

**LOT 3 BULLER ROAD WAROONA**

**LEVEL 1 FLORA AND VEGETATION SURVEY**  
**FOR JACKSON BLOCK**

PREPARED FOR:

**KD.1 PTY LTD**



JUNE 2015

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## LOT 3 BULLER ROAD WAROONA LEVEL 1 FLORA SURVEY - JACKSON BLOCK

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## EXECUTIVE SUMMARY

A Level 1 Flora and Vegetation survey of approximately 36.8 ha on Lot 3 Buller Road in Waroona, known as the Jackson Block Survey Area, was undertaken in May 2015. It comprised a desktop assessment and reconnaissance site survey.

Key findings of the desktop assessment were:

- The survey area is located on Bassendean dunes, within the Swan Coastal Plain Bioregion and Northern Jarrah Forest Subregion.
- The survey area falls within Beard Vegetation Association 1000 (Beard 1981) described as a mosaic of medium forest; Jarrah – Marri / low woodland; Banksia / Low Forest; tea tree (*Melaleuca* spp.), with approximately 24.6% remaining of the pre-European extent.
- The survey area falls within Southern River Vegetation Complex (Hedde et al. 1980) described as open woodland of *Corymbia calophylla* – *Eucalyptus marginata* – *Banksia* species with fringing woodland of *Eucalyptus rudis* – *Melaleuca raphiophylla* along creek beds, with approximately 19.69% remaining of the pre-European extent.
- 12 Threatened and 25 Priority flora species have been recorded within 10 km of the survey area, however none within the actual survey area.
- Database search found no Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) within the survey area, however some TECs and PECs have been recorded within 10 km of the survey area.
- There are no Environmentally Sensitive Areas (ESAs) within the survey area, however there are two within the remainder of Lot 3 associated with wetlands. Non-ESA part of one of these wetlands extends to the northwest corner of the survey area.
- Buller Nature Reserve is located approximately 300 m southwest of the survey area and there is a recognised ecological linkage running through both areas.

Key findings of the reconnaissance site survey were following:

- A total of 83 vascular plant taxa, including 17 introduced taxa, were recorded within the survey area. The number is likely to be an underestimate due to the timing of the survey.
- No Threatened or Priority flora species were recorded within the survey area, however the timing of the survey outside the main flowering season was not ideal for observing the listed species.
- Two of the weed species were Declared Plants, \**Gomphocarpus fruticosus* (Narrow-leaf Cottonbush) and \**Zantedeschia aethiopica* (Arum Lily).
- Two vegetation units were identified and described as follows:
  - Low Woodland of *Corymbia calophylla*, *Eucalyptus marginata*, *Banksia* spp. and *Allocasuarina fraseriana* over a Low Open Shrubland dominated by *Hibbertia hypericoides* over a Grassland of native and introduced species on very low relief sand dunes.
  - Thicket of *Kunzea ericifolia*, *Melaleuca preissiana* and *Melaleuca raphiophylla*, over Open Low Shrubland of *Astartea ?scoparia* and *Adenanthos meisneri* over bare ground in lower ground associated with a sumpland.
- Neither of the vegetation units is a TEC or a PEC.
- Vegetation condition in the survey area varied from Completely Degraded to Very Good.

The main constraints to clearing of vegetation identified in this survey relate to the proximity of ESAs, Buller Nature Reserve and wetlands to the survey area, as well as the low level of the pre-European extent of the vegetation complex remaining.

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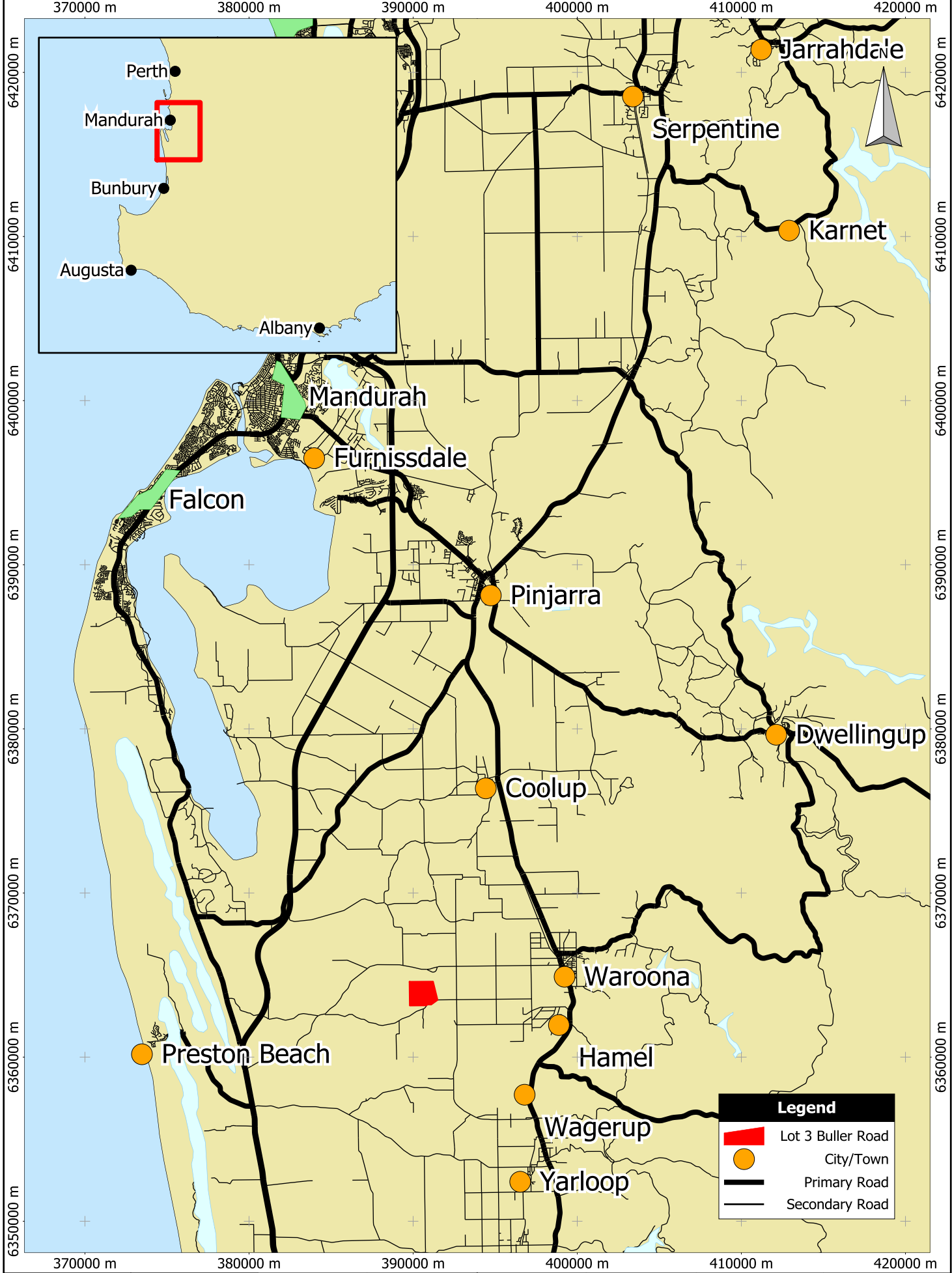
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Appendix 1:	Conservation Codes for Flora and Ecological Communities
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# 1. INTRODUCTION


MBS Environmental was engaged by KD.1 Pty Ltd (KD.1) to undertake a Level 1 Flora and Vegetation Survey of the Jackson Block Survey Area located in the southeast corner of Lot 3 (Diagram 35920) Buller Road in Waroona, approximately 100 km south of Perth (Figure 1 and Figure 2). The Jackson Block Survey Area covered approximately 36.8 ha of the total Lot 3 size of 220 ha and included previous sand extraction areas of varying degrees of rehabilitation. The Level 1 Flora and Vegetation Survey involved two main components: a desktop assessment to collect background information on flora and vegetation of the target area and a reconnaissance site visit to verify the accuracy of the desktop assessment and delineate and characterise the flora and range of vegetation units present. The findings of the survey area presented in this report and are expected to be used for the planning of future sand extraction and associated approval processes.



