TECHNICAL MEMORANDUM

Flora and Vegetation Survey and Fauna Survey

Lot 10 (111) Woollcott Avenue, Brabham

PROJECT NUMBER	EP17-131(22)	**DOC. NUMBER**	EP17-131(22)--032
PROJECT NAME	Phase 1 Bulk Earthworks Clearing Permit Application	**CLIENT**	Department of Communities and Peet Limited
AUTHOR	BRB	**REVIEWER**	TAA
VERSION	1	**DATE**	8/02/2019

1. INTRODUCTION

The Department of Communities (DoC) and Peet Limited has engaged Emerge Associates (Emerge) to provide environmental consultancy services to support residential development within Lot 10 Woollcott Avenue, Brabham. Due to the presence of native vegetation within Lot 10, Emerge has been engaged to prepare an application for a clearing permit (area permit) pursuant to Part V of the *Environmental Protection Act 1986*. The proposed clearing permit area (referred to herein as 'the site') is located within the southern portion of the Department of Communities/Peet First Stage Local Structure Plan area, which sits within the broader Brabham landholdings owned by the Housing Authority (the Department of Communities).

The site is zoned 'Urban' under the Metropolitan Region Scheme (MRS), and 'Special Use - Albion' under the City of Swan Local Planning Scheme (LPS) No. 17. It is bound by the former Caversham Airbase to the south, existing rural residential landholdings to the east, land owned by the Housing Authority to the north and south-west and private residential landholdings to the west.

The site comprises covers 11.83 ha, and supports approximately 0.81 ha of scattered native vegetation. The site is characterised by heavily disturbed areas comprising of non-native grasses with scattered native trees. The location and extent of the site is shown in **Figure 1.**

Two studies of the broader Brabham landholdings have been conducted, and which encompass the site; a detailed flora and vegetation survey conducted by Emerge Associates (2019), and a level 1 fauna assessment and targeted black cockatoo assessment conducted by Greg Harewood (2018). The purpose of this technical memorandum is to summarise the information obtained from these surveys as they relate to the site.

2. FLORA AND VEGETATION SURVEY AND FAUNA SURVEY

2.1. Emerge Associates (2019)

In accordance with the Environmental Protection Authority's (EPA's*) Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, a detailed flora and vegetation assessment was undertaken on 2 July 2018, within the site, as part of a broader survey effort across the broader Brabham landholdings between July and October 2018 (Emerge Associates 2019). During the survey an assessment was made on the type, condition and values of vegetation across the site. During this assessment, the following tasks were completed:

- Desktop review of relevant background information pertaining to the site and surrounds, including database searches for threatened flora species and ecological communities.
- Compilation of a comprehensive list of flora species recorded as part of the field survey.
- Mapping of plant communities and vegetation condition.
- Identification of conservation significant flora and vegetation.
- Documentation of the desktop assessment, survey methodology and results into a report.

2.1. Greg Harewood (2018)

A fauna assessment was carried out by Greg Harewood to the standard required of a level 1 survey (desktop assessment) and a targeted black cockatoo survey within the site, as part of a broader survey effort across the broader Brabham landholdings, in accordance with the EPA's *Technical Guidance – Terrestrial fauna Surveys*. During the fauna assessment, the following tasks were completed:

- Desktop review of relevant background information pertaining to the site and surrounds, including database searches for threatened fauna species.
- Compilation of a comprehensive list of fauna species recorded as part of the field survey.
- Identification of conservation significant fauna.
- Undertaking a targeted black cockatoo assessment within the site.
- Documentation of the desktop assessment, survey methodology and results into a report.

3. BACKGROUND

3.1. Land use

A review of historical aerial images available from 1953 onwards, shows that the site was largely cleared by 1953, with vegetation reduced to scattered native trees (Landgate 2019). Native vegetation cover has remained limited within this portion of the site to the current time due to continued use for grazing.

3.2. Wetlands

Wetlands include "areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh and saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries" (Wetlands Advisory Committee 1977). Wetlands can further be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al*. 1996).

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. The following lists of important wetlands were checked as part of this assessment:

- *Ramsar List of Wetlands of International Importance* (DBCA 2017b)
- *A Directory of Important Wetlands in Australia* (DBCA 2018a).

No Ramsar or listed 'important wetlands' are located within or near the site. A review of the *Geomorphic Wetlands of the Swan Coastal Plain* dataset indicates that one resource enhancement wetland (REW) and one multiple use wetland (MUW) occurs within the site.

The REW (unique feature identifier (UFI)# 8807) is identified as extending into the south-western portion of the site. The *Environmental Guidance for Planning and Development (GS 33)* (EPA 2008) identifies that REWs are wetlands that may have been partially modified, but sill support substantial ecological attributes and functions. The management objective for REWs is to "manage, restore and protect towards improving their conservation value".

The MUW (UFI# 13396) intersects the north-eastern portion of the site, which currently does not contain any native vegetation. MUWs are described as wetlands that retain few ecological attributes but may still provide hydrological functions (EPA 2008). The management objective of MUWs as noted by the *Water and Rivers Commission* (2001) is that 'use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through land care.'

3.3. Threatened and priority flora

A search was conducted for threatened and priority flora within a 5 km radius of the site using the *Protected Matters Search Tool* (DoEE 2017a), *NatureMap* (DPaW 2017b) and DBCA's threatened and priority flora database (reference no. 01-0818FL). A total of 16 threatened and nine priority flora species were identified as potentially occurring in the wider local area as listed in **Table 1**. None of the mapped occurrences of these species occur within the site.

Of the flora species potentially occurring in the local area, those species occurring on claypans, lateritic or granitic soils were considered unlikely to occur within the site due to the absence of these soil types within the site.

On this basis eight threatened flora species and five priority flora species were identified as having potential to occur within the site (shaded green in **Table 1**).

Table 1: Significant flora species known or likely to occur within 5 km of the site.

