and nominated subcontractors to adhere to the following clearing procedures within the proposed development area:

Management Actions

M05 Clearing will be undertaken progressively and in one direction (in the direction of the Bush Forever site or future stages containing native vegetation) to encourage fauna that remain in the areas to move to adjacent remnant vegetation and preferably towards the vegetated areas that will remain as POS or future stages.

M06 All clearing operations will be undertaken in a fauna friendly manner. The DEC recommends that machine operators bump or shake trees to be cleared before removal to allow fauna to relocate. If native fauna is encountered during clearing it will be allowed to make its own way from the works area. If this is not possible, a relevant specialist (e.g. Zoologist) will be contacted to remove it.

M07 As many Balgas *(Xanthorrhoea preissii)*, Zamia Palms and other suitable plants as possible will be collected prior to vegetation clearing, to be used for rehabilitation and landscaping.

M08 If any injured wildlife fauna are encountered the Contractor will contact the DEC's Wild Care 24 hour hotline on (08) 9474 9055 or a local veterinary hospital so that arrangements can be made for the welfare of the injured animal.

3.2.3 Site works

The subject area Manager will require contractors and nominated subcontractors to adhere to the following on site procedures within the proposed development area:

Management Actions

M09 Daily inspection of temporary fencing and marker tape will be conducted to ensure protective barriers are maintained.

M10 Attend regular meetings that raise environmental awareness and desired outcome issues.

3.2.4 Stockpile Practices

Management Actions

M11 Native vegetation to be cleared will be removed in an orderly, systematic manner and stockpiled for mulching and/or chipping for use in rehabilitation and landscaping works.

M12 Native vegetation will be slashed to a pre-determined manageable size and separately stockpiled according to vegetation quality, in order to minimise the spread and introduction of weeds in rehabilitation areas upon re-use.

M13 Native vegetation stockpiled onsite will be placed in a designated cleared area at a pre-determined distance away from retained remnant vegetation.

M14 Larger logs that maybe suitable for rehabilitation works; site stabilisation and access control will be stockpiled near rehabilitation stockpiles.

M15 Cleared areas will be temporarily stabilised with water, hydro-mulch or other stabilising material until final use can be implemented.

M16 Topsoil in areas of good quality native vegetation to be cleared will be stripped to a depth of 10cm and stockpiled for rehabilitation works.

M17 Burning of cleared vegetation will be prohibited during all stages of construction.

3.2.5 Treatment of Cleared Material

All material that has been cleared will be treated in an environmentally safe manner. This includes:

Management Actions

M18 All cleared native vegetation will be used to generate chipped mulch material. Good quality vegetation only will be used in areas requiring stabilisation and rehabilitation.

M19 All mulched material will be spread within rehabilitated POS areas within six months as it can substantially contribute to the on-site seed back when re-spread in the relatively short term. This technique is usually successful in re-establishing native vegetation on site.

M20 Mulching of cleared native vegetation will be conducted as a concurrent operation to clearing and mulched material will be stockpiled close to the source of mulch for reuse within the immediate proximity.

3.3 Rehabilitation of Public Open Space

The management actions outlined in this section and the following sections concern the management of native vegetation within POS areas and will also act to preserve habitat for terrestrial fauna within the development area.

Where drainage functions will be incorporated into POS areas consideration will be given to infrastructure design to maximise the retention of native vegetation where possible.

The POS areas that will retain and be rehabilitated with native vegetation are labelled 'Landform and Vegetation Retention' in Figure 3, and total approximately 20 ha. The vegetation in some of this POS type is currently in Good Condition or better. Installation of temporary fencing prior to site earthworks should prevent any accidental disturbance of this vegetation during construction. In the event that any areas are disturbed they will be rehabilitated in accordance with a Vegetation Management Plan(s). Similarly, areas of POS identified for vegetation retention where the vegetation is not in Good Condition or better will be rehabilitated to a Condition capable of providing habitat for fauna species native to the subject area.

Suitable species for revegetation of degraded areas will be derived as much as practicable from local provenance seed stock collected prior to clearing works and planted as direct seeding or tubestock. In addition landscaping with salvaged mature plants including species such as Balgas (*Xanthorrhoea preissii)* and Zamia Palms (*Macrozamia riedlei)* is encouraged. Where local material is not available, stock nursery seedlings of the same species will be used.

During clearing, plants that are able to be transplanted will be salvaged for use within the development, for landscaping and rehabilitation purposes. Tubestock and other mature plants will be sourced from accredited nurseries to ensure they are disease free. The use of local native species will contribute positively to the on-going biodiversity within the YCSP area and further ensure the retention of indigenous species. Suitable Carnaby's Black-Cockatoo feeding and breeding species are listed in Appendix D. While landscaping in the urban core will use some exotic species, species listed in Appendix D will be used to landscape POS and streetscapes in residential areas, where possible.

Management Actions

M21 The collection of local seed material for the use in rehabilitation and landscaping within the YCSP area will be carried out prior to vegetation clearing.

M22 Degraded areas within POS areas will be rehabilitated with native species and locally sourced seed mixes or tubestock as far as practiable.

3.4 Weed Management

Weeds have the potential to smother and compete vigorously with native species for space, water and nutrients, as well as adversely affecting the biological integrity of natural communities by altering vegetation structure (Scheltema and Harris, 1995). Remnant vegetation sites (including POS and Bush Forever Sites) in close proximity to earth worked areas can be exposed to ongoing sources of weed invasion from outside pressures including edge effect and rubbish dumping.

Maintenance weed control will be required to ensure the success of rehabilitation works as in most instances it is not possible, nor desirable, to remove all weeds initially as factors contributing to weed invasion will be continually operating through the construction phase.

To ensure that the conservation values of the remnant vegetation areas are maintained, temporary standard fencing will be installed along the boundaries of the POS areas. The erection of a fence will prevent degradation from vehicular and pedestrian access; prevent potential rubbish disposal and assist in weed management and dieback control.

A combination of weed control methods may be used to control varying intensities of weed infestation within general rehabilitation zones and individual offset areas.

- **Manual (physical) method** including hand pulling, chipping, or cutting weeds is effective in small infestations in environmentally sensitive areas;
- **Mechanical method** including mowing or brush cutting will suppress weed growth, discourage seeding and spread. This method is effective for areas bordering large infestations. Care will be taken to reduce potential disturbance as excessive mowing and brush cutting can facilitate further weed growth and reduce regeneration of native vegetation;
- **Chemical method** including the application of herbicides incorporating foliage and basal spraying; cut/ paste and stem injection. Spraying may be carried out on large or robust weed infestations, particularly to gain initial control of an infestation. The majority of spraying will be small scale 'spot spray' applications to minimised not-target impacts. Roundup Bi-active® is the most common used herbicide due to its low toxicity to wildlife and humans.

Herbicide use will be in accordance with the prescribed specifications on the Material Safety Data Sheets supplied with all herbicides.

The following management recommendations are proposed for the area:

Management Actions

M23 Access of vehicles will be restricted into the areas of vegetation to be retained through the installation of boundary fencing, particularly around POS areas.