**Legend**

-  Lot 3 Buller Road
-  City/Town
-  Primary Road
-  Secondary Road

Scale: 1:300000  
 Original Size: A4  
 Grid: MGA94(50)



KD.1 Pty Ltd  
 Lot 3 Buller Road Waroona  
 Level 1 Flora Survey -  
 Jackson Block

**Figure 1**

**Location Plan**



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**Legend**

-  Lot 3 property boundary
-  Jackson survey area

Scale: 1:10000  
 Original Size: A4  
 Air Photo Date: February 2015  
 Grid: Australia MGA94 (50)

0 300 m

KD.1 Pty Ltd  
 Lot 3 Buller Road Waroona  
 Level 1 Flora Survey -  
 Jackson Block

**Figure 2**

**Jackson Block Survey Area**

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## 2. METHODS

### 2.1 DESKTOP ASSESSMENT

The desktop assessment was undertaken using NatureMap (DPaW 2007-) and the EPBC Protected Matters Search Tool (Department of the Environment 2015) to identify native flora including threatened and priority flora species previously recorded within 10 km radius of the Jackson Block Survey Area. Central search coordinates used were 115° 50' 58" E, 32° 51' 39" S. FloraBase (Western Australian Herbarium 1998-) was also used to obtain information on relevant species. A search of Threatened and Priority Ecological Communities database was also commissioned with DPaW using a 10 km radius around central location on Lot 3 Buller Road (115° 49' 50" E, 32° 51' 39" S). Other publicly available databases were also reviewed to obtain background information on the site, including WA Atlas (Landgate 2015) and Natural Resource Management portal (Department of Agriculture and Food 2015).

Previously prepared species list for Lot 3 Buller Road was reviewed and the public domain searched for any other flora and vegetation surveys undertaken in the general area.

### 2.2 RECONNAISSANCE SITE SURVEY

The Level 1 reconnaissance site survey of the Jackson Block area was undertaken by one Senior Environmental Scientist (Kirsi Kauhanen) from MBS Environmental on 5 May 2015. An additional site visit was also undertaken on 12 May 2015 to retake photographs lost due to equipment failure. The field survey was conducted according to standards set out in Guidance Statement 51 (Environmental Protection Authority 2004) apart from the timing of the survey in autumn not being consistent with the recommended spring survey season for the southwest. The survey was undertaken with landowners' approval and the Senior Environmental Scientist held a valid DPaW licence to collect flora for scientific purposes (SL011377), issued under the *Wildlife Conservation Act 1950*.

The reconnaissance site survey involved traversing the survey area on foot to verify the accuracy of the desktop assessment, as well as to delineate and characterise the flora and range of vegetation units present. Five 10 by 10 m quadrats were surveyed recording GPS location, topography, soil type and colour, signs of previous disturbance, and plant species present and their average height and percentage cover. Photographs were taken of the quadrat sites and of additional photo points across the site. Opportunistic observations of the species present, vegetation type and condition were also made outside the quadrats. Plant samples were taken where necessary to assist with species identification.

### 2.3 DATA ANALYSIS

A species list for the Jackson Block Survey Area was compiled on the basis of data from quadrats and opportunistic observations. Nomenclature of the species recorded is in accordance with the Western Australian Herbarium 1998-).

Vegetation units were described based on findings of the desktop assessment, percentage cover data, observational data and the structural forms of Australian vegetation defined by Beard (1990) and presented in Table 1. Mapping of the vegetation units was undertaken using an aerial photograph of the Jackson Block Survey Area from February 2015 obtained from Landgate.

**Table 1: Definition of Structural Forms of Australian Vegetation (Beard 1990)**

Growth-Form of Tallest Stratum	Foliage Cover of Tallest Stratum		
	30-70%	10-30%	Less than 10%
Tall Trees (greater than 30m)	Tall Forest	Tall Woodland	Open Tall Forest
Medium Trees (10 – 30 m)	Forest	Woodland	Open Woodland
Low Trees (less than 10 m)	Low Forest	Low Woodland	Open Low Woodland
Tall Shrubs (greater than 2 m)	Thicket	Scrub	Open Scrub
Low Shrubs (less than 2 m)	Heath	Low Shrubland	Open Low Shrubland
Grassland (less than 1 m)	Closed Bunch Grassland	Open Bunch Grassland	Hummock Grassland

Assessment of vegetation condition and associated mapping was undertaken on the basis of observational data from the field survey and disturbances visible on the 2015 aerial photograph, using the Keighery (1994) Bushland Condition Scale presented in Table 2.

**Table 2: Keighery Bushland Condition Scale**

Condition	Description
Pristine	No obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance only affecting individual species and weeds are nonaggressive species.
Very Good	Vegetation structure altered, obvious signs of disturbance e.g. repeated fires, aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure altered, obvious signs of disturbance. Retains basic vegetation structure or ability to regenerate it. The presence of very aggressive weeds at high density, partial clearing, dieback, logging and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Requires intensive management. The presence of very aggressive weeds at high density, partial clearing, dieback, logging and grazing.
Completely Degraded	Vegetation structure is no longer intact and the area is completely or almost completely without native flora. 'Parkland Cleared'.

## 2.4 SURVEY LIMITATIONS AND CONSTRAINTS

An assessment of survey limitations is presented in Table 3. The main constraint was the timing of the survey in autumn that limited the proportion of flora that could be collected and identified. This is not likely to have impacted on the descriptions of vegetation units produced, but is likely to have impacted on the completeness and accuracy of the species list and ability to detect certain annual and cryptic species. The timing of the survey would not have impacted on the assessment of vegetation condition, other than through reduced weed cover.

**Table 3: Survey Limitations for Jackson Block Level 1 Flora Survey**

Potential Limitations	Comments
Sources of information and availability of contextual information.	Not a constraint – Adequate information was available on publicly available databases or obtained from DPaW.
Timing, weather, season, cycle.	Significant constraint – The survey was conducted in May, during autumn season whilst the preferred survey season in the southwest is the main flowering time, spring. A number of specimens collected were unidentifiable to species level due to a lack of flowering and/or fruiting material. Many annual species were only starting to emerge. The survey season was also not favourable for capturing cryptic species (such as orchids). The data available allows accurate descriptions of the vegetation units, however the species list is likely incomplete.
Proportion of flora collected and identified (based on sampling, timing and intensity).	Moderate constraint – The timing of the survey impacted on the proportion of flora collected with annuals and cryptic species (such as orchids). The timing of the survey also impacted on the proportion of flora identified as many specimens could not be identified due to lack of flowering and fruiting material and in some cases very juvenile form of growth. The data available allows accurate descriptions of the vegetation units, however the species list is likely incomplete.
Completeness (i.e. was the relevant survey area fully surveyed).	Not a constraint – Sufficient area was covered to satisfy the Level 1 survey.
Disturbances (fire, flood, accidental human intervention, etc.).	Minor constraint – No recent natural disturbances (e.g. fire or flood) were encountered in the survey, but there was evidence of human disturbance including historical clearing and burning, sand extraction, tracks, and camp site (?) with rubbish. Heavy grazing by kangaroos was evident and disturbance by wild pigs was also recorded.
Intensity	Not a constraint – The survey intensity is considered to have been sufficient for a Level 1 survey.
Resources	Not a constraint – Resources available, in terms of time, equipment, support and personnel were adequate to undertake and complete the survey.
Access problems	Not a constraint – The survey area was easily accessible.
Experience levels	Not a constraint – Appropriate levels of ecological, botanical and taxonomic expertise were available for the project. The consultant had previous survey experience on the Swan Coastal Plain. Additional botanical expertise was available at MBS Environmental and Western Australian State Herbarium would have been available for additional reference and potential identifications.

### 3. DESKTOP SURVEY RESULTS

#### 3.1 CLIMATE

Jackson Block Survey Area is located in a Mediterranean zone and experiences hot dry summers and mild wet winters. The closest weather station with long term rainfall dataset is Yarloop (station number 009624), located approximately 11.5 km to the southeast of the survey area. The closest weather station with long term temperature dataset is Dwellingup (station number 009538), located approximately 27 km northeast of the survey area. The average annual rainfall in Yarloop is 980.9 mm. Mean maximum temperature in Dwellingup in January is 29.7 °C and mean minimum temperature in July 15.0 °C. Average long term rainfall and temperature data, as well as data from the year preceding the survey is presented in Chart 1.

