



## VEGETATION AND BLACK COCKATOO ASSESSMENT

LOT 123, MORTIMER RD.  
CASUARINA

Integrating Resource Management

Lot 123, Mortimer Rd, Casuarina. WA

**Vegetation and Black Cockatoo Assessment**  
Lot 123, Mortimer Rd. Casuarina. WA

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# 1. Introduction

## 1.1 Purpose of this Report

The owners of Lot 123 Mortimer Road, are seeking to develop their land into an urban estate. In order to achieve these development aspirations, and to conform to regulatory requirements for the development of land, Mr I. Yujnovich commissioned Bioscience Pty Ltd to conduct a Terrestrial Flora and Vegetation Survey. The report is to be part of the development's Environmental Impact Assessment Report.

There are two distinct purposes for this report. The first is to undertake work to meet the general requirements of EPA Guidance 51 to enable regulatory authorities to gauge the conservation value of the area. The second purpose is to assist with development of the land by identifying flora and vegetation complexes present and the vegetation condition.

## 1.2 Survey Area

Lot 123 Mortimer Road, Casuarina (32.235° S, 115.853° E) is 45ha of largely *Banksia-Eucalyptus* woodland situated approximately 35km south of Perth, and approximately 4.5 Km east of the Kwinana Town centre (Figure 1). It lies within the City of Kwinana and is surrounded by a mix of semi-rural and urban properties on its western, northern and eastern boundaries with Mortimer Road defining the southern boundary (Figure 2). An initial survey was carried out in 2008 but suspended. On a request by the owner a further modified survey and Black Cockatoo survey were carried out in 2015.

## 1.3 Site History and Previous Land Use

The property is privately owned by Mr I. Yujnovich and has remained largely undisturbed; consequently, it remains vegetated. The block has not been considered for protection under Bush Forever. In 2002 part of the northern section of the property was classified as a Conservation Category Wetland (CCW) under the Department of Environment's Wetland Classification guidelines.

## 1.4 Geomorphology and Geology and Hydrogeology

The site is located on Perth Coastal Plain within the Bassendean dune system, which is an area characterised by low dunes of siliceous sands, interspersed with poorly drained areas or wetlands. Soils tend to be a deep bleached grey colour sometimes with a pale yellow B-horizon or a weak iron-organic hardpan at depths generally greater than 2m. Generally, the area has a low relief with minor variations in topography.

The site itself has several dune formations which tend to be 24 to 30m AHD, with the exception of one dune on the south eastern corner of the property that has a height of

38m AHD (Figure 3). In addition, a wetland exists on the northern proportion of the property that is 16m AHD in height. Soil investigations occurred during the installation of five monitoring bores (MMB1 – MMB5) for wetland investigation and further installation of seven monitoring bores (MMB6 – MMB12) for site groundwater assessment (Figure 4).

Investigations revealed soils across the site were uniformly medium to coarse grading Bassendean sand. The surface soil at hole number 4 had a fairly extensive root mat, but otherwise organic content was fine humus.

Soil colour, as with topsoil depth was gradational from grey/white sand to the north through to yellow sand under sand hills to the south to the east. Minor ferruginous, weakly indurated layers were found at 1 m below the surface at MMB1 and MMB2. The groundwater level was found at 1.72 m below the surface at 16 m AHD in the northern wetland area, and over 20 m below the surface at 14.5 m AHD in the southern sandhills. The extensive monitoring shows that groundwater flow, inferred from the hydraulic gradient is from north to south.

The groundwater level was 1.72 meters from the surface at the closest. Whilst it is acknowledged that groundwater levels tend to reach a maximum in September/October (Davidson *op sit*), it must be noted that the winter of 2005 has been the wettest thus far for over 65 years, and variation between the minimum and maximum is typically 1 m. AAMGL was determined from six years of monitoring, and maximum groundwater inferred by reference to long term DoW monitoring bores. Which show a general decline of about 0.4 m in the last 25 years. Table 1 presents DoW long term bore T200(O) (Site ID: 61410107), which is the closest DoW bore being located approximately 1.2km north east of the site, as well as onsite monitoring data. T200(O) was selected to compare the site with due to its location having similar conditions to that of the site.