M24 An annual weed inspection will be conducted during spring to monitor existing weed species and record any new weeds that may develop. This monitoring program will continue for two years by the proponent or until the City of Wanneroo takes over the management of the POS areas. The decision to implement further weed eradication methods will be based on these monitoring data.

3.5 Dieback Management

Management of dieback aims to minimise the risk of increasing the occurrence of the disease through spreading and impacts on existing infestations. Soil and vegetative material that are from infested areas will not be used within areas where infestation has not been recorded.

Potentially the cut to fill balance should be sufficient for the subject area so that no soil or fill will have to be imported. However testing of this onsite material will be required prior to commencement of earthworks.

Precautionary measures to prevent the potential spread of dieback within the YCSP area include:

Management Actions

M25 Testing of onsite material to be used for fill will be carried out prior to the commencement of earthworks.

M26 If on site sources are not sufficient, any additional soil and fill material required will be obtained from a dieback free source.

M27 All machinery, vehicles and tools (i.e. shovels, spades etc.) will be cleaned down to removed potentially infected soil prior to arrival at the subject area and prior to leaving the subject area. Any equipment operating in dieback affected areas (if determined to be present) will be cleaned down by either washing down or using compressed air before being moved into non-affected areas.

M28 All vehicle and pedestrian access to the bushland areas is restricted and managed during construction to minimise the risk of introducing dieback or spreading the disease from areas that are infested via tyres and footwear and by eliminating the dumping of refuse and soil. This will be managed by the installation of boundary fencing.

3.6 Fauna Management

3.6.1 Fauna Trapping and Relocation

A staged fauna trapping and relocation program prior to the clearing of the YCSP area is required to relocate conservation listed species that are present on site. The relocation program will target selected species of medium sized mammals (Stage 1) and capture reptiles and amphibians (Stage 2). Other species (e.g. Western Brushed tailed Wallaby) are not typically relocated and clearing will be designed to minimise potential impacts on these species, by clearing in one direction towards the Bush Forever site or future stages which still contain bushland.

Stage 1 trapping will be conducted in spring in vegetated areas that provide fauna habitat, prior to clearing activities. It is recommended that 60 cage traps be used on site to maximise the chances of catching individuals. This trapping technique has been used previously in other areas on the Swan Coastal Plain. Relocation effectiveness is influenced by the number of traps and amount of time that trapping is carried out over. Coffey Environments recommends that trapping is continued over eight nights. The specific trap locations will be microhabitat dependent and it is expected that not all target species will be captured on site during the trapping period.

Stage 2 trapping will be conducted immediately (maximum of two weeks) prior to clearing to minimise the chances of re-colonisation to the area. A three day systematic search of vegetated areas designated for clearing will be conducted. This searching technique includes digging out holes, removing bark from logs and trees, overturning rocks and sifting through leaf litter with rakes. This strategy is likely to only capture a limited assemblage of vertebrate fauna in a given area.

Any fauna found during the program will be relocated offsite as directed by DEC Officers. The location selected by the DEC is generally an appropriate DEC managed nature reserve.

Management Actions

M29 A fauna trapping and relocation program will be implemented prior to clearing of vegetation.

3.6.2 Fauna Protection

In addition to fauna relocation procedures in Section 3.6.1, the following management actions will be implemented by the Civil Works Contractor:

Management Actions

M30 Construction vehicles will be retained on designated access routes.

M31 No pets, traps or firearms will be permitted on site.

M32 The works area will be maintained in a clear and tidy manner to ensure that feral or other animals are not attracted to the subject area.

M33 Artificial illumination will be minimised at all times.

Following the construction period; additional actions to protect native fauna within the YCSP area include:

Management Actions

M34 Informing all prospective landowners of the conservation value of the surrounding areas to significant flora and fauna populations and encourage them to plant local native flora, maintain connectivity of vegetation, manage weeds and control of the activities of dogs and other pets in the area.

M35 Prevent degradation and improve native fauna habitat by implementing weed control programs, adopt fire management measures, replant suitable understorey species where possible, provide clearly defined access paths and fencing to allow for the movement of the native animals.

M36 A consolidated Landscape and Vegetation Management Plan will be prepared at the subdivision stage to define the management measures outlined in this strategy including manage landscaping of POS areas and streetscapes containing and retaining remnant vegetation as well as those being rehabilitated with native vegetation.

4 SUMMARY OF ACTIONS AND RESPONSIBILITIES

The developer will be responsible for the implementation of the management actions presented in this Management Strategy, as well as the ongoing management and maintenance to the satisfaction of the City of Wanneroo for a minimum of two years following the initial clearing and site works.

Following this period, the City of Wanneroo will assume responsibility for the management and the ongoing implementation of this Management Strategy.

Table 4 outlines the management actions that have been identified as key components of this VFMS within the YCSP area.

TABLE 4: SUMMARY OF MANAGEMENT ACTIONS

Management Measure	Specific Information	Timing	Responsibility	Status
Clearing of Vegetation	**M01** Clearly identify the location and limit of clearing of vegetation within all work areas on site (surveyed and pegged/fenced off) and delineated on appropriate plans. These plans will be supplied to contractors and personnel prior to the commencement of clearing.	Prior to vegetation clearing	YBJV	
	M02 Clearly mark any trees to be retained outside of the POS areas providing a 2m buffer, with high visibility flagging tape so that they are recognised by clearing contractors prior to the commencement of any clearing.	Prior to vegetation clearing	YBJV	
	M03 All staff will be inducted about the identification of trees and vegetation to be retained, and the potential presence of Threatened and/or Priority Fauna.	Prior to vegetation clearing	Site Manager	
	M04 Inform all site personnel of on-site management practices with regards to weed management and dieback management strategies.	Prior to construction	Site Manager	
	M05 Clearing will be undertaken progressively and in one direction to encourage fauna that remain in the areas to move to adjacent remnant vegetation and preferably towards the vegetated areas that remain.	During vegetation clearing	Contractors	

Management Measure	Specific Information	Timing	Responsibility	Status
	M06 All clearing operations will be undertaken in a fauna friendly manner.	During vegetation clearing	Contractors	
	M07 As many Balgas *(Xanthorrhoea preissii)*, Zamia Palms and other suitable plants as possible will be collected prior to vegetation clearing, to be used for rehabilitation and landscaping.	Prior to and during vegetation clearing	YBJV	
	M08 If any injured wildlife fauna are encountered the Contractor will contact the DEC's Wild Care 24 hour hotline on (08) 9474 9055 or a local veterinary hospital so that arrangements can be made for the welfare of the injured animal.	During vegetation clearing	Contractors	
	M09 Daily inspection of temporary fencing and marker tape will be conducted to ensure protective barriers are maintained.	During construction	Site Manager	
	M10 Attend regular meetings that raise environmental awareness and desired outcome issues.	During construction	Contractors	
	M11 Native vegetation to be cleared will be removed in an orderly, systematic manner and stockpiled for mulching and/ or chipping for use in rehabilitation and landscaping works.	Prior to and during construction	YBJV	
	M12 Native vegetation will be slashed to a pre-determined manageable size and separately stockpiled according to vegetation quality.	Prior to construction	YBJV	
	M13 Native vegetation stockpiled onsite will be placed in a designated cleared area at a pre-determined distance away from retained remnant vegetation.	Prior to and during construction	YBJV	