Species	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	State	EPBC Act				
Synaphea sp. Fairbridge Farm	T	CE	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Possible
Thelymitra dedmaniarum	T	CE	PG	Granite.	Nov-Dec (Jan)	Unlikely
Trithuria occidentalis	T	CE	A	Claypans. Muddy.	Sep-Oct	Unlikely
Andersonia gracilis	T	E	P	White/grey sandy, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Sept-Nov	Possible
Caladenia huegelii	T	E	PG	Grey or brown sand, clay loam.	Sept-Oct	Possible
Chamelaucium sp. Gingin (N.G.Marchant 6)	T	E	P	Sandy slopes and plains. Banksia woodland.	Sep-Dec	Possible
Diuris purdiei	T	E	PG	Grey-black sand, moist.	Sept-Oct	Possible
Drakaea elastica	T	E	PG	White or grey sand in dense vegetation in low-lying winter-wet areas.	Oct-Nov	Unlikely
Eucalyptus x balanites	T	E	P	Light coloured sandy soils over laterite. Habitat consists of gently sloping heathlands; open mallee woodland over shrubland or heathland with emergent mallees.	Sep-Oct	Unlikely
Grevillea christineae	T	E	P	Clay loam, sandy clay, often moist.	Aug-Sep	Possible
Grevillea curviloba subsp. curviloba	T	E	P	Grey sand. Winter-wet heath.	Oct	Possible
Grevillea curviloba subsp. incurva	T	E	P	Winter-wet areas on sand over limestone, or over ironstone at sites with a high water table.	Sep-Oct	Unlikely
Lepidosperma rostratum	T	E	P	Peaty sand, clay.	May-June	Possible
Anigozanthos viridis subsp. terraspectans	T	V	P	Grey sand, clay loam. Winter-wet depressions.	Aug-Sept	Unlikely
Eleocharis keigheryi	T	V	P	Clay, sandy loam. Emergent in freshwater: creeks, claypans.	Aug-Nov	Unlikely
Diplolaena andrewsii	T	-	P	Loam, clay. Granite outcrops & hillsides.	Jul-Oct	Unlikely
Hydrocotyle striata	P1	-	Aq	Clay. Springs.		Unlikely
Stachystemon sp. Keysbrook (R. Archer 17/11/99)	P1	-	P	Seasonally damp. Sandy soils.	Oct	Possible

Table 1 (cont.): Significant flora species known or likely to occur within 5 km of the site.

Species	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
Acacia oncinophylla subsp. oncinophylla	P3	-	P	Granitic soils.	Aug-Oct	Unlikely
Cyathochaeta teretifolia	P3	-	P	Grey sand, sandy clay. Swamps, creek edges.	Dec	Possible
Schoenus capillifolius	P3	-	A	Brown mud. Claypans.	Oct-Nov	Unlikely
Schoenus sp. Waroona (G.J. Keighery 12235)	P3	-	A	Clay or sandy clay. Winter-wet flats.	Oct-Nov	Possible
Darwinia pimelioides	P4	-	P	Loam, sandy loam. Granite outcrops.	Sep-Oct	Unlikely
Stylidium longitubum	P4	-	A	Sandy clay, clay. Seasonal wetlands.	Oct-Dec	Possible
Verticordia lindleyi subsp. lindleyi	P4	-	P	Sand, sandy clay. Winter-wet depressions.	May or Nov- Dec or Jan	Possible

Note: T=threatened, CE=critically endangered, E=endangered, V=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4, P=perennial, PG=perennial geophyte, A=annual.

3.4. Threatened and priority ecological communities

Known locations of 'Threatened Ecological Communities' (TECs) and 'Priority Ecological Communities' (PECs) within 10 km of the site were searched for using the publicly available *Weed and native flora dataset* (Keighery *et al.* 2012), *Protected Matters Search Tool* (DoEE 2018) and DBCA's Threatened and priority ecological communities' database (reference no. 11-0818EC). These search results indicate that 13 TECs (of which four are also listed as PECs in Western Australia) and one PEC occurs within 10 km of the site as listed in **Table 2.** Communities that were considered to be potentially present within the site are shaded green in **Table 2.**

Table 2: Significant flora species known or likely to occur within 5 km of the site

Code	Community name	TEC/PEC	Level of significance	
			State	EPBC Act
SCP08	Herb rich shrublands in clay pans	TEC	Vulnerable	Critically Endangered (Clay pans of the Swan Coastal Plain)
SCP3a	*Corymbia calophylla – Kingia australis* woodlands on heavy soils, Swan Coastal Plain	TEC	Critically Endangered	Endangered
SCP20c	Shrublands and woodlands of the eastern side of the Swan Coastal Plain	TEC	Critically endangered	Endangered
SCP3c	*Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain	TEC	Critically endangered	Endangered
SCP20a	*Banksia attenuata* woodlands over species rich dense shrublands	TEC	Endangered	Endangered (Banksia woodlands of the Swan Coastal Plain)

Table 2: Significant flora species known or likely to occur within 5 km of the site (continued)

Code	Community name	TEC/PEC	Level of significance	
			State	EPBC Act
MUCHEA LIMESTONE	Shrublands and woodlands on Muchea limestone	TEC	Endangered	Endangered
MOUND SPRINGS SCP	Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain	TEC	Endangered	Endangered
BANKSIA WL SCP	Banksia dominated woodlands of the Swan Coastal Plain	PEC/ TEC	Priority 3	Endangered (Banksia woodlands of the Swan Coastal Plain)
SCP20b	Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands	TEC	Endangered	Endangered (Shrublands and woodlands of the eastern Swan Coastal Plain)
SCP21c	Low lying *Banksia attenuata* woodlands or shrublands	PEC/ TEC	Priority 3	Endangered (Banksia woodlands of the Swan Coastal Plain)
SCP22	Banksia ilicifolia woodlands	PEC/ TEC	Priority 3	Endangered (Banksia woodlands of the Swan Coastal Plain)
SCP23b	Northern *Banksia attenuata – Banksia menziesii* woodlands	PEC/ TEC	Priority 3	Endangered (Banksia woodlands of the Swan Coastal Plain)
SCP02	Southern wet shrublands, Swan Coastal Plain	TEC	Endangered	-
SCP18	Shrublands on calcareous silts of the Swan Coastal Plain	TEC	Vulnerable	-
CENTRAL GRANITE SHRUBLANDS (COM 5, MARKEY)	Central northern Darling Scarp granite shrubland community	PEC	Priority 4	-

3.5. Previous flora surveys

An assessment of the flora and vegetation values within the site was undertaken by Ecoscape (Australia) Pty Ltd (Ecoscape) and documented within the environmental review (Ecoscape 2006). This environmental review covers the entire Albion District Structure Plan area. This was a releve based survey (as opposed to fixed plots). The environmental review also noted a number of historical surveys over the area however, none of the listed surveys cover the lots comprising the and the Brabham landholdings. Ecoscape (2006) identified six communities within the broader Brabham landholdings, as listed below:

- Sedgelands of *Juncus pallidus*
- *Melaleuca rhaphiophylla* woodland
- *Melaleuca rhaphiophylla* and *Melaleuca preissiana* woodland
- *Corymbia calophylla* woodland
- *Eucalyptus/Banksia* spp woodlands (in upland areas)
- Degraded areas.

4. FLORA AND VEGETATION SURVEY METHODS

4.1. Field survey methodology

Two botanists from Emerge visited the site in July 2018 to conduct flora and vegetation assessments. A number of common orchids and geophytes were recorded during the field day (as part of the survey encompassing the broader Brabham landholdings), indicating that the timing was appropriate to detect these species. Thus should conservation significant geophytic species have been present it is likely that they would have been detected. The site was traversed on foot and the composition and condition of vegetation was recorded. Searches were conducted for threatened and priority flora species with potential to occur in the site, with a particular focus on identifying areas of suitable habitat.