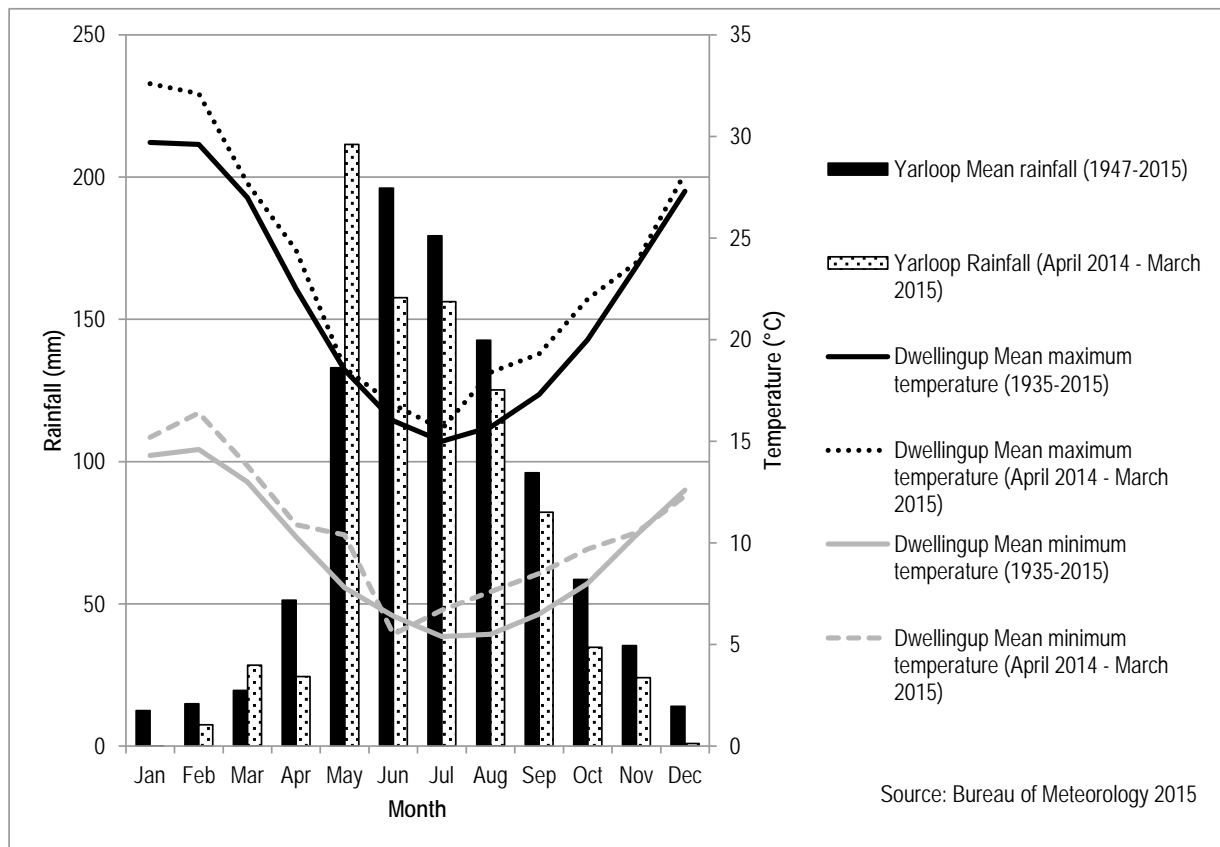


Chart 1: Nearest Climatic Data to Jackson Block Survey Area

#### 3.2 SOILS AND TOPOGRAPHY

The Jackson Block Survey Area is located on Bassendean dunes within the Swan Coastal Plain. The map unit 'Bassendean B2 Phase' has been described as "extremely to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or weak iron-organic hard pan at depths generally greater than 2 m" (Department of Agriculture and Food 2015).

The landform within the Jackson Block Survey Area ranges from 24 mAHD on top of a sand rise in the southwest part of the area to approximately 15.5 mAHD within some of the old extraction areas.

### 3.3 HYDROLOGY

The Jackson Block Survey Area is located with Harvey River Catchment, with the western portion of the area draining towards Harvey Main Drain and the eastern portion towards Samson Drain (Department of Water 2015). The area falls within the Peel-Harvey Estuary catchment area, subject to various policies and plans including the Environmental Protection (Peel-Harvey Estuary) Policy 1992, with potential implications on clearing of vegetation.

### 3.4 REGIONAL VEGETATION

The Jackson Block Survey Area is located within the Swan Coastal Plain (SWA) Biogeographical Region (Bioregion) and more specifically within the Perth (SWA02) Subregion (Commonwealth of Australia 2012). The Swan Coastal Plain is characterised by a low-lying coastal plain, mainly covered by woodlands.

Beard Vegetation Association 1000 covers the entire Jackson Block Survey Area and is described as a mosaic of medium forest; Jarrah – Marri / Low Woodland; Banksia / Low Forest; tea tree (*Melaleuca* spp.) (Beard 1981). Shepherd et al. (2001) estimated that approximately 24.6% of the pre-European extent of the vegetation association remained in Western Australia.

According to Hedde et al. (1980), only the Southern River Vegetation Complex occurs within the Jackson Block Survey Area. The complex is described as open woodland of *Corymbia calophylla* – *Eucalyptus marginata* – *Banksia* species with fringing woodland of *Eucalyptus rudis* – *Melaleuca raphiophylla* along creek beds. It is estimated that 19.69 % of the pre-European (pre-1750) extent of the vegetation complex remains within Swan Coastal Plain (Local Biodiversity Program 2013), and 29.21% within Shire of Waroona (Local Biodiversity Program 2010). National Objectives and Targets for Biodiversity Conservation has a target to prevent clearance of ecological communities with an extent below 30% of that present pre-1750 (Commonwealth of Australia 2001)

Gibson et al. (1994) divided the Swan Coastal Plain into small to medium areas on the basis of groups of plants that occur together. These Floristic Community Types (FCTs) are used to define Threatened Ecological Communities (TECs) on the Swan Coastal Plain. The extent of an FCT is not mapped in the same way as vegetation complexes, thus their presence cannot be determined by a desktop assessment. FCT classification is generally inferred by statistically analysing the results of quadrats recorded during a field survey.

### 3.5 AREAS OF CONSERVATION SIGNIFICANCE

No Environmentally Sensitive Areas (ESAs) are located within the Jackson Block Survey Area. However, there are two ESAs within Lot 3 Buller Road, both associated with Conservation Category wetlands. The closest one of these is located approximately 90 m to the west of the Jackson Block Survey Area boundary and the second one approximately 235 m to the northwest. Wetland (UFI 4801 and UFI 5004) associated with the closest ESA extends to the northwest corner of the survey area as presented in Figure 3. There are no EPP listed wetlands on Lot 3 Buller Road, however there are some on neighbouring properties, with the closest one located approximately 800 m to the north of the Jackson Block Survey Area. The Peel-Yalgorup System (Ramsar Wetland) is also located within 10 km.

Buller Nature Reserve (R22199) is located approximately 300 m to the southwest of the Jackson Block Survey Area. The Buller Road Nature Reserve and remnant vegetation on Lot 3 and surrounding properties form part of a north-south ecological linkage mapped as part of the South West Regional Ecological Linkages project (WALGA 2009).

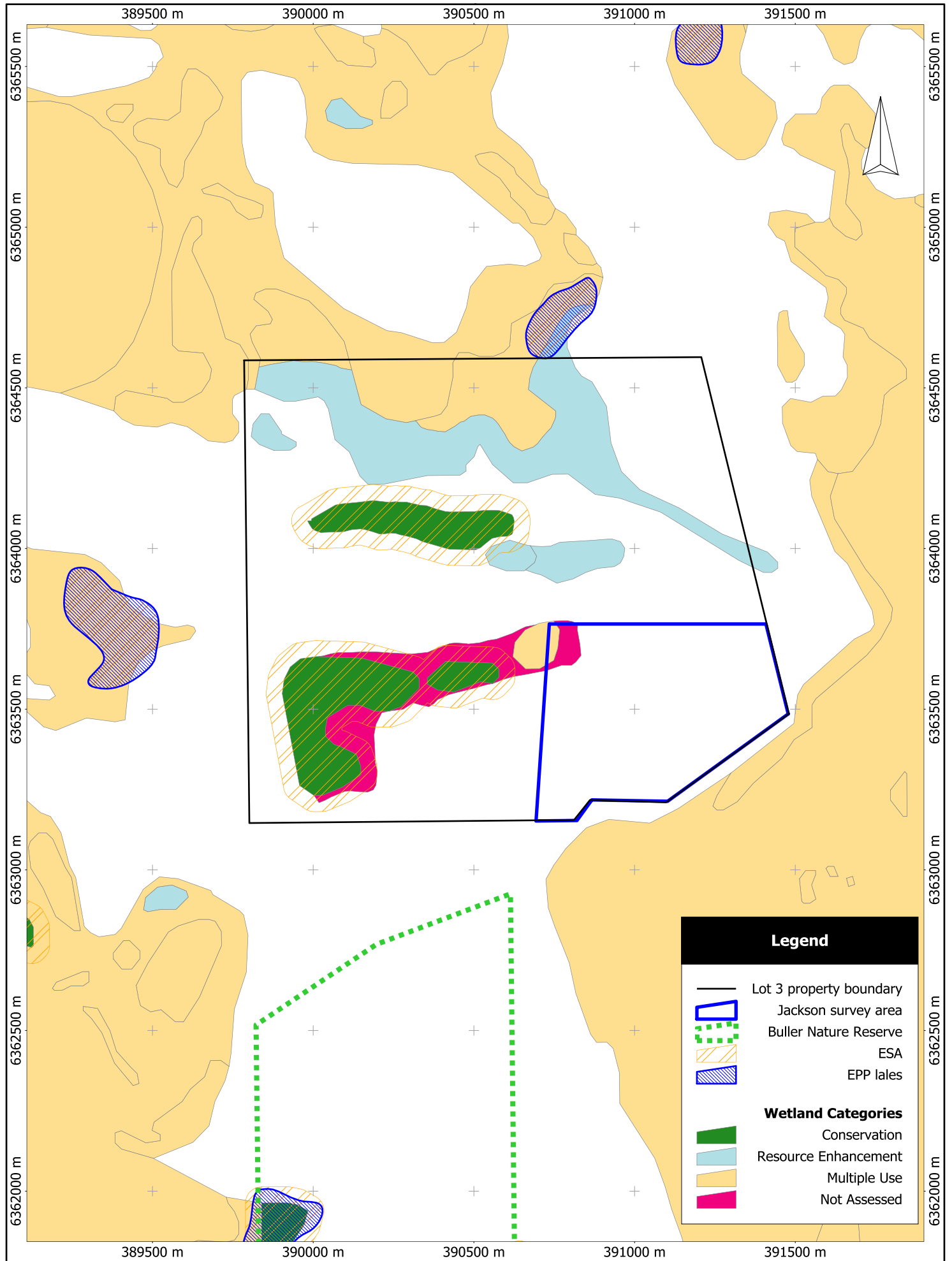
### 3.6 PREVIOUS SURVEYS

A list of species recorded on Lot 3 has been produced in the past, however the date and author of this survey remain unknown and no details are available on methods. No other previous surveys of Lot 3 are known.



