Urban Resources

Karnup Sand Mining Project

Native Vegetation Clearing Permit application

10 May 2021

59049-130383 (Rev 2)

JBS&G Australia Pty Ltd T/A Strategen-JBS&G

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Appendix A Karnup Sand Mining Project Environmental Investigations (Strategen 2015a)
Appendix B Targeted threatened orchid survey (Strategen 2015b)
Appendix C Native Vegetation Clearing Permit Application Form (Purpose Permit)

1. Introduction

1.1 Applicant

This Native Vegetation Clearing Permit (NVCP) application applies to clearing associated with the Karnup Sand Mining Project proposed by Urban Resources Pty Ltd (Urban Resources). The contact for Urban Resources is:

Subject	Detail
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Company	Urban Resources
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1.2 Purpose and scope

Urban Resources is proposing to undertake the Karnup Sand Mining Project (the Project) within Mining Tenement M70/1262. M70/1262 is currently held by Eclipse Resources; however, Urban Resources proposes to mine within the tenement as part of a sub-lease arrangement. As shown in Figure 1, Mining Tenement M70/1262 extends to the eastern side of the Freeway. Mining is not proposed in this area in response to the environmental values present. The Mining Proposal and Mine Closure Plan (MCP) for the project has been approved by the Department of Minerals and Petroleum (DMP).

The Project was previously referred under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and a decision of 'Not a Controlled Action' (EPBC 2015/7533) was made.

The mining activity and associated Project disturbance footprint is limited to 32.47% of the site, focussing on the highest value resource and avoiding impact to the wetlands on site and the associated wetland buffer.

This document, prepared to support the application for a Clearing Permit (Purpose Permit; Appendix C) through the Department of Mines, Industry Regulation and Safety [DMIRS]) under Section 51E of the *Environmental Protection Act 1986* (EP Act), includes:

- An outline of existing environmental conditions of the site
- An evaluation of potential impacts of the vegetation clearing
- Management measures and rehabilitation
- An evaluation of compliance of the proposed clearing against the 10 clearing principles listed under Schedule 5 of the EP Act.

1.3 Location and timing

The Project is located approximately 48 km south of the Perth CBD and is bound by Stakehill Road to the north, Kwinana Freeway to the east, Mining Tenements M70/1046 (Holcim) and M70/1241 (Holcim) to the west and Amarillo Drive to the south (see Figure 1). The Project area is defined as the portion of M70/1262 west of the Kwinana Freeway boundary, as shown in Figure 1, and will include the mining area, haul road, site compound and undisturbed land. The proposed mining area is adjacent to the western Project area boundary.

Mining activities are anticipated to commence in Q4 2021. Mining is expected to continue for up to five years, followed by decommissioning and rehabilitation to a form that is consistent with the site's

combination of areas zoned for Urban Deferred development and Parks and Recreation. DevelopmentWA represents the State's requirement to develop significant areas of the site for residential development, and the City of Rockingham have proposed overlapping areas for regional sporting facilities and open space associated with the broader regional catchment. Subject to the final requirements of the State, the areas will contain a mix of Urban Development, Regional Infrastructure, parklands suitable for active recreation.

1.4 Relevant legislation and policy

Western Australian legislation and regulations relevant to this NVCP application includes:

- Biosecurity and Agriculture Management Act 2007
- Bush Fires Act 1954
- Conservation and Land Management Act 1984
- Environmental Protection Act 1986 (EP Act)
- Environmental Protection (Clearing of Native Vegetation) Regulations 2004
- Environmental Protection (Noise) Regulations 1997
- Mining Act 1978
- Road Traffic (Vehicle Standards) Regulations 2002
- Biodiversity Conservation Act (BC Act).

Federal Government legislation and Guidance relevant to this NVCP application includes:

- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
- Draft Survey Guidelines for Australia's threatened orchids (Commonwealth of Australia 2013).

The following EPA guidelines and position statements are relevant to survey practices:

- EPA Guidance Statement No. 51–Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2016)
- EPA Guidance Statement No. 56–Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA 2004)
- EPA Position Statement No. 3–Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002).

All surveys commissioned for the purposes of assessing the environmental impact of the Project conformed to these guidelines as they were at the time of the survey.

Conservation status under the EPBC Act was also considered.

1.5 Proposed development

The Project footprint is 41.89 ha (including the mining area, haul road, stockpiles and site compound; Figure 1). The area of vegetation proposed to be cleared for the Project comprises 30.83 ha. The majority of vegetation proposed to be impacted is regrowth, post clearing of the former pine plantation.). Clearing is required to facilitate sand mining within the Project area, including the following key disturbance:

- Mining area, including:
    - Topsoil and vegetative stockpiles
    - Haul road.

- Site compound, including:
    - Site office and administration
    - Generator and storage
    - Refuelling pad and equipment storage / workshop
    - Visitor and staff parking.

Vegetation clearing will involve the stripping of vegetation and topsoil. Vegetation and topsoil material will be stockpiled separately for potential use in later revegetation if and as required.