## 1.5 Climate

The climate is Mediterranean, with mild wet winters and hot dry summers. The nearest Bureau of Meteorology weather stations is Medina which is 5km west of the site, where the annual rainfall is 754.8 mm per annum (43 year dataset, 1972 to 2015). Evaporation is approximately 1,800 mm per year. As with the rest of the Perth region, the majority of rain falls between May and August, with November to March being very dry (Table 2).



## 2. Botanic Background

The South West of Western Australia possesses a flora which is so unique and diverse it is considered one of the planets' 34 biodiversity hotspots. The south-west of Western Australia is one of the richest but most threatened reservoirs of plant and animal life on earth. It is one of the most biologically diverse areas on Earth. It contains approximately 13,000 species of plants, of which 3,000 are yet to be formally named, and has a high level of endemism. There are over 700 Genera of plants, with more being discovered each year. The major Families present are Myrtaceae (over 807 species) Proteaceae (681 species) Papilionaceae (424 species) and Mimosaceae (398 species) (FloraBase).

It also has the highest concentration of rare and endangered species in Australia (Hopper and Gioia 2004). For these reasons, the South West of Australia Floristic Region (SWAFR) is valued socially, culturally, economically and ecologically, making it increasingly important to protect for future generations. The SWAFR has been listed by Conservation International as one of 34 Global Biodiversity Hotspots, by WWF as one of the Global 200 Ecoregions, and by BirdLife International as an Endemic Bird Area. Furthermore, it is one of only five globally significant Mediterranean-climate regions in the world and is considered a global Centre of Plant Diversity (WWF/IUCN) (WWF, 2010).

### 2.1 Swan Coastal Plain Flora

Within the South West Province, the Swan Coastal Plain is a sedimentary, generally low lying formation which extends for about 300 Km in a north south direction between the Darling Scarp and the Indian Ocean. The eastern side of the plain has soils composed of mostly alluvial clays washed from the escarpment, whereas the western side is predominantly aeolian and marine sands which have formed into dunes near coastal (Quindalup), middle (Spearwood) or further interior (Bassendean) areas. The variation of soil types has given rise to a range of habitats for the flora which has developed.

The site had been mapped as being Bassendean Sands. Bassendean sands are poorly sorted, white salicaceous sand in generally low dunes and according to (G, A et al. 1998) "support Jarrah *Eucalyptus marginata*, Prickly bark *Eucalyptus tottiana* Firewood *Banksia Banksia menziesii*, *Banksia attenuata*, and the sheoak *Allocasuarina fraseriana* and a diverse heath understory. Low-lying, permanently wet swamps and winter wet depressions, as well as stream banks, support low closed or open forests of Flooded gum *Eucalyptus rudis*, Moonah *Melaleuca*."



## 2.2 Floristic Community Types and Vegetation Complexes

The work of (Gibson 1994) adopts an approach to vegetation complexes which recognises that flora species occur in groups depending on environmental factors. By sampling 509 plots on publicly owned land containing different vegetation types in generally very good condition, this study divided the Swan Coastal Plain into four major groups based on the predominating geomorphological elements present. The four groups are the eastern edge of the Swan Coastal Plain (The Pinjarra Plain and Ridge Hill Shelf), the seasonal wetlands (which include a range of soil types and geomorphologies), the Bassendean Dunes, and the Spearwood and Quindalup Dunes mostly adjacent to the coast. Within these four groups, thirty major floristic community types were described, with some further refined by subdivision to give 43 total groups.

The approach of Gibson *et al* has some shortcomings in that it only considers the presence or absence of species in a vegetation unit, rather than their relative abundance. As such the method requires a complete list of all species at a site, irrespective of abundance or dominance. Given the seasonal nature of some ephemeral species, the approach requires detailed work over a number of seasons. However, it is very useful in assessing the conservation value of a particular site for the flora it contains by enabling comparisons to other areas and thereby determining how well represented such community types are in the conservation estate.

Vegetation complexes can be considered as broad ecosystems that contain a range of habitats depending on relief, aspect and local geomorphology. Previous mapping places the property in the Bassendean Vegetation Complex, South. According to (Gibson 1994) the Swan Coastal Plane has 30 defined floristic communities, of which only four are located within the Bassendean dune system. These four groups (i.e. 20 to 23) can be subdivided into nine different subgroups (i.e. 20a, 20b, 21a, 21b, 21c, 22, 23a, and 23b).