Management Measure	Specific Information	Timing	Responsibility	Status
	M14 Larger logs that maybe suitable for rehabilitation works, site stabilisation and access control will be stockpiled near rehabilitation stockpiles.	Prior to and during construction	YBJV	
	M15 Cleared areas will be temporarily stabilised with water, hydro-mulch or other stabilising material until final use can be implemented.	During construction	YBJV	
	M16 Topsoil in areas of good quality native vegetation to be cleared will be stripped to a depth of 10cm and stockpiled for rehabilitation works.	During construction	YBJV	
	M17 Burning of cleared vegetation will be prohibited during all stages of construction.	At all times	YBJV	
	M18 All cleared native vegetation will be used to generate chipped mulch material. Good quality vegetation only will be used in areas requiring stabilisation and rehabilitation.	During construction	YBJV	
	M19 All mulched material will be spread within rehabilitated POS areas within six months.	During and post construction	YBJV	
	M20 Mulching of cleared native vegetation will be conducted as a concurrent operation to clearing and mulched material will be stockpiled close to the source of mulch for reuse within the immediate proximity.	During vegetation clearing and construction	YBJV	
Rehabilitation of POS	**M21** The collection of local seed material for the use in rehabilitation and landscaping within the YCSP area will be carried out prior to vegetation clearing.	Prior to vegetation clearing	YBJV	
	M22 Degraded sections within POS areas will be rehabilitated with native species and locally sourced seed mixes or tubestock as far as pracitcable.	Post construction	YBJV	

Management Measure	Specific Information	Timing	Responsibility	Status
Weed Management	**M23** Access of vehicles will be restricted into the areas of vegetation to be retained through the installation of boundary fencing.	During construction	YBJV	
	M24 An annual weed inspection will be conducted during spring to monitor existing weed species and record any new weeds that may develop.	During and post construction	YBJV	
Dieback Management	**M25** Testing of onsite material to be used for fill will be carried out.	Prior to construction	YBJV	
	M26 If on site sources are not sufficient, any additional soil and fill material required will be obtained from a dieback free source.	During construction	YBJV	
	M27 All machinery, vehicles and tools (i.e. shovels, spades etc.) will be cleaned down to removed potentially infected soil prior to arrival at the subject area and prior to leaving the subject area.	During construction	YBJV	
	M28 All vehicle and pedestrian access to the bushland areas will be restricted and managed to minimise the risk of introducing dieback or spreading the disease from areas that are infested.	During construction	YBJV	
Fauna Management	**M29** A fauna trapping and relocation program will be implemented prior to clearing of vegetation.	Prior to construction	YBJV	
	M30 Construction vehicles will be retained on designated access routes.	At all times	Site Manager	
	M31 No pets, traps or firearms will be permitted on site.	At all times	Site Manager	

Management Measure	Specific Information	Timing	Responsibility	Status
	M32 The works area will be maintained in a clear and tidy manner to ensure that feral or other animals are not attracted to the subject area.	During construction	Site Manager	
	M33 Artificial illumination will be minimised at all times.	During construction	Site Manager	
	M34 Informing all prospective landowners of the conservation value of the surrounding areas to significant flora and fauna populations and encourage them to plant local native flora, maintain connectivity of vegetation, manage weeds and control of the activities of dogs and other pets in the area.	Post construction	YBJV	
	M35 Prevent degradation and improve native fauna habitat by implementing weed control programs; adopt fire management measures; replant suitable understorey species where suitable; provide clearly defined access paths and fencing to allow for the movement of the native animals.	During and post construction	YBJV	
General	**M36** A consolidated Landscape and Vegetation Management Plan will be prepared at the subdivision stage to define the management measures outlined in this strategy including manage landscaping of POS areas and streetscapes containing and retaining remnant vegetation as well as those being rehabilitated with native vegetation	Pre-construction	YBJV	

5 MONITORING AND REPORTING

5.1 Monitoring

The implementation of the management actions detailed in this Vegetation and Fauna Management Strategy will be an on-going process, which should be flexible in responding to changes in the natural environment, recreational use of the environment and community values. Monitoring procedures will assist in the adaptive management of the POS and rehabilitated areas, as well as informing the progress of management.

Rehabilitation 'success' is difficult to quantify, however various methods to assess revegetation performance can be implemented as part of the Management Strategy. The parameters to assess performance of the subject area's rehabilitation program are provided in Table 5 below.

TABLE 5: KEY PERFORMANCE INDICATORS TO MEASURE MANAGEMENT PERFORMANCE.

Assessment Parameter	Assessment Method	Performance Criteria
Use of Mulched Vegetation	Inspect site to ensure mulch has been utilised on site within 6 months.	All mulched material spread within the POS areas within 6 months of the initial clearing of vegetation
Seedling survival	Require seedling health to be measured.	80% survival rate of planted tube stock, 3 months after planting.
Foliage cover	As per the *Australian Soil and Survey Handbook* (McDonald *et.al.*, 1998).	30% cover (excluding weeds) 2 years after implementation of rehabilitation.
Species representation	Number of species of plants present calculated from the percentage of number of species originally planted.	One third of species sown and planted being evident in areas of $100m^2$ at any time after rehabilitation.
Presence of weeds	Identification of any declared plants and significant environmental weed species within the rehabilitated areas.	The number and density of weeds within the POS areas has not increased in 2 years after implementation. Environmental weeds controlled to an extent where their impacts on new plant growth of decreasing significance.

Assessment Parameter	Assessment Method	Performance Criteria
Overall success of plant establishment	Subjective measure based on a visual assessment of species composition plant density and plant condition within the rehabilitated areas. Five categories used (Excellent, Good, Satisfactory, Poor and Unacceptable). Photographic record of plant growth in each rehabilitated area. Overall assessment of the ability of the revegetated area to attain a final required vegetation structure and composition.	Species composition and projected plant growth (size, form) likely to achieve foliage cover (30% cover, excluding weeds, 2 years after implementation).
Protection of POS areas	Inspect site ensure appropriate fencing in place.	Standard fencing is present around POS areas within 6 months of the initial clearing.

If the performance criteria are not met then remedial action will be undertaken as required so that the criteria can be satisfied during the duration of the proponent's management period.

5.2 Reporting

Monitoring the performance criteria listed in Table 5 will be undertaken on a six-monthly basis by the proponent's delegated environmental consultant for a two year period following the initial clearing and earth-working of the subject area. A letter report will be prepared annually that summarises the findings of the surveys and any remediation measures recommended to be implemented by the proponent. A copy of each of the reports will be presented to the proponent, the DEC and the City of Wanneroo.