The site was surveyed, but due to the lack of intact vegetation, samples were not collected from within the site area. Plant taxa were recorded opportunistically as the botanists traversed the site, and identified in accordance with requirements of the Western Australian Herbarium. Flora species not native to Western Australia are denoted by an asterisk ('*') in text and raw data. Photographs were taken throughout the field visit to show particular site conditions.

Vegetation condition was assigned and changes in vegetation condition were also noted and mapped across the site. The condition of the vegetation was assessed using methods from Keighery (1994) (as shown in **Table 3**).

Table 3: Vegetation condition scale applied during the field assessment

Condition	Definition (Keighery 1994)	Indicator (DoEE 2016)	
		Typical native vegetation composition	Typical weed cover
Pristine	Pristine or nearly so, no obvious signs of disturbance.	Native plant species diversity fully retained or almost so	Zero or close to
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.	High native plant species diversity	Less than 10%
Very good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing	Moderate native plant species diversity	5-20%
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.	Low native plant species diversity	5-50%
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	Very low native plant species diversity	20-70%

Table 3: Vegetation condition scale applied during the field assessment (continued)

Condition	Definition (Keighery 1994)	Indicator (DoEE 2016)	
		Typical native vegetation composition	Typical weed cover
Completely degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.	Very low to no native species diversity	Greater than 70%

4.2. Mapping and data analysis methodology

4.2.1. Plant communities identification and description

The vegetation was described according to the dominant species present using the structural formation descriptions of the National Vegetation Inventory System (NVIS) (ESCAVI 2003).

Samples were taken from the broader Brabham landholdings, however due to the degraded nature of the plant communities to the south, no samples were taken from within the site. The local plant communities within the site were identified from the opportunistic observations recorded during the site visit. No further detailed classification analysis (outlined above) was undertaken for the identification and description of plant communities within this report.

The vegetation within the site was classified as 'parkland cleared' and 'cleared' based on the field observations. Two plant communities are mapped as occurring, neither of which constitute a native vegetation community.

The identified plant communities were then mapped on aerial photography (1:8,000) and boundaries were interpreted from aerial photography and notes taken in the field. Vegetation condition was mapped on aerial photography (1:8,000) based on the locations recorded during the field survey to define areas with differing condition.

4.2.2. Floristic community type assignment

No Floristic Community Types (FCT's) were recorded within the site due to the degraded condition of the vegetation, therefore no further analysis was required.

4.2.3. Species accumulation curve

No samples were collected from the site and no Species Accumulation Curve (SAC) was required, given species list was comprehensive.

4.3. Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) is provided in **Table 4**.

Table 4: Evaluation of survey methodology against standard constraints outlined in EPA Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information and previous surveys described in **Section 3** is adequate to place the site and vegetation in context.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by a qualified botanist with over seven years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant with 15 years' experience in environmental science in Western Australia.
Suitability of timing	No limitation	The survey was conducted in September and October and thus within the main flowering season. A variety of perennial, annual and geophytic flora species were recorded during the survey, and therefore the survey timing was considered adequate to allow the detection of species for which seasonal timing is critical.
Temporal coverage	No limitation	Comprehensive flora and vegetation assessments can require multiple visits, at different times of year, and over a period of a number of years, to enable observation of all species present. The site was visited twice in spring 2018 and therefore, according to the EPA guidelines, this survey is considered to meet the requirements of a 'detailed' survey.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.
Sampling intensity	No limitation	Due to the lack of vegetation within the site, sampling was not required.
Influence of disturbance	Minor limitation	Time since fire is greater than 50 years as interpreted form aerial imagery and therefore short lived species more common after fire may not have been visible.
	No limitation	Historical ground disturbance was evident in the vegetation and current or recent grazing was evident. The disturbance history of the site was considered when undertaking field sampling.
Adequacy of resources	No limitation	All resources required to perform the survey were available.

5. FAUNA SURVEY METHODS

A level 1 fauna assessment and a targeted black cockatoo survey were undertaken in accordance with EPA (2016) guidelines by Greg Harewood on 12 August 2018. During the fauna assessment, the tasks included a desktop survey and a site reconnaissance survey.

5.1. Desktop survey methodology

5.1.1. Database searches

Searches of the following databases were undertaken to aid in the compilation of a list of conservation significant fauna potentially occurring within the site;

- *NatureMap* database search (DPaW 2017b);
- *Great Cocky Count* (Birdlife Australia, 2018); and
- *Protected Matters Search Tool* (DotEE 2018).

5.1.2. Fauna of conservation significance

The conservation significance of fauna species was assessed using data from the following sources:

- *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act);
- *Wildlife Conservation Act 1950* (WC Act);
- Red List of Threatened Species Archives produced by the International Union for Conservation of Nature (IUCN); and
- DBCA Priority Fauna list (DBCA 2018a).

The EPBC Act requires the compilation of a list of migratory species that are recognised under international treaties including:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA);
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

The conservation status of all vertebrate fauna species listed as occurring or possibly occurring in the vicinity of the site has been assessed using the most recent lists published in accordance with the above-mentioned databases.

The assessment for conservation significant invertebrates has been limited to those listed by the DBCA and EPBC Act database searches (which rely on distribution records and known habitat preferences). No assessment of the potential for Short Range Endemics (SREs) to be present was made.

5.1.3. Likelihood of occurrence

Fauna of conservation significance identified during the literature review as previously being recorded in the general area were assessed and ranked for their likelihood of occurrence within the site itself. The rankings ranged from 'would not occur' to 'known to occur'. Fauna species identified as, 'unlikely to occur' indicates; the site is outside of the currently documented distribution for the species in question, or no suitable habitat (type, quality and extent) was identified as being present during the field assessment. Individuals of some species may occur occasionally as vagrants/transients especially if suitable habitat is located nearby but the site itself would not support individuals or a population the species.

5.2. Field survey methodology

5.2.1. Targeted black cockatoo habitat assessment

A daytime reconnaissance survey of the site was carried out by Greg Harewood (Zoologist) on 12 August 2018. A dusk black cockatoo roost survey was carried out in the evening of the same day. The purpose of the field survey was to determine whether it was likely that three species of threatened black cockatoo; Carnaby's black cockatoo, forest red-tailed black cockatoo and Baudin's black cockatoo, would be utilising the areas that may be impacted on as a consequence of clearing native vegetation within the site.

Opportunistic observations of fauna species were made during the assessment. Methods involved traversing a series of transects across the site during the day while searching microhabitats such as logs, rocks, leaf litter and observations of bird species with binoculars. Secondary evidence of species presence (i.e. tracks, scats, skeletal remains, foraging evidence or calls) were noted.