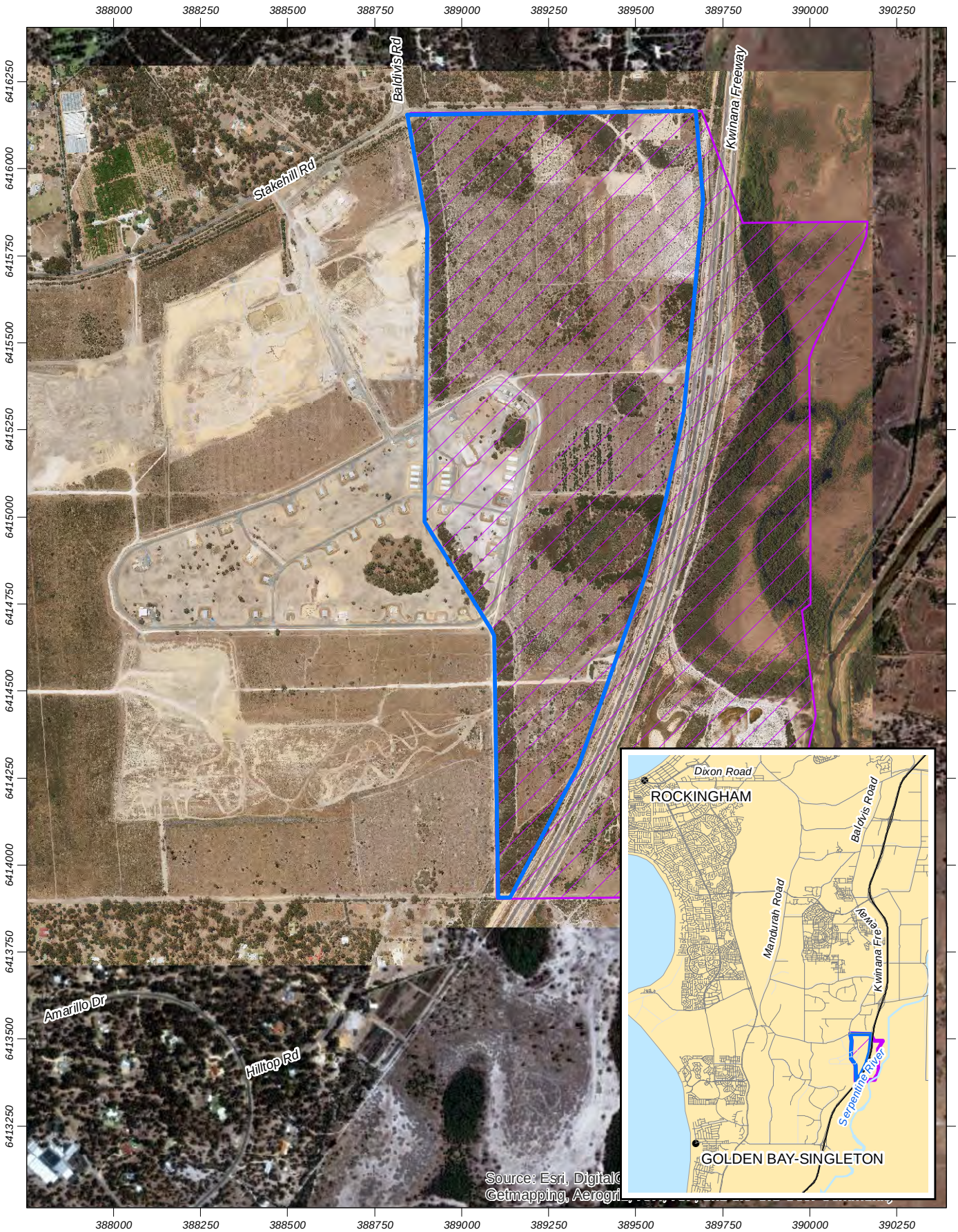

Figure 1: Regional location of the Project

Scale 1:15,000 at A4

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 30/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Aerial image background: ESRI approx. 2010.

Legend

- Project area
- Tenement M70/1262

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Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R003\RevA\URE15096_01_R003_RevA_F001.mxd

2. Existing environment

2.1 Geology, landform and soils

The Project area is located within the Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion) of Western Australia (Mitchell et al. 2002). The Swan Coastal Plain comprises five major geomorphological systems that lie parallel to the coast, namely (from west to east) the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf (Churchward & McArthur 1980; Gibson et al. 1994). Each major system is composed of further subdivisions in the form of detailed geomorphological units (Churchward & McArthur 1980; Semeniuk 1990; Gibson et al. 1994). Beard (1990) describes the Swan Coastal Plain as a low-lying coastal plain, often swampy, with sand hills also containing dissected country rising to the duricrust Dandaragan plateau on Mesozoic, mainly sandy, yellow soils.

The Project area is situated predominately on Bassendean sand with topography varying from two mAHD to 10 mAHD. The Project area predominantly comprises light grey sand at the surface, becoming yellow with depth. The sand is fine to medium grained, sub-rounded, moderately well sorted sand of aeolian origin (Golder Associates 2006a). The low-lying land adjacent to the Serpentine River comprises a strong brown to light grey clay with variable silt content and is of alluvial origin (Golder Associates 2006a).

The topography of the Project area is influenced by a north-south ridge located along the western Project area boundary and a gentle slope towards the banks of the Serpentine River in the east (Golder Associates 2006a). The Project area remains relatively consistent with the pre-plantation topography and elevations vary between approximately 2 mAHD and 13 mAHD.

The six-wetland areas within the Project area are shown to be underlain by dark grey and black peaty clay with variable organic content and some sand in places. Acid Sulfate Soils (ASS) may exist within 3 m of the surface in the lowest lying areas of the site (Golder Associates 2006a).

A search of the WA Atlas ASS Swan Coastal Plain risk map (Land gate 2015) (search conducted 21 April 2015) located six areas classified as Class 1 (High to Moderate risk of ASS occurring within 3 m of natural soil surface) within the Project area. These six areas are related to the wetlands present within the Project area. The remaining balance of the Project area is classified as Class 2 (Moderate to Low risk of ASS occurring within 3 m of natural soil surface).

2.2 Flora and vegetation

2.2.1 Studies undertaken

Strategen (now Strategen-JBS&G) undertook a Level 1 flora survey of a 94.94 ha area (the Survey area) in May 2015 (Figure 2), which included a desktop study and a field assessment (Appendix A). The Survey area incorporates the Project area, excluding the Baldivis Explosives Reserve six small wetlands (Figure 1). The Baldivis Explosives Reserve forms part of the Project area, however this area was not surveyed due to access restrictions. Vegetation to be disturbed within the Explosives Reserve was observed from the boundary. The vegetation type was inferred from these observations and a review of aerial photography.

In response to a request for additional information from the Commonwealth Department of the Environment (now Department of Agriculture, Water and the Environment), a targeted orchid survey of the Survey Area was undertaken by Strategen in September 2015 (Appendix B), including a site reconnaissance to determine potential suitable orchid habitat followed by a targeted transect survey in accordance with *Draft survey guidelines for Australia's Threatened Orchids* (DotE 2013).

Previous flora and vegetation studies have been undertaken for other projects in the Project area and surrounds as described in Table 1.