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7 DISCLAIMER

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Figures

Yanchep City Structure Plan
Vegetation and Fauna Management Strategy

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YANCHEP CITY STRUCTURE PLAN
VEGETATION AND FAUNA MANAGEMENT STRATEGY

REGIONAL LOCATION

FIGURE 1

metres

0 100 200 300 400 500

SCALE 1 : 15 000 @ A3

PREDOMINANT USE	OTHER USES
RETAIL	Residential, Commercial, Office, Community, Education
COMMERCIAL	Residential, Other Retail, Office
COMMUNITY (As shown)	Residential, Commercial, Retail (Excluding School Sites)
RESEARCH & DEVELOPMENT	Residential, Community, Education, Office
SERVICE INDUSTRY	Commercial, Light Industry
RESIDENTIAL (High Density)	Other Compatible
RESIDENTIAL (Medium Density)	Other Compatible
METRO RAIL	
RAIL UNDERGROUND	
FIXED ROUTE PUBLIC TRANSPORT (Bus / Light Rail)	

TAYLOR BURRELL BARNETT
Town Planning and Design
187 Roberts Road Subiaco
Western Australia 6008
Telephone: (08) 9382 2911
Facsimile: (08) 9382 4086
admin@tbbplanning.com.au

SOURCE: Taylor Burrell Barnett, Plan No. 07/004/004F, 07/07/2010.

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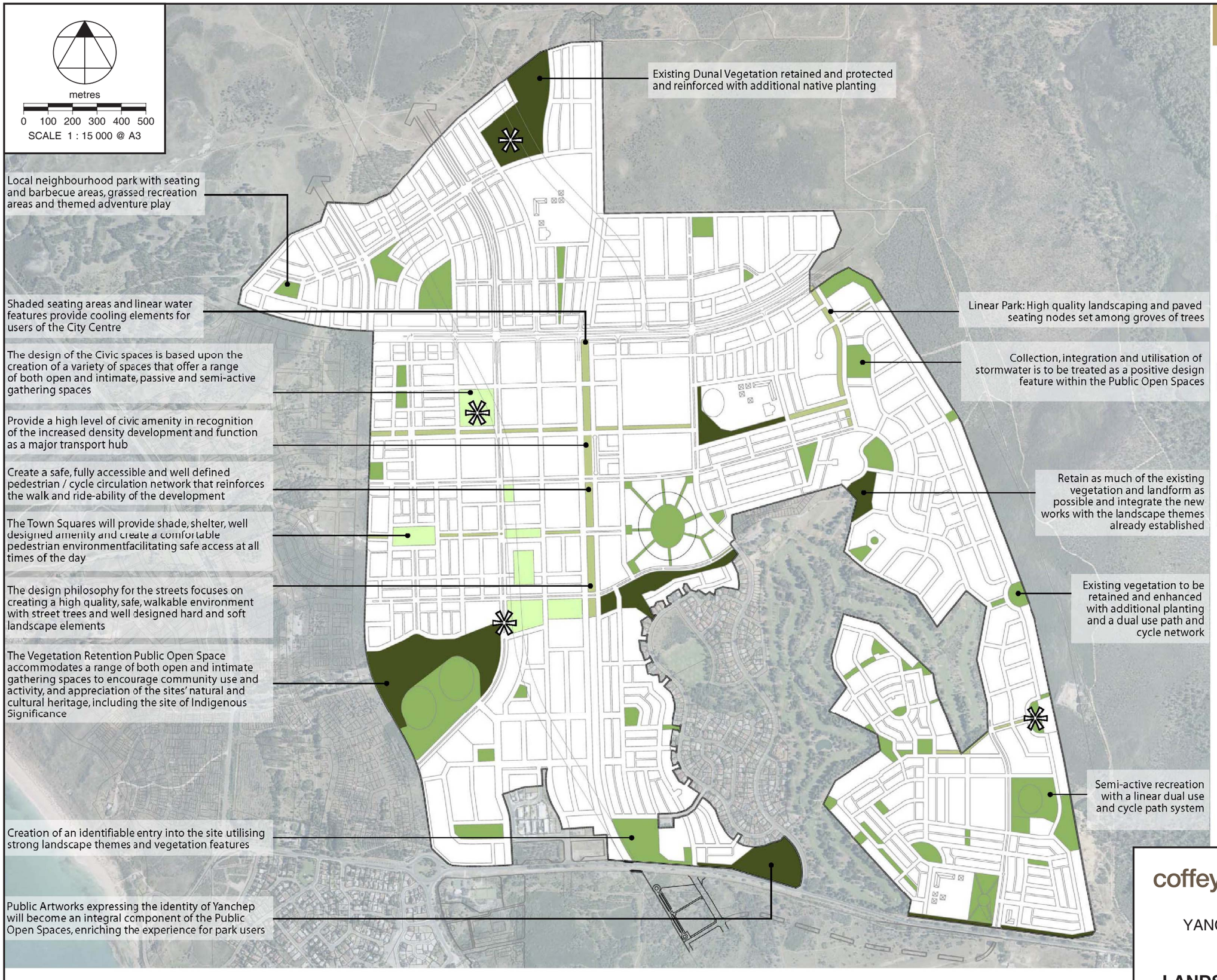
VEGETATION AND FAUNA MANAGEMENT STRATEGY

YANCHEP CITY STRUCTURE PLAN

FIGURE 2



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YANCHEP CITY STRUCTURE PLAN
VEGETATION & FAUNA MANAGEMENT STRATEGY

LANDSCAPING CONCEPT PLAN

FIGURE 3

ENVI/PERT/00234AA/Flora & Fauna MP/EP2008-129F04.dgn DATUM: MGA50 DRAWN: CR 09-07-10 CHECKED: AR 09-07-10 PRINTED: Fri 09 Jul 10

metres

0 100 200 300 400 500

SCALE 1 : 15 000 @ A3

LEGEND

- Study Site Boundary
- Cadastral Boundary
- Topographic Contour (mAHD)

SHEARWATER AVENUE

TOREOPANGO AVENUE

MITCHELL FREEWAY

MARMION AVENUE

YANCHEP BEACH ROAD

CONTOUR SOURCE: Taylor Burrell Barnett, 2010.

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YANCHEP CITY STRUCTURE PLAN
VEGETATION AND FAUNA MANAGEMENT STRATEGY