5.2.2. Black cockatoo breeding habitat assessment

The assessment of black cockatoo breeding habitat involved the identification of all suitable breeding trees (native, endemic species only) within the site that had a diameter at breast height (DBH) of equal to or over 500 millimetres (mm). The location of each tree identified as being over the threshold DBH was recorded with a GPS and details on tree species, number and size of hollows (if any) was noted. These trees were re-examined to further assess the likelihood of any hollows present being suitable for black cockatoo nesting. Identified hollows were examined using binoculars and/or a drone for evidence of actual use by black cockatoos (i.e. chewing around hollow entrance). Trees with possible nest hollows were scratched and raked with a large stick in attempt to flush any sitting birds from hollows and calls of chicks were listened for.

5.2.3. Black cockatoo foraging habitat assessment

The location and nature of black cockatoo foraging evidence (i.e. chewed fruits around the base of trees) observed during the targeted black cockatoo assessment was photographed and recorded.

5.2.4. Black cockatoo roosting habitat assessment

Direct and indirect evidence of black cockatoos roosting in trees within the site (i.e. branch clippings, droppings, moulted feathers) was noted during the single dusk survey. Data from the *Great Cocky Count* was reviewed to determine the location/extent of any likely black cockatoo roosting habitat areas in the vicinity of the site (Birdlife Australia 2018).

5.3. Survey constraints

No seasonal sampling has been carried out as part of this targeted black cockatoo habitat assessment. The conclusions presented are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore indicative of the environmental condition of the site at the time of the field assessments. It should be recognised that site conditions can change with time.

A lack of observational data collected from the field investigations does not conclusively indicate that a species is absent from the site or does not utilise the site at various times. Opportunistic observations of black cockatoo species may not have been detected due to:

- Seasonal inactivity during the field survey;
- Species present within micro habitats not surveyed;
- Cryptic species able to avoid detection; and
- Transient wide-ranging species not present during the survey period.

The habitat requirements and ecology of many of the species known to occur in the wider area are often not well understood or documented. It can therefore be difficult to exclude species from the potential list based on an apparent lack of a specific habitat or microhabitat within the site. As a

consequence of this limitation the potential fauna list produced is most likely an overestimation of those species that truly utilise the site for some purpose. Some species may be present in the general area but may only use the site itself on rare occasions or as vagrants/transients.

In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any fauna species that would possibly occur within the site (or immediately adjacent), as identified through ecological databases, publications, discussions with local experts/residents and the habitat knowledge of the surveyor, has been assumed to potentially occur in the site.

During the black cockatoo habitat survey, trees (≥ 500 mm DBH) with hollows were searched for. It should be noted that the characteristics (i.e. internal dimensions) of any hollow identified, are an estimation. Due to the hidden nature of some hollows, there is a possibility that the identification of hollows is limited as not all are observable.

6. RESULTS AND DISCUSSION

6.1. General site conditions

The site is generally flat and low lying, with localised sandy rises. The site has historically been cleared and grazed by livestock, and more recently grazed by western grey kangaroos. Consequently, much of the site comprises pastures with scattered individual or patches of native trees.

The fauna habitat of the site is well below levels present prior to historical disturbances having occurred. Despite the lack of biodiversity, the site still retains some value for a small number of conservation significant fauna species, in particular the three species of threatened black cockatoo (Carnaby's black cockatoo, forest red-tailed black cockatoo and Baudin's black cockatoo), though the habitat suitable for these species is relatively limited in extent and fragmented. Individual remnant native trees within the site may support fauna habitat suitable for black cockatoos. However these trees are utilised generally by common and widespread fauna species with non-specific requirements which allow them to persist in disturbed/highly disturbed habitats.

6.2. Flora and vegetation

The site area covers 11.83 ha. While the majority of the site is identified as being in a 'completely degraded' condition, there is approximately 0.81 ha of native vegetation which consists of scattered native trees. The scattered native vegetation consists of small pockets of native overstorey over a largely weed dominated understory.

A total of 3 native and 34 non-native (weed) species were recorded within the site during the field survey, representing 16 families and 37 genera. The dominant families containing native taxa were *Myrtaceae* (two native taxa) and *Xanthorrhoeaceae* (one native taxon). The family containing the most taxa was *Poaceae* (11 non-native species). All 37 plant species were recorded opportunistically by botanists in the field. A complete species list is provided in **Appendix A.**

6.2.1. Threatened and priority flora

No threatened or priority flora species were recorded within the site. The site was traversed in detail by the botanists in July (within the main flowering period).

6.2.2. Declared pests

Four species listed as declared pests pursuant to the BAM Act, as outlined in **Table 5** were recorded in the site.

Table 5: WoNS and declared pest plants recorded in the site

Species	Status
	BAM Act
**Moraea flaccida* (one-leaf cape tulip)	Declared pest – s22(2) (exempt)
**Solanum linnaeanum* (apple of Sodom)	
**Zantedeschia aethiopica* (arum lily)	
*Phytolacca octandra	

6.2.3. Plant communities

The site was observed to be characterised by heavily disturbed areas containing non-native grasses with occasional native trees, which was not identified as comprising a native plant community. Whilst no native plant communities were identified within the site, the cleared areas were broken down into two separate communities. These are described in **Table 6** and illustrated in **Figure 2.**

Table 6: Plant communities present within the site.

Plant community	Description	Area (ha)
Parkland cleared	Parkland cleared areas consisting of scattered *Corymbia calophylla*, *Eucalyptus rudis* and *Melaleuca* spp trees, bare ground non-native vegetation **(Plate 1).**	0.81
Cleared	Cleared areas consisting of bare ground or non-native vegetation **(Plate 2).**	11.02

Plate 1: Individual scattered native trees forming 'Parkland cleared' plant community within the site in 'completely degraded' condition

Plate 2: 'Cleared' plant community within the site in 'completely degraded' condition

6.2.4. Vegetation condition

The majority of the site was predominantly cleared prior to 1953, with vegetation reduced to scattered trees with limited cover. Past disturbance is significant and the lack of understorey suggests these parts of the site has been used for stock grazing and/or cleared. Consequently the vegetation is in completely degraded condition, and would require intensive management to

revegetate. The extent of vegetation by condition category is detailed in **Table 7** and shown on **Figure 3**.

Vegetation condition within the site was assessed by Emerge Associates. The method applied to assess vegetation condition was robust, as it combined the standard qualitative, categorical scheme of Keighery (1994), with the additional indicators for diversity and weed cover outlined in DoEE (2016). The entire extent of vegetation within the site was determined to be in a 'completely degraded' condition and is dominated by non-native flora species, as shown in **Figure 3.** The more intact plant communities were present external to the study site, within the broader Brabham landholdings, associated with St Leonard's Creek.