## 2.3 Previous Casuarina Studies

A site immediately north east of Lot 123 Mortimer Road has been preserved under Bush Forever (Site 273: Casuarina Prison Bushland). It has been described as possessing 3 floristic communities types as per Gibson *et al* 1994, firstly the *Melaleuca preissiana* damplands (type 4), secondly the Central *Banksia attenuata* – *Eucalyptus marginate* woodlands (type 21a), and finally the Central *Banksia attenuata* – *Banksia menziesii* woodland (type 23a). Site 273 was considered to be in excellent to pristine condition, and contained 104 native taxa four of which are significant (*Lysinema elegans*, *Burchardia bairdiae*, *Drosera gigantea* subsp. *Geniculata* and *Hensmania turbinate*).



### 3. Methodology and Limitations of the 2008 Survey

#### 3.1 Methods

Representative site locations were determined firstly by examination of aerial photographs, then by driving around the property, and finally by traverses on foot through each area of interest. Two different approaches were taken to undertake the survey.

Once the general locations of the different floristic communities were ascertained, quadrats of 10 x 10 m were selected and marked out by stakes in at least two separate areas for each major community type present. A complete inventory of flora species was recorded on the 5<sup>th</sup> of November 2008, three times between early spring and mid-summer in each quadrat. Size and percentage cover of each species were also recorded. Further brief visits were undertaken in late summer.

Transects involved two observers walking a parallel path about 40 m apart for about 100 m into the remnant bushland, then turning 90 degrees and walking apart for about 50 m, then turning another 90 degrees to complete another 100 m parallel to the original direction and returning to the origin. At each 20 m of the walk, each observer took brief notes of the vegetation structure and condition. Salient and/or indicative samples were collected by each observer. Observers compared notes at the completion of each transect. Further transects were walked for the purposes of determining vegetation condition, typically in smaller and more degraded areas.

#### 3.2 2008 Flora Survey

Specimens were collected from quadrats and transect to represent all species present (except for trees and larger species well known to the authors). Samples were split into two, with fresh sample stems placed in fresh water for subsequent photography and identification on the same or the next day. The remainder of the sample was pressed and dried for preservation and vouchering in the WA Herbarium.

Identification relied on the use of taxonomic keys, principally in (W.E and J 1978, G, A et al. 1998, A, S et al. 1999) and then by further reference and nomenclature updated using the WA Herbarium FloraBase.

#### 3.2 Limitations of the Flora Survey

The survey was restricted to the flowering plants in the survey areas, even though a number of fungi, mosses and lichens were observed (particularly in wetter areas).

Although a significant time was spent in the field, recording flora, the probability is that

some species of very restricted distribution or very small population size may have been missed. A number of native species only germinate and become abundant after fire, whereas no substantial fires had been experienced in the remnant vegetation for at least the last four years, thus such species may be present but were not recorded.

### 3.3 Limitations of the floristic community survey

Die-back caused by *Phytophthora cinnamomi* is prevalent in many areas throughout the site, particularly in Banksia and Jarrah woodlands. Because this fungus has a wide and diffuse host range amongst the flora of the Swan Coastal Plain, it may represent another selective pressure changing species presence, and thus obscuring the original community type present prior to development.

### 3.4 Details of Quadrats

Each quadrat was marked with permanent stakes at each corner and the precise location recorded by GPS and marked on the map (Figure 5).

### 3.5 Details of transects

One 100m transect was conducted in 2008, which was logged by GPS and is marked on the map on Figure 5.

## 4. Conservation Value

Despite extensive clearing for building, semi-rural and horticultural activities, large areas of Bush Protected native vegetation exist within 5km of the property remains (Figure 5), however they tend to be fragmented. The conservation value of flora and vegetation in any area can be assessed according to parameters including:

- The rarity of vegetation within the area.
- The diversity of vegetation communities and floristic types present.
- Whether the area falls within the accepted geographic range of the types of vegetation present, or is an extension of that range.
- The condition of the vegetation in the area.
- The diversity of the flora present.
- The presence of rare species (particularly Declared Rare Flora) or priority taxa, poorly known species, poorly protected species or geographically restricted species.
- Whether any species present are at the limits of, or outside their known range.