TOPOGRAPHY

FIGURE 4

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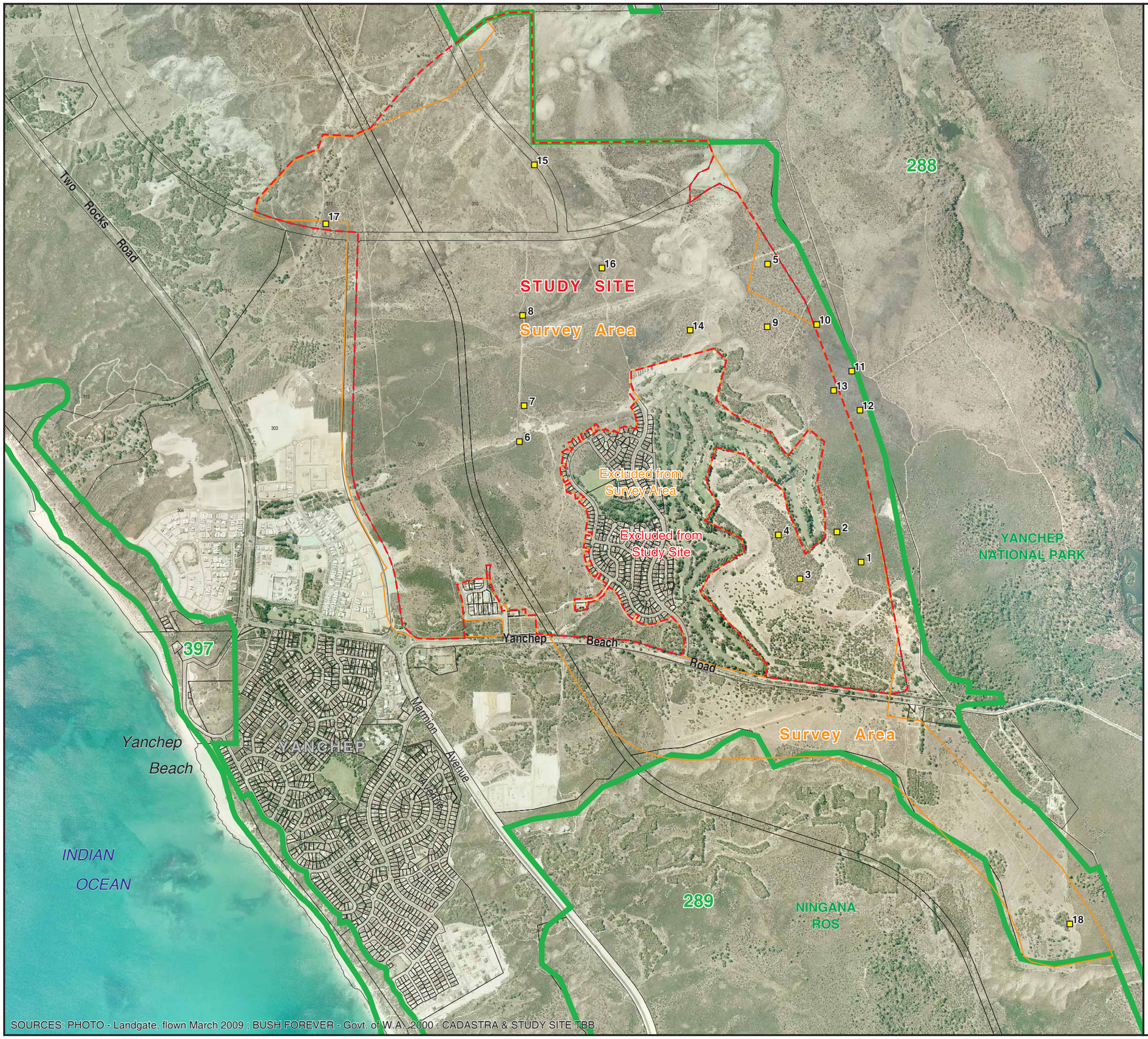
DATUM: MGA50

ENVI/PERT/00234AA/Flora & Fauna MP/EP2008-129F05.dgn



SOURCES: PHOTO - Landgate, flown March 2009 ; BUSH FOREVER - Govt. of W.A., 2000 ; CADASTRA & STUDY SITE TBB.

metres

0 250 500 750 1000

SCALE 1 : 20 000 @ A3

LEGEND

- Study Site Boundary, Yanchep City Structure Plan
- Survey Area Boundary, (ATA Environmental, 2007a & 2007b)
- Cadastral Boundary
- Bush Forever Site Boundary
- 288 Bush Forever Site Number
- 17 Vegetation Quadrat

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YANCHEP CITY STRUCTURE PLAN
VEGETATION AND FAUNA
MANAGEMENT STRATEGY

LOCAL STRUCTURE PLAN AREA AND ATA ENVIRONMENTAL (2007a & b) SURVEY AREA

FIGURE 5

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metres

0 200 400 600 800 1000

SCALE 1 : 15 000 @ A3

LEGEND

- Study Site Boundary
- Cadastral Boundary
- Vegetation Association Boundary
- Ba — Vegetation Association

SOURCES: PHOTO - Landgate, flown March 2009
CADASTRA - DOLA, 2000

VEGETATION ASSOCIATIONS LEGEND

QUINDALUP VEGETATION COMPLEX

Young Quindalup Dune Heath

Ar *Acacia rostellifera* Closed Heath

Old Quindalup Dune Heath

ArDs *Acacia rostellifera* Closed Heath with scattered *Dryandra sessilis*

As *Acacia saligna* Open Scrub to Shrubland

AsXp *Acacia saligna* and *Xanthorrhoea preissii* Tall Shrubland

Ms *Melaleuca systena* Closed Heath

COTTESLOE - NORTH VEGETATION COMPLEX

Limestone Heath Types

Ds *Dryandra sessilis* Heath to Closed Heath

DsCq *Dryandra sessilis* and *Calothamnus quadrifidus* Heath to Closed Heath

Cq *Calothamnus quadrifidus* Closed Heath

Mh *Melaleuca huegelii* Open Heath to Heath

Sand over Limestone

Ba *Banksia attenuata* Low Open Forest

Eg *Eucalyptus gomphocephala* Woodland to Open Forest

Pl Denotes plantation predominantly *Eucalyptus gomphocephala* and *Agonis flexuosa*

C Cleared

TWO ROCKS ROAD

YANCHEP BEACH ROAD

MARMION AVE

YANCHEP

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YANCHEP CITY STRUCTURE PLAN
VEGETATION AND FAUNA MANAGEMENT STRATEGY