Table 1: Previous studies undertaken within the Project area and surrounds

Author (year)	Year	Title	Scope
Bennett Environmental Consulting	2006	*Flora and Vegetation of Baldivis Explosives Reserve*	Record the vegetation units and associated species, search for significant plant species and record the presence of any Threatened Ecological Community in remnant wetland vegetation of the of the Baldivis Explosives Reserve.
Strategen	2008	*Baldivis Explosives Reserve Environmental Constraints and Opportunities Analysis*	Assessment of environmental issues, constraints and opportunities associated with undertaking sand extraction activities in the Baldivis Explosives Reserve and subsequently development for residential purposes.
Strategen	2010	*Karnup (Baldivis Explosives Reserve) Development Land Wetland values and buffer assessment*	Assessment of existing management categories applied by the Department of Environment and Conservation (DEC) to wetlands within the Baldivis Explosives Reserve and surrounding allotment; determination of appropriate buffer provisions for the wetlands.
MUJA & ARE Bamford Consulting Ecologists	2006	*Fauna Values of the Wetland and Bushland Remnants within the Pine Plantation south of Stakehill Road, Karnup*	Develop an understanding of fauna habitats within remnant vegetation of the study area.

2.2.2 Flora

A desktop assessment identified 108 native vascular plant taxa from 40 plant families that have the potential to occur within the vicinity of the Project area, the majority of taxa were from within the *Cyperaceae* (15 taxa), *Myrtaceae* (9 taxa) and *Fabaceae* (8 taxa) families (Strategen 2015; Appendix A).

41 native vascular plant taxa from 34 genera were recorded in the Survey area. Six introduced species were also recorded.

2.2.2.1 Databases searches

Database searches of NatureMap and the Department of Parks and Wildlife (DPaW; now Department of Biodiversity, Conservation and Attractions [DBCA]) Threatened Flora Database were undertaken to determine whether any Threatened or Priority flora species are known from within a 5 km radius of the Project area. Results of the database searches are presented in Figure 4. Desktop and database searches identified 18 Threatened and Priority flora species as potentially occurring within the Project area as outlined in Table 2; however, only three Threatened flora species (*Caladenia huegelii, Drakaea elastica* and *Drakaea micrantha*) and four Priority flora species (*Cardamine paucijuga, Sphaerolobium calcicola, Dillwynia dillwynioides* and *Jacksonia sericea*) were considered to have the potential to occur in the Project area based on specific habitat requirements (Strategen 2015; Appendix A).

Table 2: Threatened and Priority flora potentially occurring within the Project area

Species	Conservation status		Description	Potential to occur
	EPBC Act	BC Act / DBCA listing		
Andersonia gracilis	**Threatened** - Endangered	Threatened	A slender shrub to 50 cm tall with few, spreading branches. Flowers are pink to pale mauve. Habitat for this species occurs within seasonally damp, black sandy clay flats near swamps (Western Australian Herbarium 1998-, DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Project area– wetland areas will not be impacted by the proposed mining.
Caladenia huegelii	**Threatened** – Endangered	Threatened	A slender orchid from 30 to 50 cm tall. One or two striking flowers characterised by a greenish-cream lower petal with a maroon tip. Other petals are cream with red or pink suffusions. Habitat for this species occurs within well-drained, deep sandy soils in low mixed Banksia, Allocasuarina and Jarrah woodlands (Western Australian Herbarium 1998, DotE 2015e).	**Possible –** Preferred soil type/habitat occurs within the Project area.
Centrolepis caespitosa	**Threatened** – Endangered	Priority 4	A diminutive, densely tufted, glabrous annual herb. Flowers are red/brown and are singular. Habitat for this species is relatively unknown. Brown et al. (1998) identified that this species occurs within winter-wet claypans dominated by low shrubs and sedges.	**Unlikely –** Preferred soil type/habitat does not occur within the Project area– wetland areas will not be impacted by the proposed mining. DBCA has removed this species from its Threatened flora listing and is now classed as Priority 4.
Darwinia foetida	**Threatened** – Critically Endangered	Threatened	An erect, spreading shrub to 70 cm tall. Green flowers, visible from October to November. Habitat for this species occurs within wet/winter-damp clay under Myrtaceous shrubland (DotE 2015e).	**Highly unlikely –** Preferred habitat does not occur within the Project area as wetland areas will not be impacted by the proposed mining. Both Western Australian Herbarium (1998) and DotE (2015e) list this species' distribution to be highly restricted within the Muchea area (approximately 70 km north of Perth).
Diuris drummondii	**Threatened** – Vulnerable	Threatened	A perennial orchid to 105 cm tall. Often forms dense colonies with individuals displaying between three and eight widely spaced yellow flowers. Habitat for this species occurs in low-lying depressions in peaty and sandy clay swamps (DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Project area– wetland areas will not be impacted by the proposed mining.
Diuris micrantha	**Threatened** – Vulnerable	Threatened	A slender orchid to 60 cm tall. Yellow flowers with reddish-brown markings measuring 1.3 cm across. Habitat for this species occurs within clay-loam substrates in winter-wet depressions or swamps (DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Project area– wetland areas will not be impacted by the proposed mining.
Diuris purdiei	**Threatened** – Endangered	Threatened	A slender orchid to 45 cm tall. Unusually flattened flowers, marked with brown blotches on their under surface. Habitat for this species occurs in areas subject to winter inundation within dense heath with scattered Myrtaceous trees (DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Project area – wetland areas will not be impacted by the proposed mining.
Drakaea elastica	**Threatened** – Endangered	Threatened	A slender orchid to 30 cm tall with a prostrate, round to heart shaped leaf. Singular, bright green, glossy flower. Habitat for this	**Possible –** Preferred soil type/habitat occurs within the Project area.