### 4.1 DPaW Declared Rare and Priority Flora

Prior to the surveys a desktop survey was carried out through NatureMap to build a species list and to find out what species categorised as Declared rare Flora and Priority were present near the site (Appendix 6). None of the species on the list were



found within the site under study, however because of the limitations of the survey, they cannot be excluded.

## 4.2 Regional and Local Significance

The ecological criteria for classifying regional and local significance have recently been summarised by DEC (June 2007) as part of the South West Biodiversity Projects (SWBP). Five headings are considered within Table 1 of this publication:

1. regional representation;
2. diversity;
3. rarity;
4. maintenance of ecological processes or natural systems - connectivity; and/or
5. protection of wetland, streamline, estuarine or coastal natural areas

The first heading refers to "regional representation" whereby, if the area is not already recognised as being of international, national or local value, it is considered in the context of Swan Coastal Plain Vegetation Systems as described by (Heddl. E.M. 1980) and how much of the original extent of such systems remain (as at 2015).

As described in Section 2.3, Lot 123 Mortimer Road was mapped by Heddl et al 1980 as Bassendean Complex, Central and South which although not strongly represented in the conservation estate, are otherwise in the unusual position of having 31% of pre-European settlement area remaining. As described in the Bush Forever Report (2000) this percentage had declined to approximately 24% of pre-European settlement area remaining, of which 13% has now been protected by Bush Forever legislation.

There are several surrounding properties are protected under Bush Forever, as can be seen in figure 5. Of particular significances are sites 270, 273 and 348 as they are within a 5km radius of Lot 123 Mortimer Road, and have very similar floristic community types and account for 560.3Ha of protection. Consequently, the site can be considered to be "regionally" well representative. In addition as the block was not considered for protection under Bush Forever, suggesting that its regional significance is relatively inconsequential.

The criteria of diversity and rarity both score poorly. Based on the species richness for the floristic community types described by Gibson et al, the floristic communities present have lost between 55 and 75% of the species which may have been originally present. None of the taxa found are considered rare or priority species.

## 5. Flora Survey Results

### 5.1 Description of Quadrats

#### Quadrat MR01

Location	6431530 N 50 392837E
Landform	Depression surrounded 100m to the south, east and west by a gentle sloping sand dune.
Soil Type	White surface and dark grey/black Bassendean Sands >150mm, 90% surface litter of leaves.
Vegetation	Open shrubland of <i>Astartea fascicularis</i> , <i>Pericalymma ellipticum</i> over sedgeland.
Condition	Good to very good
Fire Age	+ 7 years
Search Intensity	95% of flora recorded
Quadrat size/shape	10 x 10m

#### Quadrat MR02

Location	6430846N 50 392794E
Landform	Gentle south east sloping sand dune.
Soil Type	White medium to coarse surface and light grey Bassendean Sands >150mm, 95% surface litter of <i>Banksia</i> leaves.
Vegetation	Open woodland of <i>Banksia attenuate</i> , and <i>Banksia menziesii</i> over low shrubland, over sedgeland.
Condition	Poor to good
Fire Age	+ 7 years
Search Intensity	95% of flora recorded
Quadrat size/shape	10 x 10m

#### Quadrat MR03

Location	6431246N 50 392642E
Landform	Low lying valley
Soil Type	Moss covered dark peaty soil.
Vegetation	Open woodland of <i>Melaleuca raphiophylla</i> , <i>Eucalyptus marginate</i> , <i>Corymbia calophylla</i> and <i>Allocasuarina fraseriana</i> over shrubland over dense sedgeland.
Condition	Poor to good
Fire Age	≈ 5 years
Search Intensity	95% of flora recorded
Quadrat size/shape	10 x 10m

#### Quadrat MR04

Location	6431650N 50 392857E
Landform	Flat plain, 40m east of gentle rising sand dune.
Soil Type	White medium to coarse surface and grey/black Bassendean Sands >150mm, 5% bare soil surface.
Vegetation	Low open woodland of <i>Corymbia calophylla</i> , over open shrubland of <i>Pericalymma ellipticum</i> over open sedgeland.
Condition	Poor to good
Fire Age	+ 7 years