VEGETATION ASSOCIATIONS

FIGURE 6

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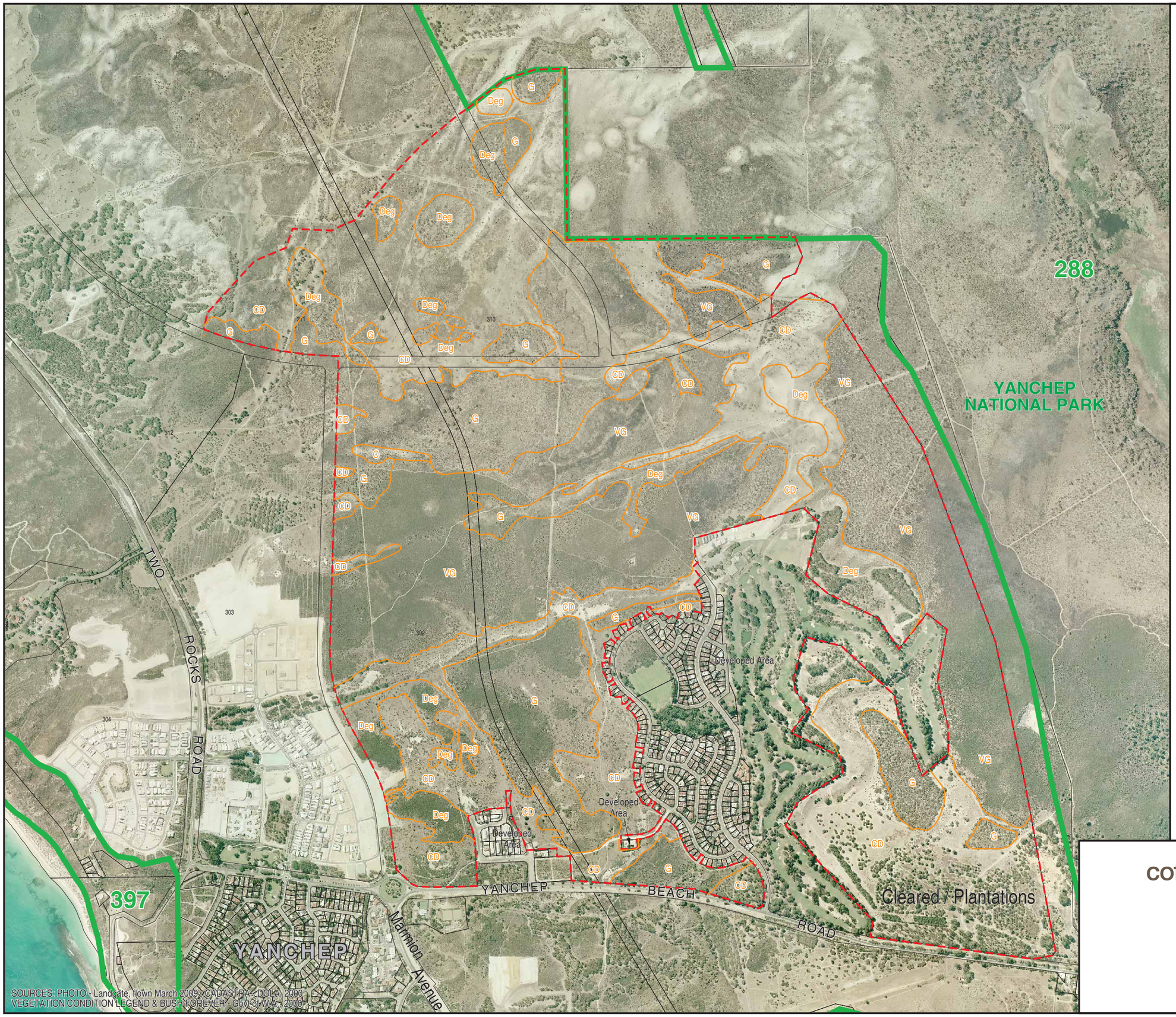

metres

0 200 400 600 800 1000

SCALE 1 : 15 000 @ A3

LEGEND

- Study Site Boundary
- Cadastral Boundary
- Bush Forever Site Boundary
- 288 Bush Forever Site Number
- Vegetation Condition Boundary

VEGETATION CONDITION
(Legend Source: BUSH FOREVER Govt. of W.A.)

P **Pristine** or nearly so, no obvious signs of disturbance. (Not Applicable)

Ex **Excellent**. Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive species. (NA)

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 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.

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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YANCHEP CITY STRUCTURE PLAN
VEGETATION AND FAUNA
MANAGEMENT STRATEGY

VEGETATION CONDITION

FIGURE 7

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ENVI/PERT/00234AA/Flora & Fauna MP/EP2008-129F08.dgn

metres

0 200 400 600 800 1000

SCALE 1 : 15 000 @ A3

LEGEND

- Study Site Boundary
- Cadastral Boundary
- Floristic Community Boundary
- 28 Floristic Community Type

FLORISTIC COMMUNITIES

- 24 Northern Spearwood shrublands and woodlands
- 28 Spearwood Banksia attenuata or *Banksia attenuata-Eucalyptus* Woodlands
- 29b *Acacia* Shrublands on taller dunes

TWO ROCKS ROAD

YANCHEP BEACH ROAD

MARMION AVE

YANCHEP

SOURCES: PHOTO - DLI, 2006 (data via TBB/MAPS)
CADASTRA - DOLA, 2000

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YANCHEP CITY STRUCTURE PLAN
VEGETATION AND FAUNA MANAGEMENT STRATEGY

FLORISTIC COMMUNITY TYPES

FIGURE 8

Appendix A
Flora Species List

Yanchep City Structure Plan
Vegetation and Fauna Management Strategy

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
**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
**Carprobrotus edulis*	<1	0.1
**Hypochaeris glabra*	3	0.1
Petrorhagia dubia	<1	0.1
Desmocladus fascicularis	2	0.1

SPECIES	% COVER	HEIGHT (M)
**Trifolium campestre*	<1	0.05

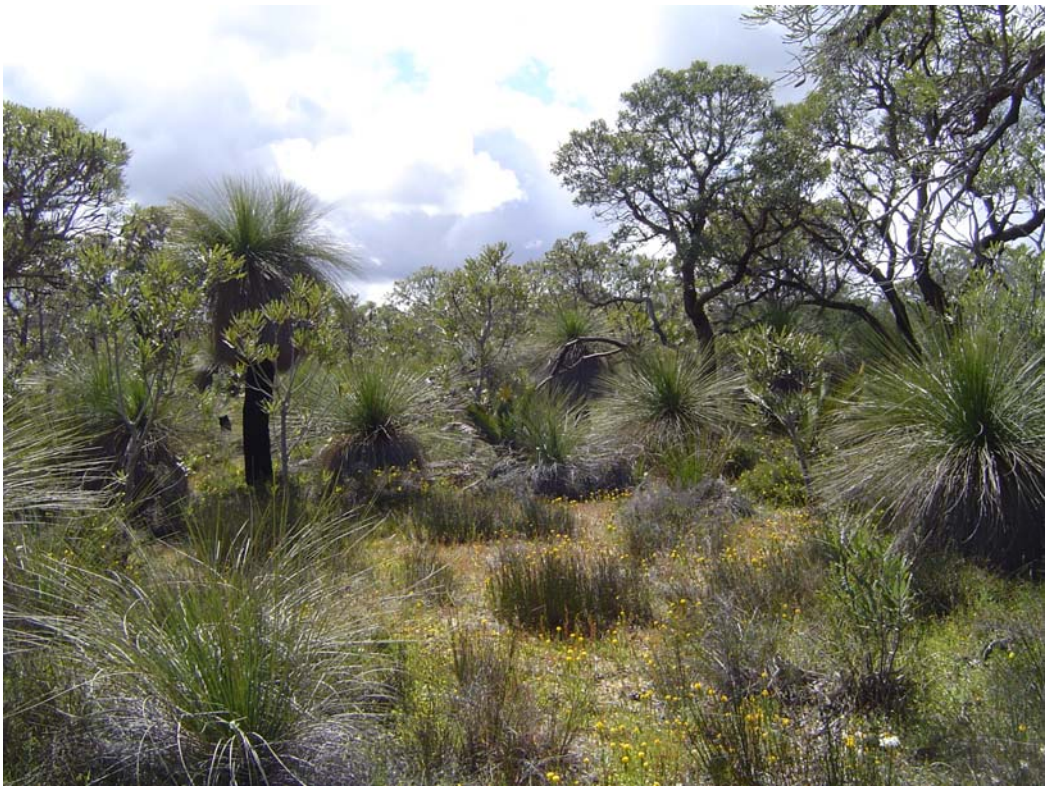
QUADRAT Q8
371254E 6510700N
Condition: Very Good to Good