Table 7: Vegetation condition categories within the site

Condition category (Keighery (1994))	Size (ha)
Pristine	0
Excellent	0
Very good	0
Good	0
Degraded	0
Completely degraded^	11.83

6.2.1. Floristic community type

The two plant communities within the site; **Parkland cleared** and **Cleared**, were not assigned to a FCT. The scattered native vegetation consisting of *Corymbia calophylla*, *Eucalyptus rudis* and *Melaleuca* spp trees does not represent an intact vegetation community and was too degraded to represent a FCT in its current state.

6.2.2. Threatened and priority ecological communities

No threatened ecological communities or priority ecological communities occur within the site.

6.2.3. Local and regional significance

The scattered large, mature eucalypt trees (≥ 500 mm DBH) are likely to be locally and/or regionally significant. Due to their size, these trees have the potential to provide foraging, roosting and nesting habitat for black cockatoos (especially forest red-tailed black cockatoo), along with other ecological services.

6.3. Fauna

6.3.1. Vertebrate fauna of conservation significance

In total of 40 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the site during the survey period. Three introduced species (spotted turtle dove, little corella and laughing kookaburra) were also recorded. Most of the fauna species recorded were common, widespread bird species.

Three vertebrate fauna species of conservation significance were positively identified as utilising the site for some purpose during the survey period, listed below;

- *Calyptorhynchus latirostris* Carnaby`s Black Cockatoo – S2 (WC Act), Endangered (EPBC Act). Some foraging evidence attributed to this species was found during field survey (chewed banksia cones). The small areas of remnant native vegetation containing marri and jarrah within the site represents foraging habitat for this species. No actual nest sites were found however larger native endemic trees (≥ 500 mm DBH) can be considered potential breeding habitat. No evidence of roosting seen.
- *Calyptorhynchus banksii naso* Forest Red-tailed Black Cockatoo – S3 (WC Act), Vulnerable (EPBC Act). Foraging evidence attributed to this species was also found (chewed marri fruits). The small areas of remnant native vegetation containing marri and jarrah (in addition to some scattered individual trees) within the site represents foraging habitat for this species. No actual nest sites were found however larger native endemic trees (≥ 500 mm DBH) can be considered potential breeding habitat. No evidence of roosting seen.
- *Calyptorhynchus baudinii* Baudin`s Black Cockatoo – S2 (WC Act), Endangered (EPBC Act), Some foraging evidence attributed to this species was found during field survey (chewed marri fruits). The small areas of remnant native vegetation containing marri and jarrah (in addition to some scattered individual trees) within the site represents foraging habitat for this species. No actual nest sites were found however larger native endemic trees (≥ 500 mm) can be considered potential breeding habitat. No evidence of roosting seen.

6.3.2. Invertebrate fauna of conservation significance

Four invertebrate species of conservation significance appeared in the DBCA database search (DBCA 2018b); a native bee (*Leioproctus douglasiellus*), the graceful sunmoth (*Synemon gratiosa*), the Guildford springtail *(Australotomurus morbidus)* and Carter's freshwater mussel (*Westralunio carteri*).

The above species are considered unlikely to persist within the site due to a total absence of suitable habitat, local extinction and/or because the area is outside of their currently documented range.

6.3.3. Targeted black cockatoo habitat assessment

A summary of the potential black cockatoo breeding trees (using DotEE criteria i.e. any suitable tree species with a DBH ≥ 500 mm (Commonwealth of Australia 2012)) observed within the site is provided in **Table 8** below and their location shown in **Figure 4.**

Table 8: Summary of potential cockatoo breeding habitat trees (DBH ≥500 mm)

Total Number of Habitat Trees	Number of Trees with No Hollows Considered Suitable for Nesting Black Cockatoos	Number of Trees with Hollows Considered Possibly Suitable for Nesting Black Cockatoos	Tree Species				
			Stags	Marri	Flooded Gum	Jarrah	Coastal Blackbutt
2	2	0	0	2	0	0	0

The assessment identified a total of two *Corymbia calophylla* (marri) trees with a DBH of ≥ 500 mm within the site. On further inspection, both trees were identified containing hollows. None of the hollows were considered suitable to use for black cockatoo nesting. The observations recorded during the field survey are provided below;

- Tree 1, located in the northern portion of the site contained a large 'knot hole' in use at the time by *Anas gracilis* (grey teal duck). The entrance was restricted by protruding wood and appeared too shallow for the use of cockatoos. No evidence of previous use by black cockatoos was recorded.
- Tree 2, located within the southern portion of the site contained a top entry hollow which capered to be too low and shallow for the use of cockatoos. No evidence of previous use by black cockatoos was recorded.

Given the apparent lack of actual nesting trees and a relative small number of potential breeding habitat trees, any proposed development within the site is unlikely to have significant direct or indirect impact on breeding black cockatoos. It is therefore unlikely to significantly impact on the total potential breeding habitat resources available in the wider area.

6.3.4. Black cockatoo foraging assessment

The following is a list of the main flora species recorded within the wider Brabham landholdings during the flora and vegetation survey (Emerge Associates 2018) that are known to be used as a direct food source (i.e. seeds or flowers) by one or more species of black cockatoo:

- Marri – *Corymbia calophylla;*
- Jarrah – *Eucalyptus marginata;*
- Coastal Blackbutt – *Eucalyptus todtiana;*
- Flooded Gum – *Eucalyptus rudis;*
- Banksia species *(B. attenuata, B ilicifolia and B menziesii);*
- Sheoak – *Allocasuarina fraseriana;*
- Balga – *Xanthorrhoea preissii (and possibly X. gracilis X. brunonis);*
- Variable-leaved Hakea – *Hakea varia*; and
- Guildford or Onion Grass - *Romulea rosea.*

There is limited area of potential foraging vegetation comprising of *Corymbia calophylla* (Marri), *Eucalyptus marginata* (Jarrah) and *Eucalyptus rudis* (Flooded Gum), covering 0.81 ha of the site. The site does not represent a significant foraging resource due to the limited extent and fragmented nature of the scattered native trees. Based on available vegetation mapping, it is estimated that there is approximately 8 750 ha of native vegetation within 10 km the site, much of which is likely to contain more favourable foraging habitat for black cockatoos.

The results suggest that the proposed removal of the vegetation from the site is unlikely to have a significant impact on the availability of foraging resources for black cockatoos in the general area.

6.3.5. Black cockatoo roosting assessment

No evidence of roosting activity within the site was recorded during the survey period.

A review of the *Great Cocky Count* database shows no documented roost sites within the site, the closest active roost being approximately 3 km south-west. This site was in use by 36 red-tailed black cockatoos during the *Great Cocky Count* conducted in April 2018. Another 27 documented roost sites (but not necessarily in current use) occur within 10 km of the site (Birdlife Australia 2018).

The results suggest that the potential removal of some of the vegetation from the site is unlikely to have a significant impact on the availability of roosting habitat for black cockatoos in the general area.