Species	Conservation status		Description	Potential to occur
	EPBC Act	BC Act / DBCA listing		
			species is within bare patches of white sand over dark sandy loams on damp areas (DotE 2015e).	
Drakaea micrantha	**Threatened** – Vulnerable	Threatened	A tuberous, terrestrial orchid to 30 cm tall. Silvery-grey heart shaped leaf with prominent green veins. Red and yellow singular flower. Habitat for this species occurs within cleared, open sandy patches (Brown et al. 1998).	**Possible –** Preferred soil type/habitat occurs within the Project area.
Lepidosperma rostratum	**Threatened** – Endangered	Threatened	A rhizomatous sedge to 30 cm in diameter. Stems are circular in cross section and flowers are spike-like and up to 4 cm long. Habitat for this species occurs in sandy soils among low heath comprised of *Banksia telmatiaea* and *Calothamnus hirsutus* in winter-wet swamps.	**Unlikely –** Preferred soil type/habitat does not occur within the Project area– wetland areas will not be impacted by the proposed mining.
Synaphea stenoloba	**Threatened** – Endangered	Threatened	A caespitose shrub to 45 cm tall. Yellow flowers visible from August to October. Habitat for this species occurs within loamy soils in low-lying areas that are seasonally inundated (DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Project area – wetland areas will not be impacted by the proposed mining.
Acacia benthamii	Not listed	Priority 2	A shrub to 1 m tall. Flowers are yellow and visible from August to September (Western Australian Herbarium 1998). Habitat for this species is typically on limestone breakaways.	**Unlikely –** Preferred soil type/habitat does not occur within the Project area.
Cardamine paucijuga	Not listed	Priority 2	A slender, erect annual herb to 0.4 m tall. Flowers are white and visible from September to October (Western Australian Herbarium 1998). Habitat for this species occurs in a broad range of settings.	**Possible –** Preferred soil type/habitat could occur within the Project area.
Sphaerolobium calcicola	Not listed	Priority 3	A slender, multi-stemmed, scandent or erect shrub to 1.5 m tall. Flowers are orange-red and visible in June or from September to November (Western Australian Herbarium 1998). Habitat for this species occurs in a broad range of settings.	**Possible –** Preferred soil type/habitat could occur within the Project area.
Dillwynia dillwynioides	Not listed	Priority 3	A decumbent or erect, slender shrub to 1.2 m tall. Flowers are red and yellow/orange and visible in August to December (Western Australian Herbarium 1998). Habitat for this species is in winter-wet depressions and sandy soils.	**Possible –** Preferred soil type/habitat occurs within the Project area.
Schoenus capillifolius	Not listed	Priority 3	A semi-aquatic, tufted, annual grass-like herb to 5 cm tall. Flowers are green and visible from October to November (Western Australian Herbarium 1998). Habitat for this species is in brown mud in claypans.	**Unlikely –** Preferred soil type/habitat does not occur within the Project area– wetland areas will not be impacted by the proposed mining.
Stylidium longitubum	Not listed	Priority 3	An erect annual herb to 12 cm tall. Flowers are pink and visible from October to December (Western Australian Herbarium 1998). Habitat for this species occurs in sandy clay in seasonal wetlands.	**Unlikely –** Preferred soil type/habitat does not occur within the Project area– wetland areas will not be impacted by the proposed mining.

Species	Conservation status		Description	Potential to occur
	EPBC Act	BC Act / DBCA listing		
Jacksonia sericea	Not listed	Priority 4	A Low spreading shrub to 0.6 m tall. Flowers are orange and visible from December to February (Western Australian Herbarium 1998). Habitat for this species occurs in calcareous and sandy soils.	**Possible –** Preferred soil type/habitat occurs within the Project area.

2.2.2.2 Threatened and Priority Flora

The targeted orchid survey identified potential habitat for *C. huegelii* and *D. Micrantha*, however suitable habitat for *D. Elastica* was restricted to wetland areas which will not be impacted by the proposed mining activities.

Approximately 6.89 ha of 'highly suitable habitat' and 40.77 ha of 'unlikely habitat' for *C. huegelii* was identified within the site. Approximately 12.76 ha of 'highly suitable habitat' and 40.77 ha of 'unlikely habitat' for *D. micrantha* was identified within the site. No individuals of *C. huegelii* or *D. micrantha* were recorded within the site. *C. huegelii* and *D. micrantha* typically flower in September and October (Hoffman and Brown 2011); thus given the survey was undertaken on 21-22 September 2015 and no individuals were identified, it is considered that these species do not occur within the site. At the time of the survey, the Department of Parks and Wildlife were contacted to confirm the timing was suitable based on nearby reference sites. The timing was confirmed to be suitable.

Dillwynia dillwynioides and *Schoenus capillifolius* were recorded by Bennett (2006); however, these species were recorded in wetlands that do not form part of the Project area. The location of these species and other known locations of Threatened and Priority Flora species in the area are shown in Figure 4.

No Threatened or Priority flora species have been identified within the Project footprint by the three flora and vegetation surveys that have been undertaken over the site. Areas that contain Priority flora have been excluded from the project footprint.

2.2.3 Vegetation

2.2.3.1 Regional Vegetation Mapping

Vegetation occurring within the region was initially mapped at a broad scale (1:1 000 000) by Beard during the 1970s. This dataset has formed the basis of several regional mapping systems, including physiographic regions defined by Beard (1981); System 6 Vegetation Complex mapping undertaken by Heddle *et al.* (1980); and the biogeographical region dataset (Interim Biogeographic Regionalisation for Australia, IBRA) for Western Australia (DotE 2015a).

The Project area occurs within the Swan Coastal Plain 2 IBRA subregion, which is dominated by *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains and paperbark (*Melaleuca*) in swampy areas (Mitchell et al. 2002).

The Project area occurs within the Drummond Botanical Subdistrict, which is characterised by low *Banksia* woodlands on leached sands; *Melaleuca* swamps on poorly-drained depressions; and *Eucalyptus gomphocephala* (Tuart), *Eucalyptus marginata* (jarrah) and *Corymbia calophylla* (marri) woodlands on less leached soils (Beard 1990). The vegetation association, as mapped by Beard (1981) is association 1001 (Bassendean and Spearwood systems): Medium very sparse woodland; jarrah, with low woodland; *Banksia* & *Casuarina* (Figure 2). The percentage of pre-European extent of this vegetation association on each system at the state level is presented in Table 3 and is based on the latest GIS-based estimate undertaken by DBCA (Table 3; Government of Western Australia 2019).

Table 3: Pre-European and current extent of vegetation associations occurring within the Survey area

Vegetation association	Pre-European extent (ha)	Current extent (ha)	% remaining	Current Extent Protected for Conservation (ha)	% Current Extent Protected for Conservation
1001 – Bassendean system	53 284	11 394	21.38	1 603	3.01

Vegetation association	Pre-European extent (ha)	Current extent (ha)	% remaining	Current Extent Protected for Conservation (ha)	% Current Extent Protected for Conservation
1001 – Spearwood system	3567	1169	32.78	2.27	0.06

System 6 mapping refers to vegetation mapping undertaken at a Vegetation Complex scale by Heddle et al. (1980). This is the primary source of information used to calculate potential impacts of proposals to clear native vegetation on the Swan Coastal Plain. The Project area occurs at the interface between the Serpentine River and Karrakatta vegetation complexes. These complexes can be described as follows:

- Serpentine River – closed scrub of *Melaleuca* spp. and fringing woodland of *Eucalyptus rudis* and *M. rhaphiophylla* along streams
- Karrakatta – predominantly open forest of Eucalyptus gomphocephala – E. marginata – C. calophylla and woodland of E. marginata – Banksia spp.