Search Intensity	90% of flora recorded
Quadrat size/shape	10 x 10m

#### Quadrat MR05

Location	6431480N 50 392710E
Landform	Swale with gentle slope to the south west.
Soil Type	White/creamy brown medium textured Bassendean Sands, with poorly developed humus layer.
Vegetation	Open woodland of <i>Banksia attenuate</i> , <i>Banksia menziesii</i> and <i>Banksia illicifolia</i> , over open low heath
Condition	Very good
Fire Age	≈ 5 years
Search Intensity	95% of flora recorded
Quadrat size/shape	10 x 10m

#### Quadrat MR06

Location	6430849N 50 392968E
Landform	Gently sloping east facing sand dune.
Soil Type	White/yellow Bassendean Sands, with surface litter of <i>Banksia</i> leaves.
Vegetation	Open woodland of <i>Eucalyptus marginate</i> , <i>Banksia attenuate</i> and <i>Banksia menziesii</i> over shrubland
Condition	Very good
Fire Age	+ 7 years
Search Intensity	95% of flora recorded
Quadrat size/shape	10 x 10m

## 5.2 Vegetation Survey Results

The concept of vegetation complexes for the Swan Coastal Plain was developed in the recognition that different vegetation types grow in soils with different geomorphic characteristics (Heddl, E.M. 1980) Vegetation complexes can be considered as broad ecosystems that contain a range of habitats depending on relief, aspect and local geomorphology. Gibson *et al* (1994) extended the previous work by Heddl *et al* (1980), by identifying 43 vegetation subtypes.

Of the 43 subtypes, 11 occur within the Bassendean system, and of these, three were represented within Lot 123 Mortimer Road.

1. Type 4 - *Melaleuca preissiana* damplands.
2. Type 21a - *Banksia attenuate* / *Eucalyptus marginata* woodlands.
3. Type 23a - Central *Banksia attenuata* / *Banksia menziesii* woodland

In general, the site is open *Banksia*-*Eucalyptus* woodland with *Banksia attenuata*, *Banksia menziesii* and, to a lesser extent, *Banksia illicifolia* the defining species

throughout. *Eucalyptus marginata*, *Eucalyptus tottiana* and *Corymbia calophylla* are also common, becoming more densely populated at greater elevation of type 21a. The overstorey of type 21c is noticeably dominated by *Allocasuarina fraseriana* however *B. attenuata*, and *Eucalyptus marginata* remain dominant. With the exception of type 4, areas differ mainly in the understorey - commonly dominated for example by *Hibbertia hypericoides*, *Eremaea pauciflora*, *Stirlingia latifolia* and/or *Conostylis aculeata*. Some areas within type 21a have considerable weed incursion (mainly *Ehrharta calycina*).

Low lying areas, or type 4 areas, are defined by a sparse *Melaleuca preissiana* overstorey with occasional *C. calophylla*, *X. preissii* and *Nuytsia floribunda*. The understorey of the CCW is dominated largely by shrub and herbaceous species common to damplands. Table 2 summarises the dominant vegetation in each area.

## 6. Vegetation Condition

### 6.1 Condition Scoring System Used

In Western Australia, particularly on the Swan Coastal Plain, vegetation condition reporting has become an important tool for judging the relative conservation value of bushland, particularly for areas being considered for either conservation or clearing to urbanization. The rationale is that biodiversity conservation is much harder in severely degraded bushland, but more easily and cost effectively implemented for bushland in good condition.

The first published condition rating method was by Trudgen in the early 1990's, who broke condition into 6 groupings, ranging from excellent to completely degraded, with intermediate grading of very good, good, poor and very poor.

Later Keighery, acknowledging Trudgen, modified the names and descriptions of the various divisions. This was adopted in the Bush Forever publications, and since 2000 has been widely cited. Accordingly, we have sought to rate vegetation condition objectively, using the same criteria adopted by Trudgen and by Keighery (Table 3).

The factors they mention which impact on condition are physical disturbance, pests and disease and weed invasion. Collectively these reduce "naturalness", reduce native biodiversity and promote the "unnatural selection" of hardy and robust taxa over more delicate and sensitive species.