Flora and vegetation surveys have been undertaken on some of the surrounding properties, however only limited information about these surveys is available in the public domain. NatureMap appears to provide the best source of information on species potentially occurring in the general area.

Clearing Permit Decision Report for a permit application 805/1 made in 2005, approximately covering the survey area, provides background information on the site and previous assessment of environmental constraints to clearing.



Legend	
	Lot 3 property boundary
	Jackson survey area
	Buller Nature Reserve
	ESA
	EPP laes
<b>Wetland Categories</b>	
	Conservation
	Resource Enhancement
	Multiple Use
	Not Assessed

Scale: 1:15000  
 Original Size: A4  
 Grid: Australia MGA94 (50)

KD.1 Pty Ltd  
 Lot 3 Buller Road Waroona  
 Level 1 Flora Survey -  
 Jackson Block

**Figure 3**  
**Areas of Conservation Significance**

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### 3.7 THREATENED AND PRIORITY FLORA

Searches of the NatureMap and EPBC Protected Matters Database using a 10 km buffer identified 37 Threatened and Priority flora species, including 12 Threatened, 2 Priority 1, 5 Priority 2, 10 Priority 3 and 8 Priority 4 species. The various conservation categories are described in Appendix 1. The species from the database searches are listed and described in Table 4. Five of the 37 species are aquatic species and no suitable habitat is available for these species within the Jackson Block Survey Area. Many of the other 32 species are associated with winter-wet areas, and the Jackson Block Survey Area provides at best marginal habitat for these species in form of a small area of fringing vegetation in the northwest corner of the area. Assessment of habitat availability within Jackson Block Survey Area is included in Table 4.

Eight of the species, as identified in Table 4, came up only in the EPBC Protected Matters Database search and not in the NatureMap search despite both searches using the same search area. Review of these species in NatureMap indicated that the closest records were much further than 10 km away. This could be due to previous observations in the EPBC Protected Matters Database being recorded with a buffer around them. The likelihood of finding these species in the survey area is low.

**Table 4: Threatened and Priority Flora Occurring within 10 km of the Jackson Block Survey Area**

Species	Federal Listing	State Listing	Description	Required Habitat	Habitat Availability within Jackson Block
<i>Andersonia gracilis</i> (Slender Andersonia) <sup>1</sup>	En	T	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple, Sep to Nov.	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Marginal, northwest corner.
<i>Caladenia huegelii</i> (Grand Spider Orchid)	En	T	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct.	Grey or brown sand, clay loam.	Yes.
<i>Darwinia foetida</i> (Muechea Bell) <sup>1</sup>	CE	T	Compact, perennial shrub, up to 0.5 m high. Fl. green/red.	Grey sand. Winter wet areas.	Marginal, northwest corner.
<i>Diuris micrantha</i> (Dwarf Bee-orchid) <sup>1</sup>	Vu	T	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct.	Brown loamy clay. Winter-wet swamps, in shallow water.	Marginal, northwest corner.
<i>Diuris purdiei</i> (Purdie's Donkey Orchid)	En	T	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct.	Grey-black sand, moist. Winter-wet swamps.	Marginal, northwest corner.
<i>Drakaea elastica</i> (Glossy-leafed Hammer-orchid) <sup>1</sup>	En	T	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red & green & yellow, Oct to Nov.	White or grey sand. Low-lying situations adjoining winter-wet swamps.	Marginal, northwest corner.
<i>Drakaea micrantha</i> (Dwarf Hammer-orchid) <sup>1</sup>	Vu	T	Tuberous, perennial, herb, 0.15-0.3 m high. Fl. red & yellow, Sep to Oct.	White-grey sand.	Yes.

Species	Federal Listing	State Listing	Description	Required Habitat	Habitat Availability within Jackson Block
<i>Eleocharis keigherey</i>	Vu	T	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. green, Aug to Nov.	Clay, sandy loam. Emergent in freshwater: creeks, claypans.	None.
<i>Eucalyptus x balanites</i> (Cadda Road Mallee) <sup>1</sup>	En	T	Mallee, to 5 m high, bark rough, flaky. Fl. white, Oct to Dec or Jan to Feb.	Sandy soils with lateritic gravel.	None.
<i>Lambertia echinata</i> subsp. <i>occidentalis</i> (Western Prickly Honeysuckle) <sup>1</sup>	En	T	Prickly, much-branched, non-lignotuberous shrub, to 3 m high. Fl. yellow, Feb or Apr or Dec.	White sandy soils over laterite, orange/brown-red clay over ironstone. Flats to foothills, winter-wet sites.	Marginal.
<i>Synaphea</i> sp. Fairbridge Farm (D.Papenfus 696) <sup>1</sup>	CE	T	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Fl. yellow, Oct.	Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	Marginal.
<i>Synaphea stenoloba</i> (Dwellingup Synaphea)	En	T	Caespitose shrub, 0.3-0.45 m high. Fl. yellow, Aug to Oct.	Sandy or sandy clay soils. Winter-wet flats, granite.	Marginal, northwest corner.
<i>Grevillea bipinnatifida</i> subsp. <i>pagna</i>	-	P1	Prostrate, lignotuberous shrub, 0.2-0.7 m high. Fl. red & orange & yellow, Aug or Oct to Nov.	Grey sandy clay and loam, ironstone. Seasonal wetlands, swamps, roadsides.	Marginal, northwest corner.
<i>Synaphea odocoileops</i>	-	P1	Tufted, compact shrub, 0.2-0.5 m high. Fl. yellow, Aug to Oct.	Brown-orange loam & sandy clay, granite. Swamps, winter-wet areas.	Marginal, northwest corner.
<i>Gastrolobium</i> sp. Harvey (G.J. Keighery 16821)	-	P2	Erect, scrambling or twining shrub, to 2 m high. Fl. orange-yellow-red, Sep.	Black peaty sandy clay, brown sandy clay. Winter-wet flats, margins of billabongs.	Marginal, northwest corner.
<i>Melaleuca viminalis</i>	-	P2	Slender, erect shrub, 1-2 m high. Fl. red.	Sandy clay. Flat areas, drainage lines.	Marginal, northwest corner.
<i>Phyllangium palustre</i>	-	P2	Erect, succulent annual, herb, ca 0.02 m high. Fl. white, Oct to Nov.	Clay. Winter-wet claypans, low-lying seasonal wetlands.	None.
<i>Pterostylis frenchii</i>	-	P2	Tuberous, herb, to 0.35 m high, with rosette leaves.	Calcareous sand with limestone, laterite. Flatlands and gentle slopes.	Yes.