Vegetation complexes are illustrated in Figure 2.

2.2.3.2 Conservation significant ecological communities

No TECs or PECs were identified as having the potential to occur within the Project area (Figure 4). The closest PEC identified in proximity to the Project area was SCP 25 (Southern *Eucalyptus gomphocephala – Agonis flexuosa* woodlands). The outer edge of the Parks and Wildlife buffer for this community is approximately 1.3 km from the Project area (Figure 4).

Since the level 1 flora and vegetation survey was conducted, additional TEC's and PEC's have become listed under both the BC Act and EPBC Act. Based on the results of the Strategen (2015) survey, the following TECs and PECs are considered likely to be present within the Survey Area and Project footprint:

- Banksia Woodlands of the Swan Coastal Plain TEC (listed as endangered under the EPBC Act; associated with VT2)
- Banksia dominated woodlands of the Swan Coastal Plain IBRA region (listed as a Priority 3 [iii] Ecological Community under the BC Act; associated with VT2).

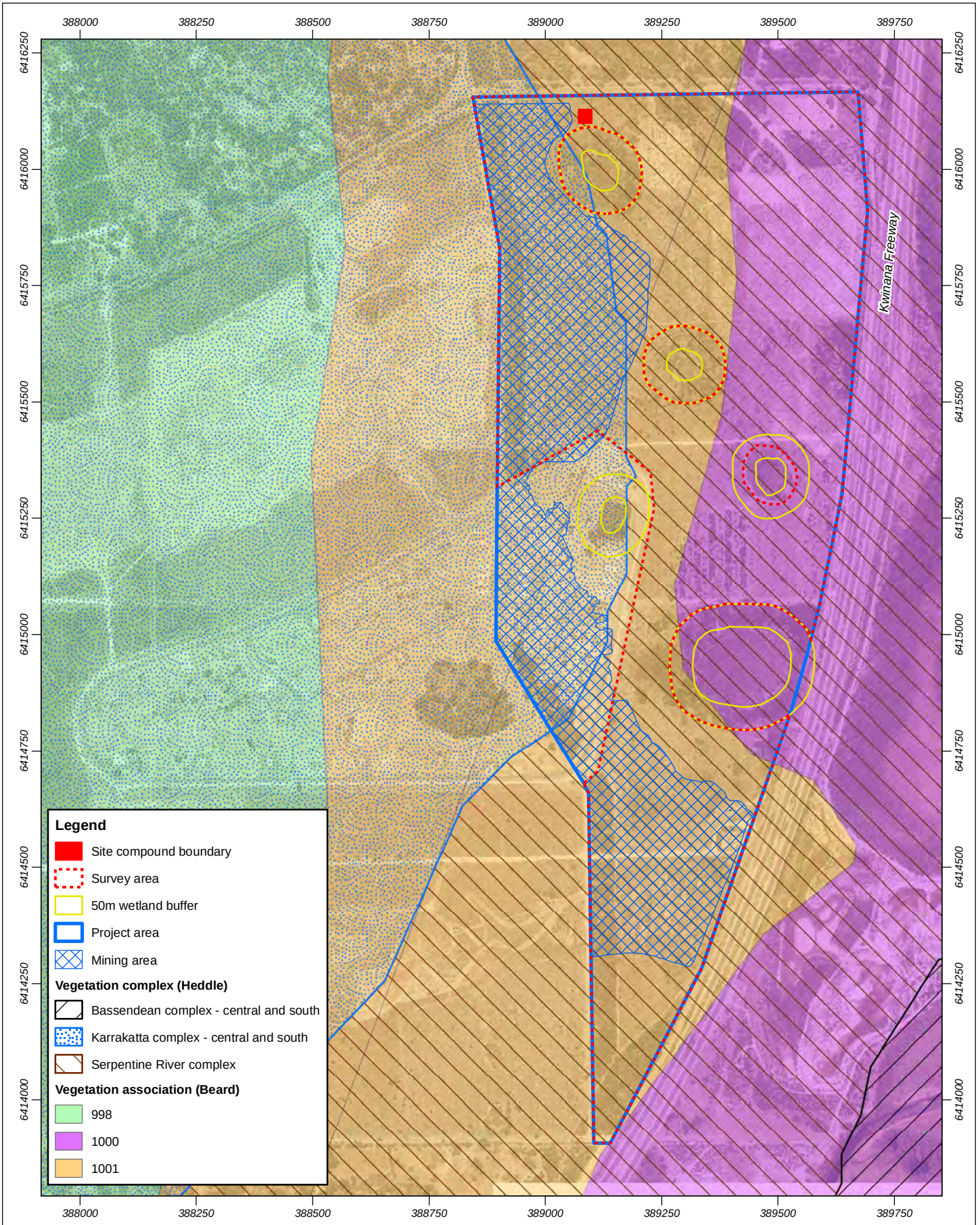

Figure 2: Vegetation associations and complexes

Scale 1:11,000 at A4

0 50 100 150 200 250 Meters

N

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 14/01/2016

Author: JCrute

Source: Aerial image: Landgate, flown 11/2014. Vegetation Beard: DAFWA 2014. Vegetation Heddle: DEC 2012.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R003\RevA\URE15096_01_R003_RevA_F002.mxd

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2.2.3.3 Site vegetation

Five native vegetation types (VTs) were defined and mapped within the Survey Area (Table 4; Figure 3) and are summarised in Table 4. Areas containing pine plantations or cleared vegetation have not been counted as unique VTs. With the exception of VT2, and wetland areas (unmapped), all vegetation types have been heavily disturbed as the area was a former pine plantation, with progressive pine clearing occurring between 2006 and 2010.

Total areas occupied within the Survey Area by each of the identified VTs are also set out in Table 4. The total area mapped within the Survey area was 94.94 ha which includes cleared areas and pine plantations (Table 4). Vegetation types are shown in Figure 3.