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
**Arctotheca calendula*	<1	0.1
Millotia myosotidifolia	2	0.05
**Trifolium campestre*	1	0.05
Hardenbergia comptoniana	<1	creeper

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

SPECIES	% COVER	HEIGHT (M)
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

FLORA SPECIES LIST
(ATA ENVIRONMENTAL, 2005)

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*
	**Briza minor*

FAMILY	SPECIES
	**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
DROSERACEAE	*Drosera erythrorhiza*

FAMILY	SPECIES
	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
	Hovea trisperma

FAMILY	SPECIES
	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

FLORA SPECIES LIST
(ATA ENVIRONMENTAL, 2005)

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*
	**Briza minor*

FAMILY	SPECIES
	**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
DROSERACEAE	*Drosera erythrorhiza*

FAMILY	SPECIES
	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
	Hovea trisperma

FAMILY	SPECIES
	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

FLORA SPECIES LIST
(ATA ENVIRONMENTAL, 2005)

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*
	**Briza minor*

FAMILY	SPECIES
	**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
DROSERACEAE	*Drosera erythrorhiza*

FAMILY	SPECIES
	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
	Hovea trisperma

FAMILY	SPECIES
	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

FLORA SPECIES LIST
(ATA ENVIRONMENTAL, 2005)

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*
	**Briza minor*

FAMILY	SPECIES
	**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
DROSERACEAE	*Drosera erythrorhiza*

FAMILY	SPECIES
	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*
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	Calandrinia sp.
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PROTEACEAE	*Banksia attenuata*
	Banksia meziesii
	Conospermum stoechadis
	Dryandra lindleyana
	Dryandra sessilis
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	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 B
Significant Flora Recorded in the Vicinity of the Study Area

Yanchep City Structure Plan
Vegetation and Fauna Management Strategy

APPENDIX 1
SIGNIFICANT FLORA RECORDED IN THE
VICINITY OF THE ATA ENVIRONMENTAL STUDY AREA 2007

Species	Conservation Status	Preferred Habitat	Flowering species
Acacia benthamii	2	Typical 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 – Sep
Conostylis pauciflora subsp. *euryrhipis*	3	White, grey or yellow sand. Consolidated dunes.	Aug – Oct
Eucalyptus argutfolia	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. Limestome 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

Appendix C
Public Open Space Provision and POS Schedule

Yanchep City Structure Plan
Vegetation and Fauna Management Strategy

LEGEND
PUBLIC OPEN SPACE PROVISION

LANDFORM AND VEGETATION RETENTION
Passive and semi-active recreation facilities
Duel use and cycle path network
Existing vegetation retained and enhanced with additional native planting
Interpretation and information signs
Integrated public artwork

NEIGHBOURHOOD AND TOWN PARKS
Passive and semi-active recreation facilities
Barbecue/picnic/play facilities (themed adventure playground)
Duel use and cycle path networks
Shelters/pavilions/shade structures
Naturalistic drainage systems
Combination of formal and informal tree and shrub planting

LINEAR PARKS AND BOULEVARDS
Formal landscaping, combination of hard and soft landscape elements
Avenues/grids of tree planting
High quality visual landscape
Built forms—seating, seating walls, steps
Lighting, water features

TOWN SQUARES AND CIVIC SPACES
High quality hard landscape and urban forms
Broad range of hard landscape elements, paving and material types
Creation of flexible spaces to accommodate performances, gatherings and community events
Lighting, water features, seating
Sculptural and integrated public artworks

1 **POS AREA**

Note: To be read in conjunction with Table 1 - POS Schedule Yanchep City Structure Plan

YANCHEP CITY STUCTURE PLAN
PUBLIC OPEN SPACE PROVISION

figure: 01

client: Yanchep Beach Joint Venture
date: September 2010
source: Plan E

Yanchep beach joint venture

TABLE ONE - PUBLIC OPEN SPACE SCHEDULE Dated 31 August 2010 YANCHEP CITY LOCAL STRUCTURE PLAN		
Gross Site Area (ha) (excluding City Centre Zone- 103.4847ha)		**518.4911**
Deductions		
Business / Commercial	57.9328	
Special Use- Research and Development	30.3027	
Retail	0.5590	
Service Industry	31.8430	
Primary Schools	8.1942	
Public High School	10.0612	
Private High School (K-12)	5.5692	
TAFE	1.6100	
Railway Reserve	6.5896	
Existing Road Reserve (Toreopango Drive)	9.7146	
Special Transit Boulevard	2.9998	
Non Credited Unrestricted Public Open Space	4.5434	
POS Drainage (1:1yr Storm Event)		
POS 1	0.5800	
POS 2 & 3	0.1300	
POS 4	0.1500	
POS 5	0.2500	
POS 6	0.1100	
POS 9A	0.1300	
POS 9B	0.2900	
POS 16	0.1200	
POS 18	0.1600	
POS 19	0.0800	
POS 21	0.2700	
POS 28	0.0800	
POS 33	0.2500	
POS 45	0.2000	
POS 53	0.4700	
POS 54	0.1200	
POS 61	0.1600	
POS 64	0.3400	
Total Deductions	**173.8095**	
Gross Subdivisible Area		344.6816
Required Public Open Space (10%)		**34.4682**
Public Open Space Requirements		
Unrestricted public open space – minimum 80%	27.5745	
Restricted public open space – maximum 20%	6.8936	
Total		**34.4682**
PUBLIC OPEN SPACE PROVISION		
Unrestricted Public Open Space		
POS 1	6.4966	
POS 2	0.1744	
POS 3	0.0065	
POS 4	1.8068	
POS 5	0.7730	
POS 6	0.3377	
POS 7	1.3715	
POS 8	0.1107	
POS 9A	9.0016	
POS 9B	7.9964	
POS 10	0.3500	

POS 11	1.7319	
POS 12	1.1321	
POS 13	0.2310	
POS 14	0.4751	
POS 15	2.7453	
POS 16	0.3011	
POS 17	0.1445	
POS 18	2.7228	
POS 19	0.0530	
POS 20	3.7361	
POS 21	1.6400	
POS 22	0.1049	
POS 23	0.2141	
POS 24	0.6254	
POS 25	0.1680	
POS 26	0.2319	
POS 27	0.1957	
POS 28	0.0544	
POS 29	0.0595	
POS 30	0.0595	
POS 31	0.1654	
POS 32	1.3659	
POS 33	0.1117	
POS 34	2.7860	
POS 35	0.5221	
POS 36	0.1110	
POS 37	0.3600	
POS 38	0.1448	
POS 39	0.1800	
POS 40	0.1400	
POS 41	0.1305	
POS 42	0.2541	
POS 43	0.2933	
POS 44	0.0400	
POS 45	0.0000	
POS 46	0.5507	
POS 47	0.0645	
POS 48	0.6030	
POS 49	0.1119	
POS 50	0.3276	
POS 51	0.0707	
POS 52	1.3902	
POS 53	0.8530	
POS 54	0.4551	
POS 55	0.2102	
POS 56	0.0639	
POS 57	0.0640	
POS 58	0.4888	
POS 59	1.6251	
POS 60	0.5889	
POS 61	1.0581	
POS 62	0.1368	
POS 63	0.1376	
POS 64	1.0021	
Total Unrestricted Public Open Space		**61.4585**
Restricted Public Open Space		
POS Drainage (1:5yr Storm Event)		
POS 1	0.5200	
POS 2 & 3	0.0600	
POS 4	0.0800	