7. CONCLUSIONS

7.1. Flora and Vegetation Survey

The majority of vegetation within the site is highly disturbed and modified. Approximately 11.02 ha of the site consists of non-native vegetation in a 'completely degraded' condition. The remaining 0.81 ha of the site includes scattered native vegetation consisting *of Corymbia calophylla, Eucalyptus rudis* and *Melaleuca spp trees,* with bare ground non-native vegetation that is present in a 'completely degraded' condition (Emerge Associates 2019).

No threatened or priority flora species were found to occur within the site.

No TECs or PECs were considered to occur within the site.

The scattered large, mature eucalypt trees may be locally or regionally significant due to their size ($\geq$ 500 mm DBH). These trees have the potential to provide foraging, roosting and nesting habitat for black cockatoos.

7.2. Fauna Survey

The targeted black cockatoo field assessment indicated habitat values for threatened black cockatoo species were found in two potential habitat trees ($\geq$ 500 mm DBH) with hollows. The hollows were inspected by drones and no evidence was found to indicate use by black cockatoos for roosting or breeding (Harewood 2018). The site does not represent a significant black cockatoo foraging habitat due to the limited extent and fragmented nature of the scattered native trees.

Within the site, there are limited fauna habitat values remaining. The scattered native vegetation present is in a 'completely degraded' condition and lacks significant native groundcover/shrubs or microhabitats such as hollow logs, and therefore the vegetation within the site doesn't represent fauna habitat of a significant value (Harewood 2018). Existing areas of remnant vegetation in an intact condition are located in close proximity to the site, to the west (Whiteman Park) and to the immediate south of the site (Bush Forever Site No. 200).

FIGURES

APPENDICES

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Figures

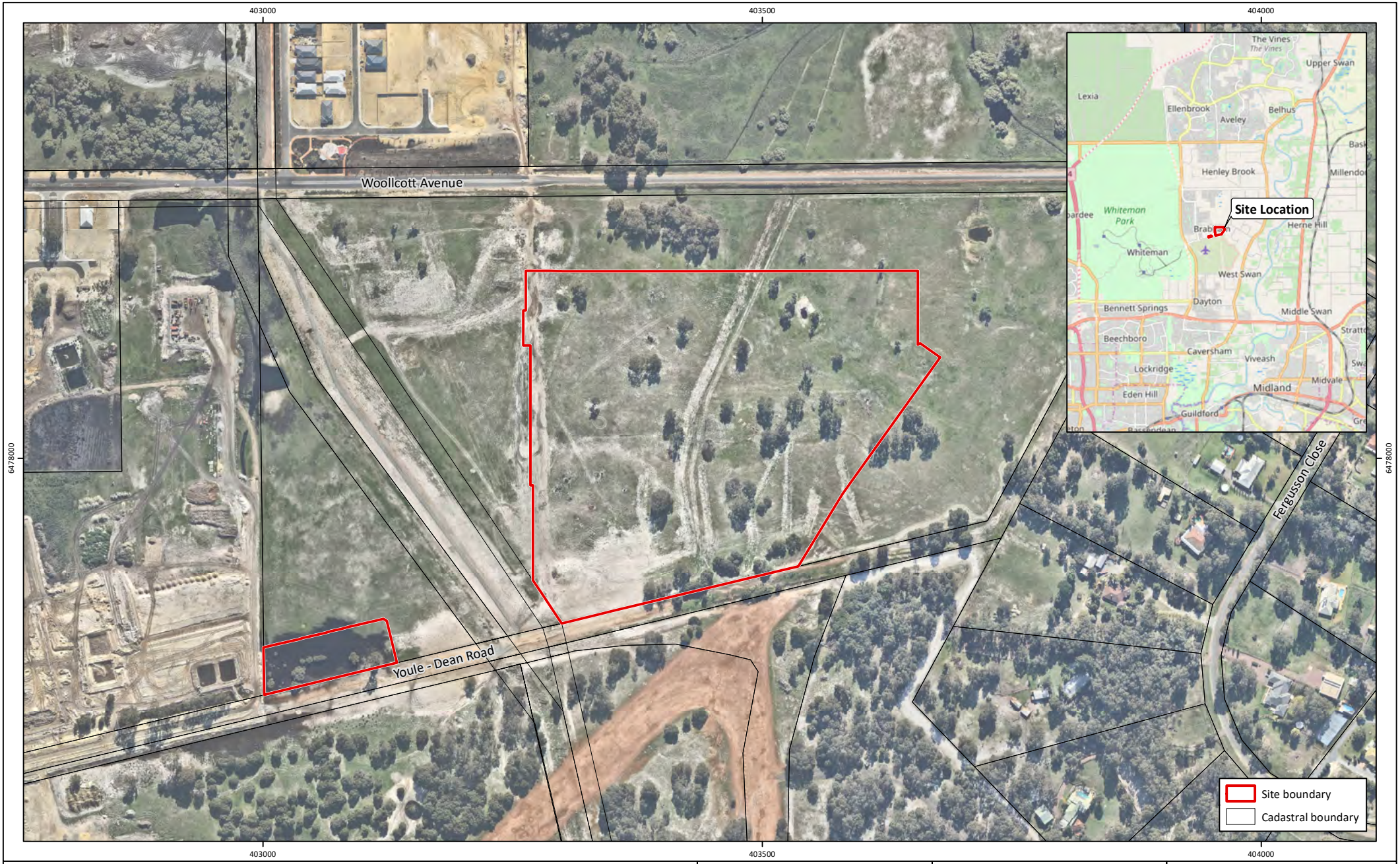

Figure 1: Site Location

Project:	Flora and Vegetation Survey and Fauna Survey Technical Memorandum Phase 1 Bulk Earthworks
Client:	Department of Communities and Peet Limited