Table 4: Vegetation Types

Vegetation Type	Description	Area (ha) within the Survey area	Area (ha) within the Project footprint	Condition
1	*Macrozamia fraseri, Daviesia triflora* and *Acacia stenoptera* mid open shrubland over *Lyginia barbata, Conostylis aculeata* and *Phlebocarya ciliata* low open sedgeland with *Xylomelum occidentale* and *Eucalyptus rudis* occurring as isolated trees. Regrowth only. Cleared pine plantation.	59.37	22.97	Good Note: Regrowth only. Cleared pine plantation.
2	*Banksia menziesii, B. attenuata, Allocasuarina fraseriana* and *Eucalyptus marginata* open woodland over *Kunzea glabrescens, Acacia pulchella* and *Macrozamia fraseri* mid sparse shrubland over *Hibbertia hypericoides, Conostephium pendulum* and *Gompholobium tomentosum* low sparse shrubland. Including 1.02 ha inferred VT2 in Good condition within Explosives Reserve.	7.91	6.54[1]	Very Good to Good
3	*Jacksonia sternbergiana* and *Adenanthos cygnorum* subsp. *cygnorum* mid shrubland over *Conostylis aculeata* and *Lyginia barbata* low sparse sedgeland. Regrowth only. Cleared pine plantation	2.02	1.32	Good Note: Regrowth only. Cleared pine plantation.
4[1]	*Banksia menziesii, B. attenuata, Eucalyptus marginata* and *Allocasuarina fraseriana* low open woodland over *Jacksonia furcellata, Regelia ciliata* and *B. sessilis* mid sparse shrubland over *Tetraria octandra* and *Ficinia nodosa* low sparse sedgeland.	9.36	-	Good
5	*Eucalyptus* sp. (planted) open woodland over *Acacia saligna, Jacksonia furcellata* and *Kunzea glabrescens* tall sparse shrubland over **Eragrostis curvula* low sparse tussock grassland.	7.11	-	Good
P[2]	Pine plantation (*Pinus pinaster*).	3.29	-	Completely Degraded
C[2]	Cleared areas.	5.88	1.7	Completely Degraded
-	Explosives Reserve (cleared areas).	-	9.36[2]	Completely Degraded

[1] 1.02 ha of VT2 is located within the boundary of the Explosives Reserve Facility, which was not surveyed during the Strategen assessment (2015). The area was not traversed due to the Explosives Reserve Facility restrictions; however, the vegetation was observed from the boundary and can be inferred to be VT2 in Good condition.

[2] The 1.02 ha of VT2 within the Explosives Reserve Facility has been included in the VT2 calculations.

Vegetation Type	Description	Area (ha) within the Survey area	Area (ha) within the Project footprint	Condition
TOTAL		**94.94**	**41.89 (of which 30.83 ha is vegetated)**	

[1] This vegetation type appears to be the result of rehabilitation activities.

[2] Cleared areas and pine plantations have been mapped but are not counted as a unique VT.

A summary of vegetation condition within the Survey and Project footprint is provided in Figure 5. Table 6 gives a numerical breakdown of the area occupied by each vegetation condition rating within the Survey area and Project footprint.

Table 5: Vegetation condition scale (Keighery 1994)

Condition rating	Description
Pristine (1)	Pristine or nearly so, no obvious sign of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by 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, grazing.
Degraded (5)	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.
Completely Degraded (6)	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.

Table 6: Area (ha) covered by each vegetation condition rating category within the Survey area and Project Footprint

Vegetation Condition	Area (ha)	Percentage of the Survey area %	Project footprint (ha)	Percentage of the Project footprint %
Excellent	0	0	0	
Very Good	7.91	8.33	5.52	13.20
Good	77.86	82.01	25.30	60.40
Completely Degraded	9.17	9.66	11.06	26.40
Total	**94.94**	**100**	**41.89**	**100**

All reporting henceforth will refer to the Project footprint, which refers to the area proposed to be disturbed.

The majority of the Project footprint is in various stages of natural regeneration following clearing of pine plantations. Natural regeneration occurred throughout the majority of the Project footprint and as such, vegetation condition within these areas was mapped as Good. Although classified as Good (Keighery 1994), species abundance is very low (Keighery 1994; Table 5).

The dominant VT within the Mining Area is VT1, which can be broadly described as an open shrubland of *Macrozamia fraseri, Daviesia triflora* and *Acacia stenoptera* with isolated *Xylomelum occidentale* and *Eucalyptus rudis* trees. This vegetation type is regrowth following the clearing of the pine plantation. Species numbers are low, reflecting the historic disturbance.

6.54 ha of VT2 was recorded in the Project footprint. This vegetation type is the least disturbed on site and was recorded as being in Very Good condition over 5.52 ha and Good condition over 1.02 ha (inferred) in the Explosives facility.

The flora and vegetation assessment did not include the Explosives Reserve Facility due to restricted access. 1.02ha of the vegetation associated with this area has been inferred to align with VT2 based on observations from the boundary of the Explosives Reserve and analysis of aerial photography.