Physical disturbances in Perth's bushland range from gross disturbance such as logging for timber (mostly of Jarrah), grazing, clearing for farming, filling, domestic gardening, digging of soaks and drains and for sand, and the dumping of rubbish. Sometimes past clearing is obscured by regrowth, however in the Bassendean sands areas; there is typically a dominance of pioneering species such as *Kunzea*



*glabrescens* or *Adenanthos obovatus* at levels of dominance not seen in undisturbed land. Grazing, depending on the livestock, typically selectively reduces the middle storey and succulent natives, leaving tuberous or spikey species.

The major disease is die-back, caused by *Phytophthora cinnamomi*. This fungus kills a wide range of native flora with about 50% of the Swan Coastal Plain flora susceptible. Devastation is worst in the jarrah forest flora of the Darling Scarp, however there are serious impacts in the Eucalyptus and Banksia woodlands of the Swan Coastal Plain. The parasite is best suited to wet, but not anaerobic soils which are somewhat acidic. Accordingly, disease impact is least on the waterlogged anaerobic soils of wetlands, and the neutral to alkaline Quindalup and Spearwood sands whereas impacts are greatest on the acidic Bassendean sands.

Pests are most commonly rabbits which are selective feeders on more succulent plants, and can create substantial ground disturbance by building substantial burrows.

Weeds are plants which are not native to the area (being introduced from overseas or from other Australian botanic provenances), and by virtue of their biology and/or the absence of natural controls, are well adapted to local conditions and thrive at the expense of native flora. Impacts on native flora can be either because of the very robust and aggressive growth rate choking other plants, or by active inhibition of competing plants (allelopathy).

## 6.2 Disturbances and Condition Reporting at Mortimer Road

In general the bushland is in quite good condition. Weed incursions have been largely restricted to the southern end of the property and along the edges of tracks and boundaries. There has also been some disturbance associated with the dumping of rubbish and/or vehicles. Fires do not appear to have been very regular.

Within the CCW *M. preissiana* are sparse and older trees appear to be stressed. Little or no regeneration of the species appears to have occurred in recent years. There is also some evidence that *C. calophylla* is encroaching on the area and this may indicate a period of reduced water table levels.

## 7. 2015 Vegetation survey

A further survey was carried out in September 2015, on the request of the owner. This was a modified brief survey which involved three ecologists walking along a transect through the site, recording large trees for a Black cockatoo survey and recording species of plants as they walked. The survey aimed to include all of the vegetation types described in the 2008 study.

Prior to the 2015 survey FloraBase and NatureBase desktop surveys were carried out to determine any priority species in the area. The results are included in Appendix 6.

### 7.1 Limitations of the Flora Survey

The survey was restricted to the flowering plants in the survey areas, even though a number of fungi, mosses and lichens were observed (particularly in wetter areas).

Due to time constraints, less time was spent in the field than was ideal. It is therefore likely that some species of very restricted distribution or very small population size may have been missed. A number of ephemeral species and species which had either already flowered or were not in flower may also have been overlooked.

### 7.2 Vegetation Survey Results

The flora list produced in 2008 was used as a checklist for species and plants that had already been identified on the site were simply marked as being present (Appendix 2). New species were added to the list and any unknown species were photographed for later identification.

In all 12 new species were added to the original list (Appendix 2). In addition the survey highlighted an area which could not be described by any of the three originally surveyed vegetation Complexes. It was therefore decided that a separate complex needed to be added:

Type 22 - *Banksia illicifolia* woodlands

### 7.3 Vegetation Condition

The vegetation was in very good to excellent condition overall (Keighery, Gibson et al. 2007). Some areas had been invaded by weeds, but this was generally limited to areas adjacent to fire breaks. The worst weed invasions were on the perimeter track, but there were some areas on the lateral tracks which were also affected. The main invasive weeds were *Ehrharta calycina* and *Briza* sp. but *Watsonia meriana* and *Zantedeschia aethiopica* were also noted in the bushland, as individual plants.

## 8. Black Cockatoo Survey

The requirements of the survey are to assess potential breeding and feeding habitat on the site.



## 8.1 Methodology

The habitat assessment for black cockatoos was carried out in accordance with the EPBC Act referral guidelines for the three threatened black cockatoo species (SEWPaC 2012). An experienced ecologist carried out a systematic and thorough search of the site on the 3rd July 2015.