Species	Federal Listing	State Listing	Description	Required Habitat	Habitat Availability within Jackson Block
<i>Trichocline</i> sp. Treeton (B.J. Keighery & N. Gibson 564)	-	P2	Tuberous, perennial, herb, to 1.6 m high.	Sand over limestone, sandy clay over ironstone. Seasonally wet flats.	Marginal, northwest corner.
<i>Angianthus drummondii</i>	-	P3	Erect annual, herb, to 0.1 m high. Fl. yellow, Oct to Dec.	Grey or brown clay soils, ironstone. Seasonally wet flats.	Marginal, northwest corner.
<i>Boronia capitata</i> subsp. <i>gracilis</i>	-	P3	Slender shrub, 0.3-0.6(-3) m high, branches pilose. Fl. pink, Jun to Nov.	White/grey or black sand. Winter-wet swamps, hillslopes.	Marginal, northwest corner.
<i>Carex tereticaulis</i>	-	P3	Monoecious, rhizomatous, tufted perennial, grass-like or herb (sedge), 0.7 m high. Fl. brown, Sep to Oct.	Black peaty sand.	Marginal, northwest corner.
<i>Eryngium</i> sp. Ferox (G.J. Keighery 16034)	-	P3	Tuberous, perennial herb, up to 0.3m high. Fl. green / metallic blue.	Grey clay. Winter wet sites.	Marginal, northwest corner.
<i>Hemigenia microphylla</i>	-	P3	Slender shrub, 0.4-1.8 m high. Fl. blue-purple, Sep to Dec.	Sandy clay, peaty clay, granite. Winter-wet depressions.	Marginal, northwest corner.
<i>Isopogon drummondii</i>	-	P3	Erect, lignotuberous shrub, 0.4-1 m high. Fl. yellow/cream-yellow, Feb to Jun.	White, grey or yellow sand, often over laterite.	Yes.
<i>Meeboldina decipiens</i> subsp. <i>decipiens</i>	-	P3	Erect, open perennial, grass-like or herb (sedge), 0.6 m high. Fl. Oct.	Sand & sandy peat. Swamps.	Marginal, northwest corner.
<i>Myriophyllum echinatum</i>	-	P3	Erect annual, herb, 0.02-0.03 m high. Fl. red, Nov.	Clay. Winter-wet flats.	Marginal, northwest corner.
<i>Schoenus capillifolius</i>	-	P3	Semi-aquatic tufted annual, grass-like or herb (sedge), 0.05 m high. Fl. green, Oct to Nov.	Brown mud. Claypans.	None.
<i>Schoenus</i> sp. Waroona (G.J. Keighery 12235)	-	P3	Tufted annual, grass-like or herb (sedge), 0.02-0.06 m high. Fl. brown-red-green, Oct to Nov.	Clay or sandy clay. Winter-wet flats.	Marginal, northwest corner.



Species	Federal Listing	State Listing	Description	Required Habitat	Habitat Availability within Jackson Block
<i>Acacia semitrullata</i>	-	P4	Slender, erect, pungent shrub, (0.1-)0.2-0.7(-1.5) m high. Fl. cream-white, May to Oct.	White/grey sand, sometimes over laterite, clay. Sandplains, swampy areas.	Yes.
<i>Aponogeton hexatepalus</i>	-	P4	Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green-white, Jul to Oct.	Mud. Freshwater: ponds, rivers, claypans.	None.
<i>Caladenia speciosa</i>	-	P4	Tuberous, perennial, herb, 0.35-0.6 m high. Fl. white-pink, Sep to Oct.	White, grey or black sand.	Yes.
<i>Centrolepis caespitosa</i>	En	P4	Tufted annual, herb (forming a rounded cushion up to 25 mm across). Fl. Oct to Dec.	White sand, clay. Salt flats, wet areas.	Marginal, northwest corner.
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	-	P4	Rhizomatous, stoloniferous perennial, grass-like or herb, 0.1-0.35 m high. Fl. yellow, Aug to Oct.	Grey sand, limestone. Hillslopes, consolidated dunes.	Yes.
<i>Ornduffia submersa</i>	-	P4	Perennial aquatic herb, up to 0.2 m high. Fl. white.	Sand and clay. Wetlands.	None.
<i>Schoenus natans</i>	-	P4	Aquatic annual, grass-like or herb (sedge), 0.3 m high. Fl. brown, Oct.	Winter-wet depressions.	None.
<i>Trithuria australis</i>	-	P4	Small aquatic herb. Fl. reddish.	Clay, sandy clay. Wetlands, claypans.	None.

Source: Western Australian Herbarium (1998-).

<sup>1</sup> The species only came up in the EPBC Protected Matters Database search and not in the NatureMap search despite both searches using the same search area.

### 3.8 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

A search of the DPaw database identified no Threatened Ecological Communities (TECs) endorsed by the Western Australian Minister for Environment within the Jackson Block Survey Area or Lot 3 Buller Road in general, however there are TECs within a 10 km radius of the site. These have been described to include *Corymbia calophylla* – *Eucalyptus marginata* woodland on sandy clay soils of the southern Swan Coastal Plain (identifier SCP3b), Herb rich shrublands in clay pans (SCP08), shrublands on dry clay flats (SCP10a), *Corymbia calophylla* – *Kingia australis* woodlands on heavy soils Swan Coastal Plain (SCP3a) and Stromatolite like freshwater microbialite community of coastal brackish lakes (Clifton-microbialite).

A search of the EPBC Protected Matters Database identified two TECs listed under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* within 10 km of the Jackson Block Survey Area. These were *Corymbia calophylla* – *Kingia australis* woodlands on heavy soils of the Swan Coastal Plain

(Endangered) and Claypans of the Swan Coastal Plain (Critically Endangered). Both communities match those also listed by the Western Australian Minister for Environment.

On the basis of the desktop assessment, claypans, clay soils, heavy soils and freshwater lakes are not expected to occur within the Jackson Block Survey Area and as a result it is unlikely that these close TECs were to occur within the survey area either.

The search of the DPaW database also looked for Priority Ecological Communities (PECs), none of which were found within the Jackson Block Survey Area or Lot 3 Buller Road in general. However there are PECs within a 10 km radius of the site including Elongate Fluvial Delta System - Peel Harvey Inlet (P1), Southern *Eucalyptus gomphocephala* - *Agonis flexuosa* woodlands (SCP3b, P3) and Low lying *Banksia attenuata* woodlands or shrublands (SCP21c, P3). On the basis of the desktop assessment, the first two of these PECs were highly unlikely to occur within the survey area. The occurrence of Low lying *Banksia attenuata* woodlands or shrublands was to be determined during the field survey.

## 4. FIELD SURVEY RESULTS

### 4.1 FLORA INVENTORY

A total of 83 vascular plant taxa, representative of 32 plant families and 60 genera were recorded within the Jackson Block Survey Area in May 2015. This included 17 introduced taxa. The majority of the taxa recorded were representative of the Myrtaceae (14 taxa), Fabaceae (13 taxa), Proteaceae (7 taxa), Restionaceae (5 taxa) and Poaceae (5 taxa) families. A complete species list is provided in Appendix 2.

### 4.2 CONSERVATION SIGNIFICANT FLORA

No Threatened flora species listed under the Western Australian *Wildlife Conservation Act 1950* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* were recorded within the Jackson Block Survey Area. Also no Priority flora species listed by DPaW were recorded. It is noted that the timing of the survey in autumn was not ideal for observing most of the Threatened and Priority species potentially occurring in the area as it was not the main flowering time for a great majority of the species.

A population of approximately 15 individuals of one orchid species was observed in the Jackson Block Survey Area (location in GDA94 Z51: 390821 mE, 6363690 mN). Only the leaf of the species was present at the time of the survey. The species was photographed, but no specimen was collected in case the species was a Threatened species. Photographs of the species are provided as Plate 1 and Plate 2. The species was found in grey sand, underneath *Eucalyptus marginata*, *Corymbia calophylla* and *Banksia grandis*. The leaf does not resemble the characteristics of any of the Threatened or Priority orchid species within 10 km radius of the Jackson Block Survey Area listed in Table 4. Out of the Threatened and Priority species, *Drakaea elastica* (Glossy-leaved Hammer-orchid) has the most similar leaf to the unidentified orchid, but where *D. elastica* leaf is described as smooth, glossy and roughly thumbnail in size (Mattiske 2007), the unidentified orchid is not glossy and is much larger in size (up to 7cm from tip to base among those observed). Review of non-Threatened and non-Priority orchid species in the general area indicates that the unidentified orchid could be *Pyrorchis nigricans* (Red Beaks), a wide-spread and common species in the southwest, with white-red flowers generally between August and October.



Plate 1: Unidentified Orchid Species – Leaf Size



Plate 2: Unidentified Orchid Species – Leaf Underside

### 4.3 INTRODUCED SPECIES

Seventeen introduced species were recorded within the Jackson Block Survey Area as listed in Appendix 2. The most common weed family was Poaceae. The weed species included two Declared Plant species under the *Biosecurity and Agriculture Management Act 2007*, \**Gomphocarpus fruticosus* (Narrow-leaf Cottonbush) and \**Zantedeschia aethiopica* (Arum Lily).

Many of the annual weed species had not yet emerged and many of the perennial weed species had died back during the summer period. Seedlings were observed emerging from the soil, but were too young for identification. Consequently the number of weed species recorded during the survey is anticipated to be an underestimate of weed species actually present in the survey area.

### 4.4 VEGETATION UNITS

Two vegetation units were identified in the survey area, one covering most of the remnant vegetation and another covering a small section of fringing wetland in the northwest corner of the survey area as presented in Figure 4. Neither of these vegetation units matches descriptions of listed TECs and PECs.