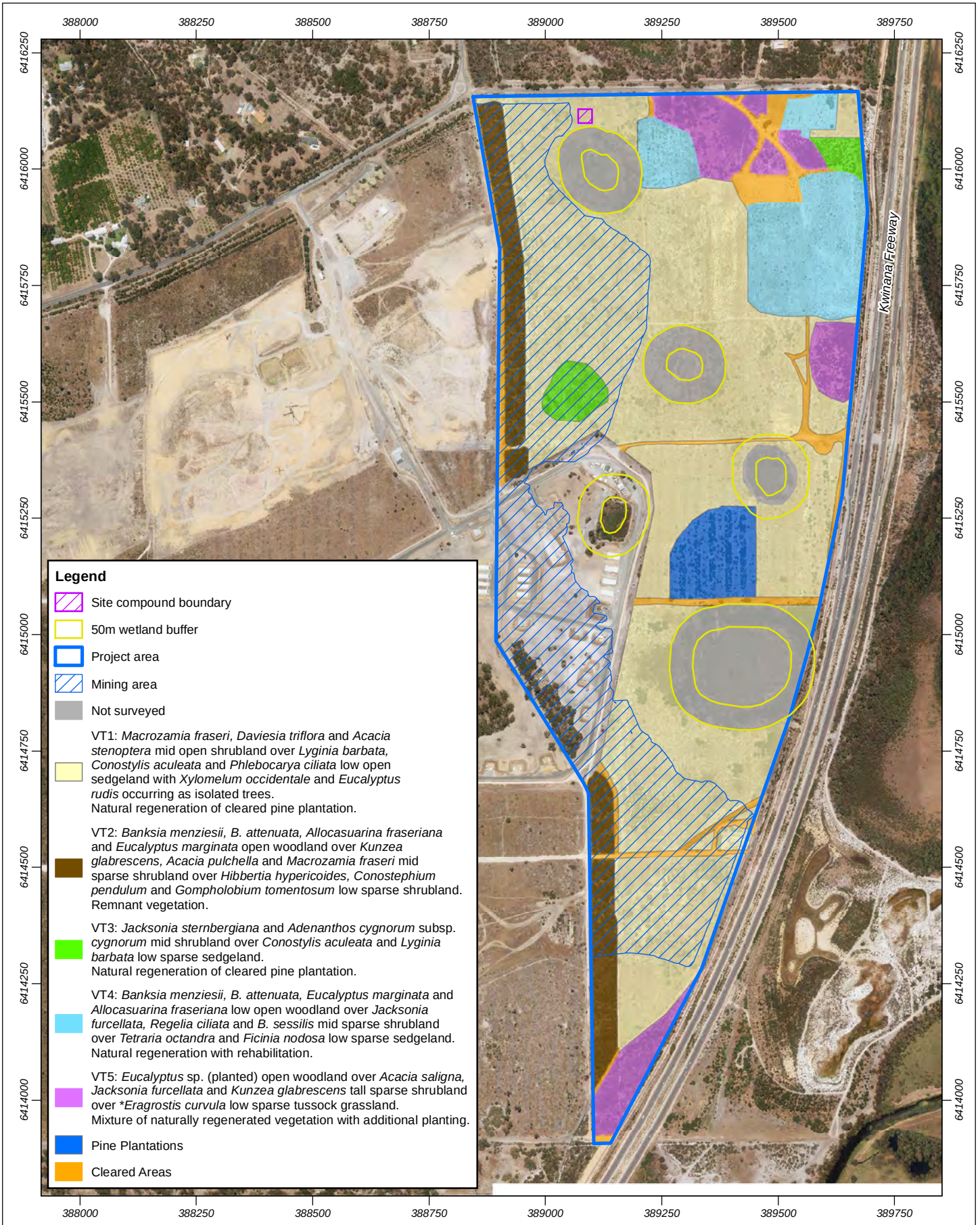

Figure 3: Vegetation types mapped within the Project area

Scale 1:10,997 at A4

0 50 100 150 200 250 Meters

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 14/01/2016
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R003\RevA\URE15096_01_R003_RevA_F004.mxd

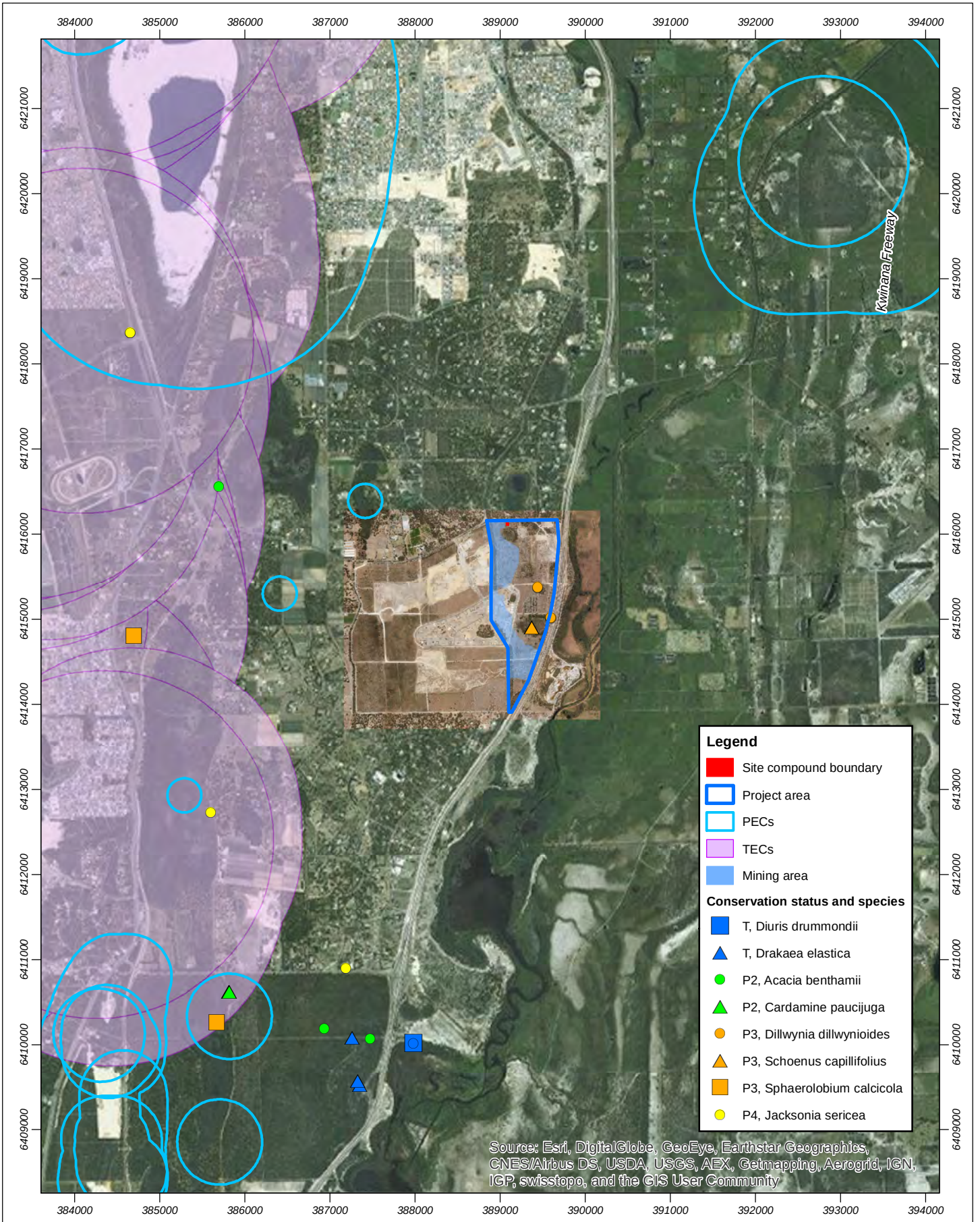

Figure 4: Location of Threatened and Priority Flora, TECs and PECs surrounding the Project area