POS 5	0.1200	
POS 6	0.0500	
POS 9A	0.0600	
POS 9B	0.1400	
POS 16	0.0600	
POS 18	0.0800	
POS 19	0.0400	
POS 21	0.1300	
POS 28	0.0400	
POS 33	0.1200	
POS 45	0.1000	
POS 53	0.2300	
POS 54	0.0600	
POS 61	0.0800	
POS 64	0.1600	
Total Restricted Public Open Space		**2.1300**
Total Credited Restricted Public Open Space		**2.1300**
Total Credited Public Open Space		**63.5885**
Percentage of Credited Public Open Space Provided (Unrestricted and Restricted POS Contribution)		**18.4%**

Notes:

1. This schedule is to be read in conjunction with the Yanchep City Structure Plan (July 2009) and Masterplan, and Figure 1 - Public Open Space Provision.
2. The gross site area excludes the City Centre zone (103.4847ha) which is subject to a separate plan.

Appendix D
Carnaby's Black-Cockatoo Habitat Species

Yanchep City Structure Plan
Vegetation and Fauna Management Strategy

Carnaby's Black Cockatoo feeding

Species	Common Name	Part consumed	Reference
	Native Australian Plants		
Family: Casuarinaceae			
Allocasuarina fraseriana	Sheoak	seeds	1, 2, 7
*Casuarina cunninghamiana**	River Sheoak	seeds	J. P. *pers obs*
Family: Mimosaceae			
Acacia saligna	Orange Wattle	bark, invertebrate	9
Family: Moraceae			
*Ficus spp.**	Fig tree	fruit	9
Family: Myrtaceae			
Agonis flexuosa	Peppermint Tree	bark, invertebrate	9
*Callistemon viminalis**	Bottlebrush	nectar	2, 3, 7, 9
Corymbia calophylla	Marri	seed, flower, nectar	2, 5, 6, 7, 9
Corymbia ficifolia	Red Flowering Gum	flower	9
Eucalyptus citriodora	Lemon-scented gum	seed, flower	9
Eucalyptus gomphocephala	Tuart	flower	9
Eucalyptus marginata	Jarrah	seed	2, 6, 7, 9
Eucalyptus salmonophloia	Salmon gum	seed	9
Eucalyptus todtiana	Coastal Blackbutt	seed	2, 7
Eucalyptus wandoo	Wandoo	flower	2, 7
Family: Proteaceae			
Banksia ashbyi	Ashby's Banksia	seed	2, 7
Banksia attenuata	Slender Banksia	seed, flower, invertebrate	2, 4, 6, 7, 8, 9
Banksia fraseri	---	seed, flower	2, 7
Banksia grandis	Bull Banksia	seed, flower	2, 6, 7
Banksia ilicifolia	Holly Banksia	seed	9
Banksia littoralis	Swamp Banksia	seed, flower	2, 7
Banksia menziesii	Firewood Banksia	seed, flower	2, 7, 9
Banksia nivea	Couch Honeypot	seed, flower	2, 6, 7
Banksia nobilis	Golden Dryandra	seed	2, 7
Banksia prionotes	Acorn Banksia	seed	9
Banksia prolata	Tree Banksia	seed	9
Banksia sessilis	Parrot bush	seed, flower	2, 6, 7, 9
Banksia splendida	Shaggy Dryandra	seed, flower	2, 7
Banksia tricuspis	Pine Banksia	seed, flower, invertebrate	10
Banksia undata	Urchin Dryandra	seed, flower	2, 7
Banksia verticillata	Albany Banksia	seed, flower	2, 7
Grevillea armigera	Prickly Toothbrush	seed, flower	2, 7
Grevillea hookeriana	Red Tooth Brushes	seed, flower	2, 7

Grevillea paniculata	Kerosene Bush	seed	2, 7
Grevillea paradoxa	Bottlebrush Grevillea	seed	2, 7
Grevillea petrophiloides	Pink Poker	seed	2, 7
Hakea auriculata	---	seed	2, 7
Hakea circumalata	---	seed	2, 7
Hakea conchifolia	Shell-leaved Hakea	seed	2, 7
Hakea cyclocarpa	Ramshorn	seed	2, 7
Hakea falcata	---	seed	2, 7
Hakea gilbertii	---	seed	2, 7
Hakea incrassata	Golfball Hakea	seed	2, 7
Hakea laurina	Pin-cushion Hakea	seed, flower	9
Hakea lissocarpha	Honeybush	seed	2, 7
Hakea multilineata	Grass leaf Hakea	seed	2,7
Hakea obliqua	Needles and Cork	seed	2, 7
Hakea pandanicarpa	---	seed	2, 7
Hakea prostrata	Harsh Hakea	seed	2, 7
Hakea ruscifolia	Candle Hakea	seed	2, 7
Hakea scoparia	---	seed	2, 7
Hakea sulcata	Furrowed Hakea	seed	2, 7
Hakea trifurcata	Two-leaved Hakea	seed	2, 7
Hakea undulata	Wavy-leaved Hakea	seed	2, 6, 7
Hakea varia	Variable-leaved Hakea	seed	2, 7
Isopogon scabriusculus	---	seed	2, 7
Lambertia multiflora	Many Flowered Honeysuckle	seed, flower	2, 3, 7
*Macadamia integrifolia**	Macadamia	seed	9
Persoonia longifolia	Snottygobble	seed	1
Family:Xanthorrhoeacea			
Xanthorrhoea preissii	Grass tree	seed	9
Introduced Plant or Crop Species			
Family: Altingiaceae			
Liquidamber styraciflua	Liquid Amber	seed	L.V. *pers. obs.*; P.B. *pers. obs.*
Family: Araliaceae			
Schefflera actinophylla	Umbrella Tree	fruit	2, 7
Family: Asteraceae			
Helianthus annuus	Sunflower plants	seed	9
Family: Bignoniaceae			
Jacaranda mimosifolia	Jacaranda	seed	9
Family: Brassicaceae			

Brassica napus	Canola	seed	D.S. *pers. obs*
Raphanus raphanistrum	Wild radish	seed	D.S. *pers. obs.*
Family: Geraniaceae			
Erodium spp.	Wild geranium	seed	D.S. *pers. obs*
Family: Iridaceae			
Romulea rosea	Guildford or Onion Grass	seed	1
Family: *Malvaceae*			
Hibiscus spp.	Hibiscus garden variety	flower	9
Family: Meliaceae			
Melia azedarach	White Cedar	seed	D.S. *pers. obs*
Family: Pinaceae			
Pinus pinaster	Pinaster Pine	seed	2, 4, 7, 9
Pinus radiata	Radiata Pine	seed	2, 4, 7
Family: Polygonaceae			
Emex australis	Doublegee	seed	1, 7
Family: Rosaceae			
Prunus amygdalus	Almond tree	seed	8

* Species is an Australian native, but not indigenous to south-west WA.