The dominant Vegetation Unit 1 is described as 'Low Woodland of *Corymbia calophylla*, *Eucalyptus marginata*, *Banksia* spp. and *Allocasuarina fraseriana* over a Low Open Shrubland dominated by *Hibbertia hypericoides* over a Grassland of native and introduced species on very low relief sand dunes'. There was variation in the density of the various tree and shrub species within the vegetation unit which appeared to be largely due to the varying degrees and types of disturbance across the site described further in Section 4.5. Four of the five quadrats surveyed (Quadrats 1, 2, 3, 5) represented this dominant vegetation unit and are illustrated in Plate 3, Plate 4, Plate 5 and Plate 7. This vegetation unit covered approximately 21.6 ha of the total Jackson Block Survey Area of 36.8 ha.

The minor Vegetation Unit 2 is described as 'Thicket of *Kunzea ericifolia*, *Melaleuca preissiana* and *Melaleuca raphiophylla*, over Open Low Shrubland of *Astartea scoparia* and *Adenanthos meisneri* over bare ground in lower ground associated with a sumpland'. One of the five quadrats surveyed (Quadrat 4) represented this minor vegetation unit and is illustrated in Plate 6. This vegetation unit covered approximately 0.5 ha of the total Jackson



Block Survey Area of 36.8 ha. It is noted that only the portion of the vegetation unit falling within the Jackson Block Survey Area was inspected and this area could represent a transition zone between vegetation communities as moving closer to the wetland on the western side.

The previously cleared areas were separated into cleared extraction areas undergoing revegetation (10.5 ha), cleared extraction areas not undergoing active revegetation (2.4 ha) and remaining cleared areas such as tracks and firebreaks (1.9 ha). The species diversity, density and cover across the revegetation areas varied significantly depending on what species had been planted or seeded, how long ago the revegetation measures had been undertaken and what the seedling mortality rate had been. Overall, the revegetation success had been very poor and large areas remained void of native vegetation and covered in weed species. Species opportunistically recorded within the revegetation areas are included in the species list in Appendix 2. It is noted that two of the species observed in the revegetation areas, *Eucalyptus camaldulensis* and *Melaleuca quinquenervia* are not native to the area. The vegetation in the revegetation area is shown in Plate 8 and Plate 9.

Due to the small number of quadrats surveyed, significant variation in species diversity between them (due to disturbance history) and the timing of the survey in autumn, no analysis was undertaken to infer Floristic Community Types (FCTs). Additional fieldwork at Level 2 with higher intensity quadrat sampling during spring time would be necessary to accurately infer the FCTs.



Plate 3: Survey Quadrat 1 – Vegetation Unit 1





Plate 4: Survey Quadrat 2 – Vegetation Unit 1



Plate 5: Survey Quadrat 3 – Vegetation Unit 1





Plate 6: Survey Quadrat 4 – Vegetation Unit 2



Plate 7: Survey Quadrat 5 – Vegetation Unit 1





Plate 8: Revegetation Area – View from Eastern Part of Pit to Southwest



Plate 9: Revegetation Area – View from Western Part of Pit to Northwest

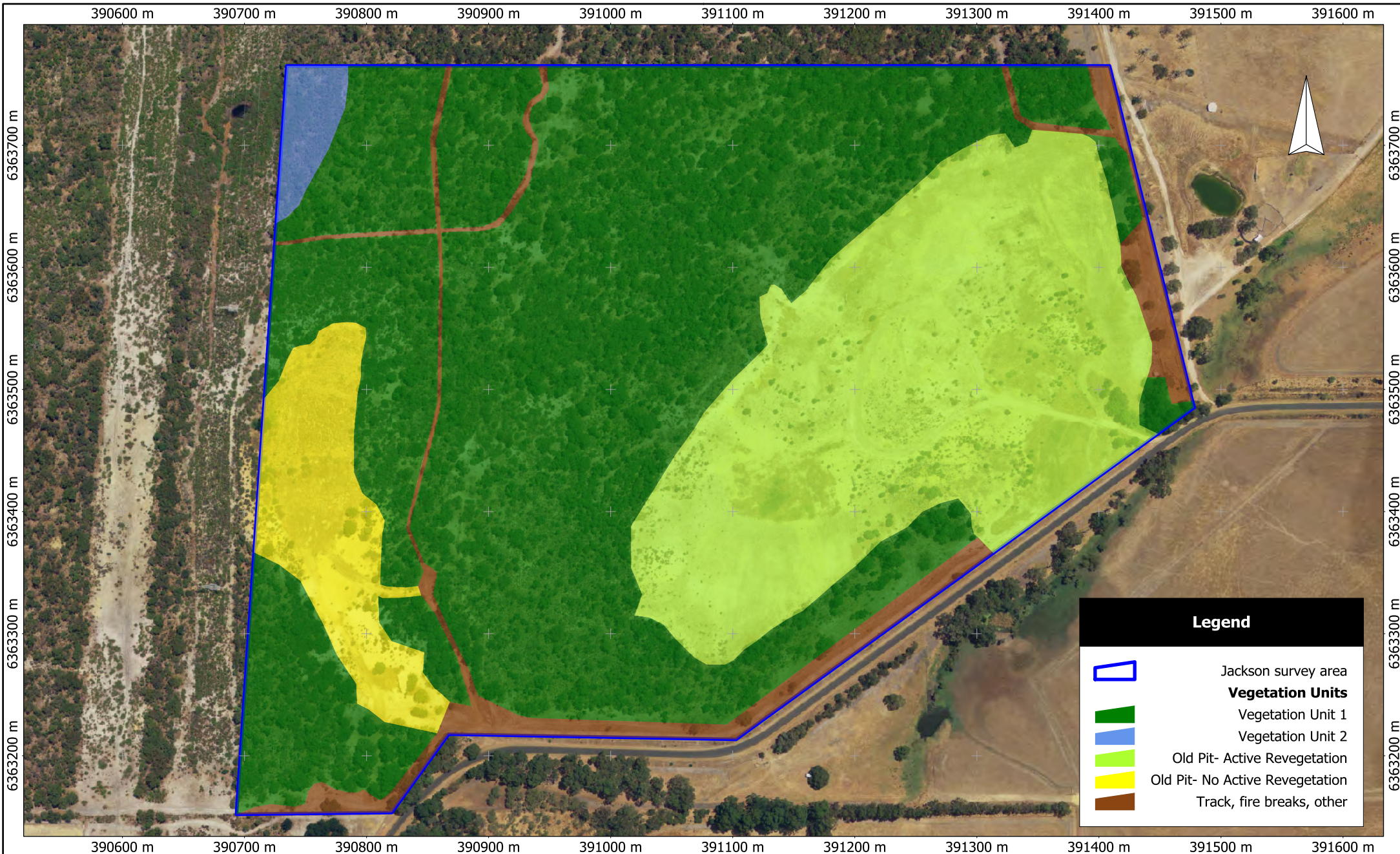
## 4.5 VEGETATION CONDITION

Vegetation condition in the Jackson Block Survey Area was mapped and assessed using the Keighery (1994) Bushland Condition Scale (Table 2) and varied from Completely Degraded to Very Good as follows:







- Previous extraction areas, tracks, fire breaks and other cleared areas were assessed as Completely Degraded. These areas were completely or almost completely without native vegetation and covered in total 14.8 ha of the total 36.8 ha.
- Degraded condition was assigned to small patches (totalling 1.6 ha) adjacent to larger clearing areas where some native vegetation remained, but the structure was severely impacted.
- Good condition was assigned to two small patches of vegetation (totalling 0.6 ha) that were surrounded by tracks and other disturbance, showed deterioration of the vegetation structure, and in case of the northeast corner, was heavily infested by weeds.
- Very Good – Good condition was assigned to the majority of the survey area (19.8 ha). In these areas the vegetation condition varied over short distances creating a mosaic between Very Good and Good condition. The variation in the condition appeared to have been caused by variation in the type and degree of disturbance (logging, grazing, fire, potential dieback) and recovery from that disturbance. Both upper storey and understorey densities fluctuated significantly.
- None of the vegetation was found to be in Excellent or Pristine condition.

Vegetation condition mapping is presented in Figure 5. According to anecdotal records, all of the Jackson Block Survey Area was cleared close to 50 years ago in preparation for sand extraction that did not end up extending as far as planned. The anecdotal record was supported by the general lack of very old large trees and the presence of cut stumps and burned-out logs. There were several fence lines across the remnant vegetation, assumed to have been constructed for grazing purposes. There was evidence of fire, but not for at least a decade. Several tracks crossed the survey area and there was what appeared to have been an old camp site with some rubbish. In some areas, vegetation appeared to be in poor health and dead trees were present. This could be related to drought or pest and disease. Evidence of wild pig activity and substantial grazing by kangaroos was recorded.