Plan Number:
EP17-131(22)--F80

Drawn:	SCM
Date:	29/01/2019
Checked:	TAA
Approved:	TAA
Date:	08/02/2019

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Metres

Scale: 1:5,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

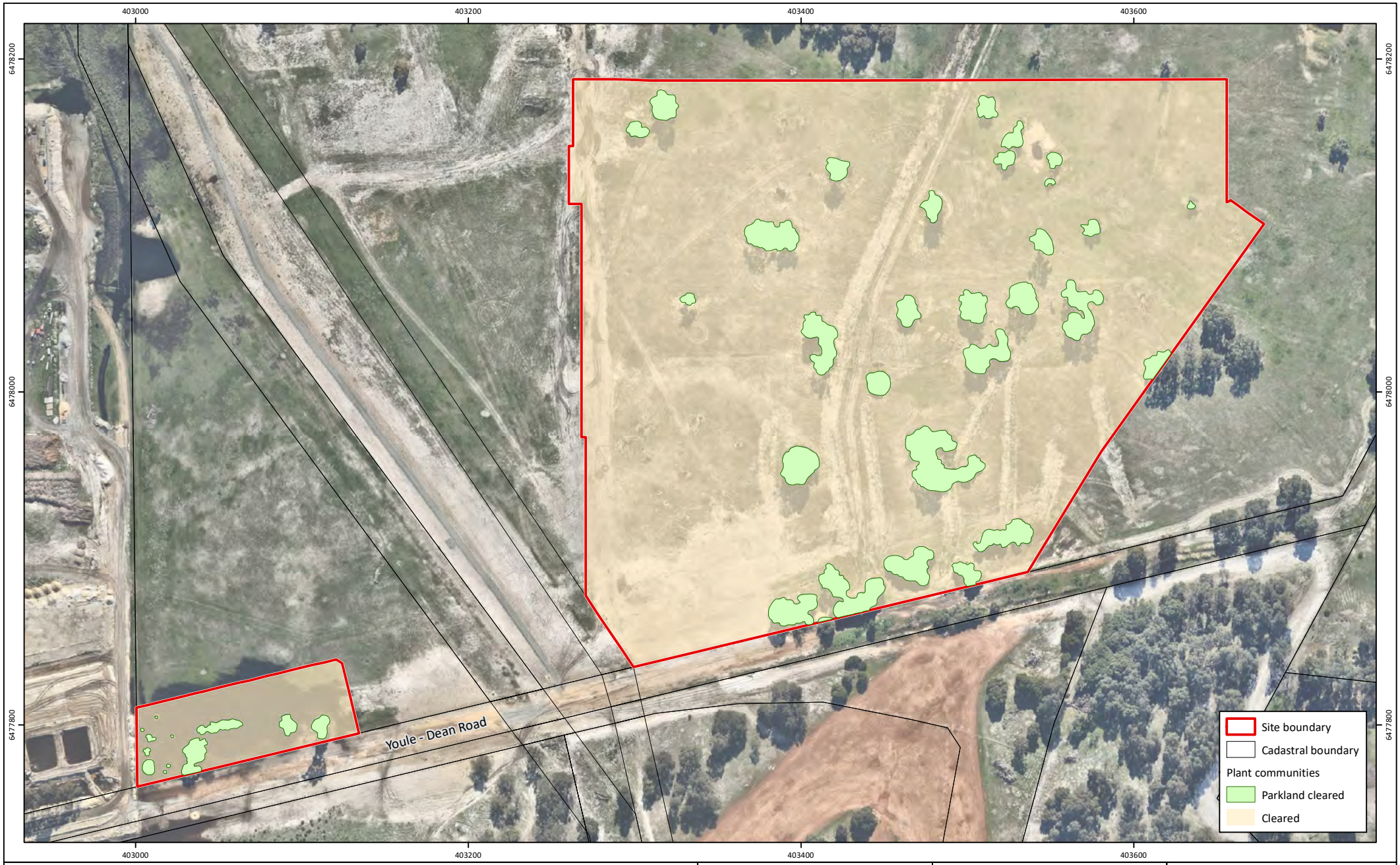

Figure 2: Plant Communities

Project:	Flora and Vegetation Survey and Fauna Survey Technical Memorandum Phase 1 Bulk Earthworks
Client:	Department of Communities and Peet Limited

Plan Number:
EP17-131(22)--F81

Drawn:	SCM
Date:	29/01/2019
Checked:	TAA
Approved:	TAA
Date:	08/02/2019

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emerge ASSOCIATES

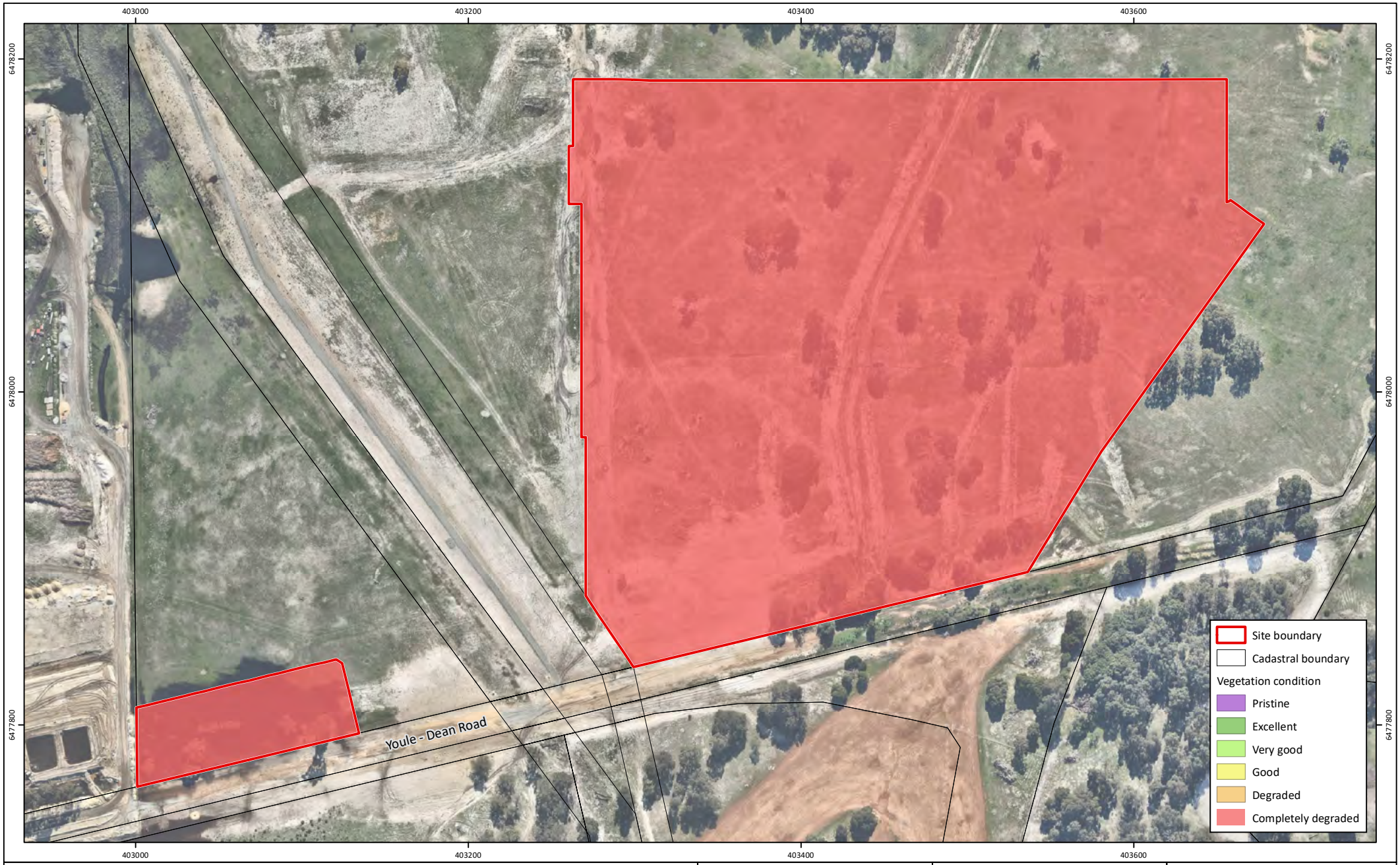

Figure 3: Vegetation Condition

Project: Flora and Vegetation Survey and Fauna Survey Technical Memorandum
Phase 1 Bulk Earthworks