The assessment of foraging habitat was based on the EBPC Act Environmental Offset Policy 2012, which incorporates a general guide to offset assessment including broad criteria for determining habitat quality, based on the broad site characteristics, site condition and site context. A set of specific criteria relevant to Black Cockatoo foraging habitat quality were compiled for the field assessment and used as a basis for mapping habitat quality. The habitat quality was assessed for each habitat type within the project area. Appendix 3 shows the criteria and scoring method used. Habitat quality was assessed, based on the combined score of all the criteria total scores (where: 0-5 = low, 6-10 = moderate, 11 - 15 = good, 16 - 21 = excellent).

All Jarrah (*Eucalyptus Marginata*) and Marri (*Corymbia calophylla*) trees with diameter at breast height of greater than 50 cm were recorded as waypoint locations (i.e. by use of GPS) along with other relevant tree data such as presence of potential hollows (Appendix 5). Evidence of cockatoo foraging activity, or individuals observed, was also recorded across the site. Other potential habitat trees found in the area were also assessed, including *Eucalyptus tottiana* (Prickly bark) and *Eucalyptus gomphocephala* (Tuart)

## 8.2 Results

### 8.2.1 Black Cockatoo (Great) Assessment

The majority of the site was uncleared, and the large trees and shrubs that were present were native (Appendix 3). The majority of the trees present were Banksias, mainly, *Banksia menziesii*, *Banksia attenuata* and *Banksia illicifolia*. There were also some large *Eucalyptus marginata*, *Corymbia calophylla* and *Eucalyptus gomphocephala*. One area described as a CCW Dampland had large *Melaleuca preissiana* present, but were in poor condition. There was a great deal of seedling recruitment on the property, mainly banksias but also some of the eucalypts and to a very minor extent the melaleucas.

### 8.2.2 Black Cockatoo (Lesser) Assessment

Although no Black cockatoos were present during the most recent site visit, their calls were noted during the transect. The majority of the site contains species of plant

which are known to provide foraging for black cockatoo species, in particular the Baudin's Cockatoo, which feeds on a wide variety of shrubs and trees.

Thirty-two trees were identified as potential breeding trees (trees with a diameter at breast height of greater than 50 cm) across the site (Appendix 5). The trees recorded were Jarrah (*Eucalyptus marginata*), Marri (*Corymbia calophylla*) and Tuart (*Eucalyptus gomphocephala*).

### 8.3 Discussion

The site contains 32 trees assessed as potential breeding trees for Carnaby's Black Cockatoo in reference to the definition in the referral guidelines (SEWPaC 2012). All of these trees contained potential nesting hollows or hollows forming. It should be noted that in assessing potential breeding habitat for black cockatoos, the tree diameter measurement is recognized as a reliable and precise measurement, whereas the visual detection of actual hollows is known to be unreliable, particularly via ground based assessment. However, SEWPaC considers that all trees with diameter at breast height greater than 50 cm have the potential to form hollows suitable for cockatoo nesting. This takes into consideration medium term changes in breeding patterns of Black Cockatoo (SEWPaC 2012).

The majority of the potential breeding trees were Marri and Jarrah trees. Marri trees are considered to be a preferred breeding tree species for Forrest red tailed cockatoos based on recorded usage. Very little is known about Baudin's Black-Cockatoo breeding biology, such as its breeding range, timing of nesting events, nest tree and nest hollow characteristics, clutch size, incubation period, fledging period and nesting success (Johnstone; and Storr; 1998) as the nests are extremely difficult to locate. Most characteristics of the species' biology are inferred from Carnaby's Black-Cockatoo. There are several records of Carnaby's Black Cockatoo breeding within Marri trees (Johnstone, Kirby et al. 2013). There is anecdotal evidence of Carnaby's Black Cockatoo nesting in Jarrah hollows. Based on documented breeding occurrences, Jarrah trees are considered to be a less frequently used tree species for breeding. All of the three cockatoo species are found in the vicinity as part of their natural range (Figures 4-6).

The Forrest Red Tail, Baudin's and Carnaby's cockatoo are all commonly spotted species in the area.

Overall, Marri (*Corymbia calophylla*) is the primary food source with the Baudin's