**Legend**

-  Jackson survey area
- Vegetation Units**
-  Vegetation Unit 1
-  Vegetation Unit 2
-  Old Pit- Active Revegetation
-  Old Pit- No Active Revegetation
-  Track, fire breaks, other

Scale: 1:4000  
 Original Size: A4  
 Air Photo Date: February 2015  
 Grid: MGA94(50)

0 100 m

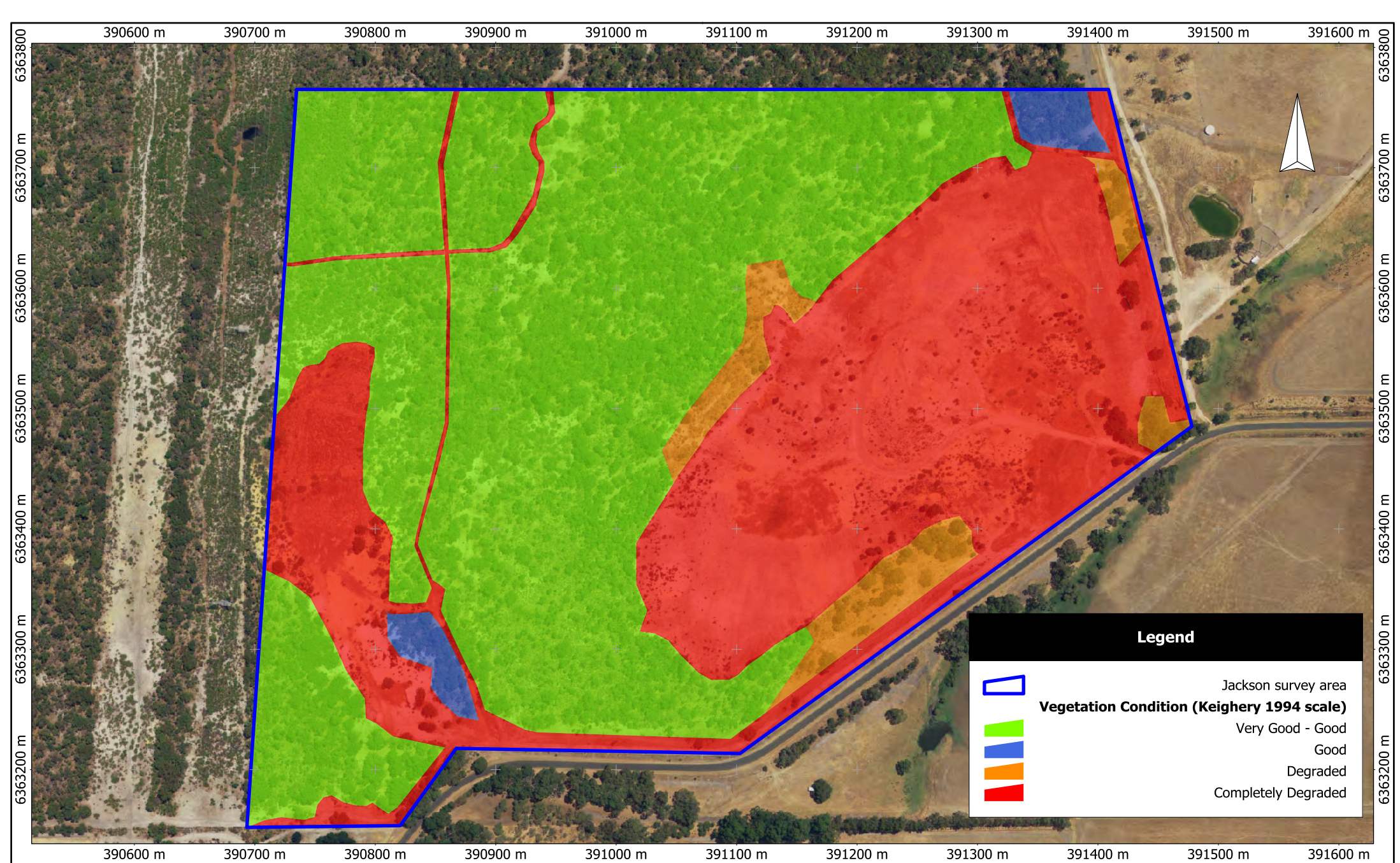
KD.1 Pty Ltd  
 Lot 3 Buller Road Waroona  
 Level 1 Flora Survey - Jackson Block






**Figure 4**  
**Vegetation Units**

4 Cook St  
 West Perth WA 6005  
 Ph: (08) 9226 3166  
 Fax: (08) 9226 3177  
 info@mbsenvironmental.com.au  
 www.mbsenvironmental.com.au

**MBS**  
 ENVIRONMENTAL





Legend	
	Jackson survey area
<b>Vegetation Condition (Keighery 1994 scale)</b>	
	Very Good - Good
	Good
	Degraded
	Completely Degraded

Scale: 1:4000  
 Original Size: A4  
 Air Photo Date: February 2015  
 Grid: Australia MGA94 (50)



KD.1 Pty Ltd  
 Lot 3 Buller Road Waroona  
 Level 1 Flora Survey - Jackson Block

**Figure 5**  
**Vegetation Condition**

4 Cook St  
 West Perth WA 6005  
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 Fax: (08) 9226 3177  
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[www.mbsenvironmental.com.au](http://www.mbsenvironmental.com.au)



## 5. DISCUSSION

The 83 flora species recorded in the Jackson Block Survey Area are all species previously recorded in the general area. The previously available species list for Lot 3 (author and date unknown) included 47 species so the May 2015 survey significantly increased the number of species known to occur on the property. Undertaking the survey in autumn, outside the main flowering season in spring, reduced the likelihood of detecting some species and made the species identifications level more difficult. Consequently it is likely that further species occur in the survey area than what was recorded during the May 2015 survey.

The May 2015 survey recorded none of the 37 Threatened or Priority flora species potentially occurring in the general area, however the timing of the survey was not ideal for observing these species.

The vegetation units described for the Jackson Block Survey Area on the basis of this survey are consistent with earlier vegetation mapping of the wider area by Beard (1981) and Heddle et al. (1980) and do not represent TECs or PECs.

Vegetation Unit 2 described as Thicket of *Kunzea ericifolia*, *Melaleuca preissiana* and *Melaleuca raphiophylla*, over Open Low Shrubland of *Astartea scoparia* and *Adenanthos meisneri* over bare ground is associated with a sumpland that connects to the closest ESA approximately 90 m away from the survey area boundary. Clearing of such vegetation could potentially have an impact on the ESA, however it is noted the vegetation between the survey area and the ESA has already been cleared in the past for a major power line easement.

The main constraints to clearing of vegetation identified in this survey relate to the proximity of ESAs, Buller Nature Reserve and wetlands to the survey area, as well as the low level of the pre-European extent of the vegetation complex remaining.



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## APPENDICES

## APPENDIX 1: CONSERVATION CODES FOR FLORA AND ECOLOGICAL COMMUNITIES

# CONSERVATION CODES FOR FLORA AND ECOLOGICAL COMMUNITIES

Table A1-1: Conservation Codes for Western Australian Flora

Category	Definition
Threatened (T)	<p>Wildlife Conservation (Rare Flora) Notice under the <i>Wildlife Conservation Act 1950</i>.</p> <p><b>Threatened Flora: Declared Rare Flora - Extant.</b></p> <p>Taxa that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such. Ranked by Department of Parks and Wildlife (DPaW) using IUCN Red List criteria:</p> <ul style="list-style-type: none"> <li>• CR: Critically endangered – considered to be facing an extremely high risk of extinction in the wild.</li> <li>• EN: Endangered – considered to be facing a very high risk of extinction in the wild.</li> <li>• VU: Vulnerable – considered to be facing a high risk of extinction in the wild.</li> </ul>
Presumed Extinct (X)	<p>Wildlife Conservation (Rare Flora) Notice under the <i>Wildlife Conservation Act 1950</i>.</p> <p><b>Presumed Extinct Flora: Declared Rare Flora – Extinct.</b></p> <p>Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.</p>
<p>Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora. Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring. Conservation Dependent species are placed in Priority 5.</p>	
Priority 1 (P1), Poorly known taxa	<p>Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.</p>
Priority 2 (P2), Poorly known taxa	<p>Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.</p>

Category	Definition
Priority 3 (P3), Poorly known taxa	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
Priority 4 (P4), Rare, near threatened and other taxa in need of monitoring	<ul style="list-style-type: none"> <li>• Rare – taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.</li> <li>• Near Threatened - Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</li> <li>• Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</li> </ul>
Priority 5 (P5), Conservation dependant	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.

Source: DEC (2013) Conservation Codes. <http://www.dec.wa.gov.au/management-and-protection/threatened-species/listing-of-species-and-ecological-communities.html?start=1>

**Table A1-2: Categories of Threatened Species under the Commonwealth EPBC Act**

Category Code	Definition
Ex	<b>Extinct:</b> A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	<b>Extinct in the wild:</b> A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) It is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) It has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	<b>Critically endangered:</b> A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
EN	<b>Endangered:</b> A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) It is not critically endangered; and (b) It is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
VU	<b>Vulnerable:</b> A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) It is not critically endangered or endangered; and (b) It is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
CD	<b>Conservation dependent:</b> A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) The species is a species of fish. (ii) The species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised. (iii) The plan of management is in force under a law of the Commonwealth or of a State or Territory. (iv) Cessation of the plan of management would adversely affect the conservation status of the species.
M	<b>Migratory:</b> Species that migrate to, over and within Australia and its external territories comprising species covered by the Bonn Convention, Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement and other international agreements approved by the Minister such as the Republic of Korea - Australia migratory Bird Agreement.