Client: Department of Communities and Peet Limited

Plan Number:
EP17-131(22)--F82

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Date:	29/01/2019
Checked:	TAA
Approved:	TAA
Date:	08/02/2019

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emerge ASSOCIATES

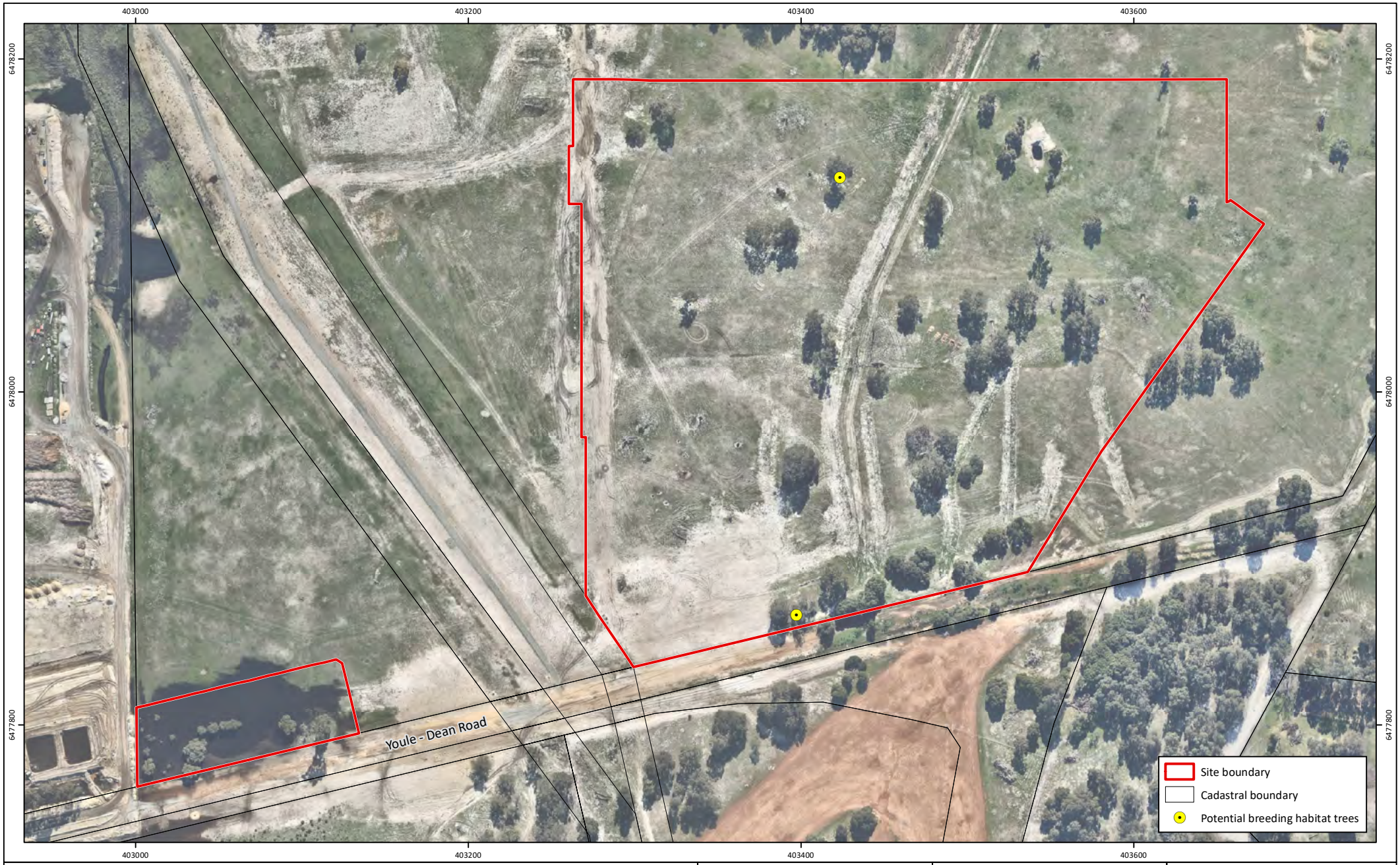

Figure 4: Potential Black Cockatoo Breeding Habitat Trees

Project:	Flora and Vegetation Survey and Fauna Survey Technical Memorandum Phase 1 Bulk Earthworks
Client:	Department of Communities and Peet Limited

Plan Number:
EP17-131(22)--F83

Drawn:	SCM
Date:	29/01/2019
Checked:	TAA
Approved:	TAA
Date:	08/02/2019

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0 50 100
Metres

Scale: 1:3,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Attachment 1

Species List

Vascular Flora Species List - Brabham Clearing Permit Area

Note: * denotes introduced (weed) species, D denotes declared pests

Family	Species
Araceae	
	D *Zantedeschia aethiopica*
Asteraceae	
	* *Arctotheca calendula*
	* *Conyza bonariensis*
	* *Cotula coronopifolia*
	* *Hypochaeris glabra*
	* *Ursinia anthemoides*
Brassicaceae	
	* *Heliophila pusilla*
Cucurbitaceae	
	* *Citrullus amarus*
Fabaceae	
	* *Lotus subbiflorus*
	* *Lupinus angustifolius*
Geraniaceae	
	* *Geranium molle*
Iridaceae	
	* *Hesperantha falcata*
	D *Moraea flaccida*
	* *Romulea rosea*
Lobeliaceae	
	* *Monopsis debilis*
Myrtaceae	
	Corymbia calophylla
	Melaleuca preissiana
Phytolaccaceae	
	D *Phytolacca octandra*
Plantaginaceae	
	* *Bacopa monnieri*
	* *Gratiola pubescens*
Poaceae	
	* *Avena barbata*
	* *Briza maxima*
	* *Bromus diandrus*
	* *Bromus madritensis*

* *Cynodon dactylon*
* *Ehrharta calycina*
* *Ehrharta longiflora*
* *Lagurus ovatus*
* *Paspalum dilatatum*
* *Poa annua*
* *Tribolium uniolae*

Polygonaceae

* *Rumex crispus*

Primulaceae

* *Lysimachia arvensis*

Rubiaceae

* *Galium murale*

Solanaceae

* *Solanum linnaeanum*
* *Solanum nigrum*

Xanthorrhoeaceae

Xanthorrhoea brunonis