Source: DSEWPAC (2013) *Threatened Species Under the EPBC Act*.  
<http://www.environment.gov.au/biodiversity/threatened/species.html>

**Table A1-3: Categories for Western Australian Threatened and Priority Ecological Communities**

Category	Definition
Presumed Totally Destroyed (PD)	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. <sup>1</sup>
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. <sup>1</sup>
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. <sup>1</sup>
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. <sup>1</sup>
Priority 1 (P1), Poorly known ecological communities	Ecological communities that are known from very few occurrences with a very restricted distribution (generally $\leq 5$ occurrences or a total area of $\leq 100$ hectares). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2 (P2), Poorly known ecological communities	Communities that are known from few occurrences with a restricted distribution (generally $\leq 10$ occurrences or a total area of $\leq 200$ hectares). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3 (P3), Poorly known ecological communities	<ul style="list-style-type: none"> <li>(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation, or</li> <li>(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or</li> <li>(iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.</li> </ul> <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>

Category	Definition
Priority 4 (P4), Rare, near threatened and other ecological communities in need of monitoring	<p>(i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.</p> <p>(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
Priority 5 (P5), Conservation dependant ecological communities	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Source: DEC (2013). WA's Threatened Ecological Communities.  
[http://www.dec.wa.gov.au/index.php?option=com\\_content&view=article&id=849&Itemid=2017](http://www.dec.wa.gov.au/index.php?option=com_content&view=article&id=849&Itemid=2017)

**Table A1-4: Categories of Threatened Ecological Communities under the Commonwealth EPBC Act**

Category Code	Definition
CE	<b>Critically endangered:</b> An ecological community that, at that time, is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	<b>Endangered:</b> An ecological community that, at that time: <p>(a) Is not critically endangered; and</p> <p>(b) Is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.</p>
V	<b>Vulnerable:</b> An ecological community that, at that time: <p>(a) Is not critically endangered or endangered; and</p> <p>(b) Is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.</p>

Source: DSEWPAC (2013) *About Threatened Ecological Communities*.  
<http://www.environment.gov.au/biodiversity/threatened/communities/about-ecological-communities.htm#tec>

## APPENDIX 2: SPECIES LIST



# DEFINITION OF STRUCTURAL FORMS OF AUSTRALIAN VEGETATION (BEARD 1990)

Family	Species	Quadrats					Revegetation Areas	Site Overall
		1	2	3	4	5		
Anarthriaceae	<i>Lyginia ? barbata</i>			x		x		x
Apocynaceae	* <i>Gomphocarpus fruticosus</i>						x	x
Araceae	* <i>Zantedeschia aethiopica</i>	x	x	x			x	x
Asparagaceae	<i>Lomandra sp.1</i>							x
Asparagaceae	<i>Lomandra sp.2</i>							x
Asteraceae	* <i>Dittrichia graveolens</i>						x	x
Asteraceae	<i>Olearia axillaris</i>							x
Casuarinaceae	<i>Allocasuarina ? humilis</i>							x
Casuarinaceae	<i>Allocasuarina fraseriana</i>					x		x
Cyperaceae	<i>Mesomelaena tetragona</i>							x
Dasyopogonaceae	<i>Dasyopogon bromeliifolius</i>					x		x
Dilleniaceae	<i>Hibbertia subvaginata</i>							x
Dilleniaceae	<i>Hibbertia vaginata</i>							x
Dilleniaceae	<i>Hibbertia hypericoides</i>		x	x		x		x
Droseraceae	<i>Drosera ? pallida</i>							x
Droseraceae	<i>Drosera erythrorhiza</i>					x		x
Ericaceae	<i>Astroloma pallidum</i>			x				x
Ericaceae	<i>Leucopogon conostephioides</i>							x
Ericaceae	<i>Leucopogon propinquus</i>							x
Euphorbiaceae	* <i>Ricinus communis</i>						x	x
Fabaceae	* <i>Chamaecytisus palmensis</i>						x	x
Fabaceae	* <i>Lupinus sp.</i>			x			x	x
Fabaceae	<i>Acacia huegelii</i>							x
Fabaceae	<i>Acacia pulchella</i>					x	x	x
Fabaceae	<i>Acacia saligna</i>			x			x	x
Fabaceae	<i>Daviesia divaricata</i>						x	x
Fabaceae	<i>Daviesia sp.</i>							x
Fabaceae	<i>Gompholobium ? tomentosum</i>			x		x		x
Fabaceae	<i>Hovea trisperma</i>			x		x		x
Fabaceae	<i>Jacksonia furcellata</i>						x	x
Fabaceae	<i>Jacksonia stembergiana</i>						x	x
Fabaceae	<i>Kennedia prostrata</i>			x			x	x
Fabaceae	* <i>Trifolium sp.</i>						x	x
Haemodoraceae	<i>Anigozanthos manglesii</i>							x

Family	Species	Quadrats					Revegetation Areas	Site Overall
		1	2	3	4	5		
Haemodoraceae	<i>Conostylis aculeata</i>					x	x	x
Iridaceae	* <i>Watsonia</i> sp.							x
Iridaceae	<i>Patersonia occidentalis</i>							x
Juncaceae	<i>Juncus pallidus</i>						x	x
Lamiaceae	<i>Hemiandra pungens</i>							x
Lauraceae	<i>Cassytha</i> sp.				x			x
Loranthaceae	<i>Nuytsia floribunda</i>							x
Myrtaceae	<i>Astartea ?scoparia</i>				x			x
Myrtaceae	<i>Babingtonia camphorosmae</i>							x
Myrtaceae	<i>Corymbia calophylla</i>		x	x		x	x	x
Myrtaceae	<i>Eucalyptus camaldulensis</i>						x	x
Myrtaceae	<i>Eucalyptus marginata</i>	x	x				x	x
Myrtaceae	<i>Eucalyptus rudis</i>						x	x
Myrtaceae	<i>Hypocalymma ?angustifolium</i>							x
Myrtaceae	<i>Hypocalymma robustum</i>	x	x			x		x
Myrtaceae	<i>Kunzea ericifolia</i>				x		x	x
Myrtaceae	<i>Melaleuca preissiana</i>				x			x
Myrtaceae	<i>Melaleuca quinquenervia</i>						x	x
Myrtaceae	<i>Melaleuca raphiophylla</i>				x			x
Myrtaceae	<i>Melaleuca thymoides</i>							x
Myrtaceae	<i>Scholtzia involucreta</i>							x
Orchidaceae	<i>Orchid</i> sp.							x
Oxalidaceae	* <i>Oxalis glabra</i>							x
Phytolaccaceae	* <i>Phytolacca octandra</i>							x
Pittosporaceae	<i>Billardiera laxiflora</i>							x
Poaceae	* <i>Arundo donax</i>						x	x
Poaceae	* <i>Briza maxima</i>						x	x
Poaceae	* <i>Briza minima</i>						x	x
Poaceae	* <i>Cynodon dactylon</i>						x	x
Poaceae	* <i>Ehrharta calycina</i>						x	x
Proteaceae	<i>Banksia attenuata</i>	x	x			x		x
Proteaceae	<i>Banksia grandis</i>			x		x		x
Proteaceae	<i>Banksia ilicifolia</i>	x						x
Proteaceae	<i>Banksia menziesii</i>		x					x
Proteaceae	<i>Petrophile linearis</i>							x
Proteaceae	<i>Stirlingia latifolia</i>			x		x	x	x
Proteaceae	<i>Xylomelum occidentale</i>		x	x			x	x

Family	Species	Quadrats					Revegetation Areas	Site Overall
		1	2	3	4	5		
Restionaceae	<i>Adenanthos meisneri</i>				x			x
Restionaceae	<i>Desmocladius ?fasciculatus</i>			x				x
Restionaceae	<i>Desmocladius ?flexuosus</i>	x	x	x	x	x		x
Restionaceae	<i>Hypolaena exsulca</i>							x
Restionaceae	<i>Loxocarya sp.</i>							x
Solanaceae	* <i>Solanum nigrum</i>						x	x
Stylidiaceae	<i>Stylidium ?piliferum</i>							x
Stylidiaceae	<i>Stylidium repens</i>				x			x
Typhaceae	* <i>Typha orientalis</i>							x
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>			x				x
Xanthorrhoeaceae	<i>Xanthorrhoea sp.</i>							x
Zamiaceae	<i>Macrozamia riedlei</i>		x			x		x
	Total species	6	10	16	8	16	29	83