Scale 1:60,000 at A4

0 0.5 1 1.5 2 km

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 14/01/2016
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Background aerial image: : ESRI online, approx. 2010. TEC/PEC & Flora: DPAW 2015.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R003\RevA\URE15096_01_R003_RevA_F003.mxd

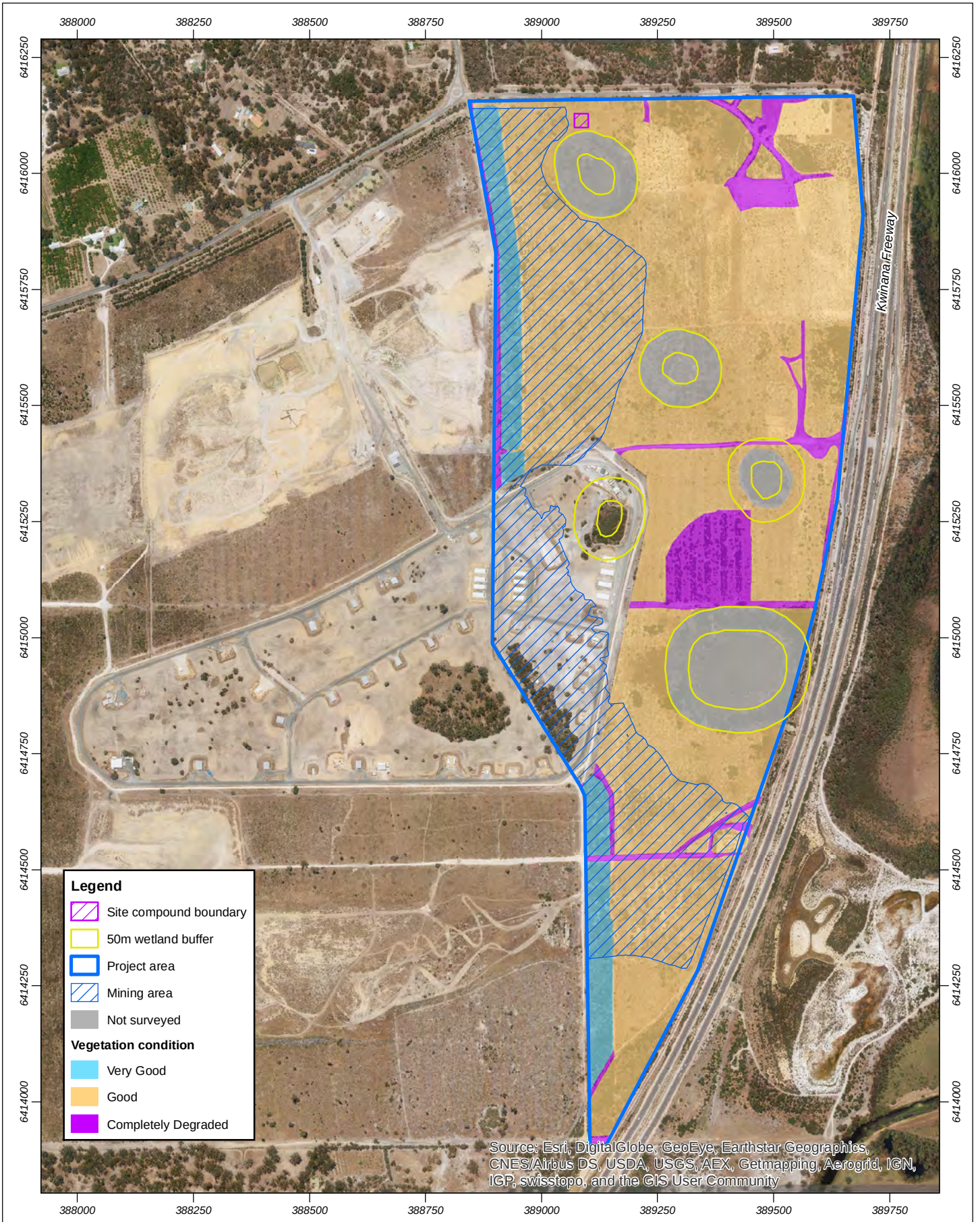

Figure 5: Vegetation condition mapped within the Project area

Scale 1:11,000 at A4

0 50 100 150 200 250 Meters

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 14/01/2016
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R003\RevA\URE15096_01_R003_RevA_F005.mxd

2.3 Fauna

The desktop fauna assessment was conducted using a series of databases including NatureMap and the EPBC Act Protected Matters Search Tool. Bamford Consulting Ecologists (BCE) undertook a fauna survey of an area encompassing some parts of the Project area and adjacent wetlands (BCE 2006). It should be noted that in 2006, the majority of the Project area was occupied by pine plantation. During the most recent assessment undertaken by Strategen in 2015, the Survey Area and Project footprint comprised remnant native woodland vegetation, historical pine plantations and natural regeneration in areas that were previously cleared (Strategen 2015).

An assessment of the likelihood of conservation significant species occurring within the Project area, based on results presented by BCE (2006) is presented in Table 7. The conservation status of each species was updated based on current listings provided by the DBCA (2007, 2014) and DotE (2015c, 2015e). Likelihood of occurrence was also updated (where required) based on the change in vegetation within the Survey area and Project footprint between 2006 and 2015. An updated desktop assessment was also conducted by Strategen (2015) to determine if any Threatened or Priority fauna species were likely to occur within the Project area.

Table 7: Threatened and Priority fauna potentially occurring within the Project area

Species	Conservation status[1]		Habitat description	Potential to occur
	EPBC Act	BC Act / DBCA listing		
Reptiles				
Ctenotus gemmula (Jewelled Ctenotus)	Not listed	P3	Pale sands with heath and Banksia spp. or mallee woodlands.	**Possible** – areas of remnant banksia woodland.
Lerista lineata	Not listed	P3	Coastal heath on sand, shrubland.	**Unlikely** – lack of suitable habitat.
Morelia spilota imbricata (Carpet Python)	Not listed	Schedule 4 (Other specially protected fauna)	Undisturbed bushland and rocky outcrops.	**Unlikely** – while potentially present in the region, the lack of connecting habitat to Project area renders it unlikely this species would be present.
Neelaps calonotos (Black-striped Snake)	Not listed	P3	Dunes and sand plains with heath or eucalypt or banksia woodlands.	**Possible**.
Birds				
Oxyura australis (Blue-billed Duck)	Not listed	P4	Deep and well vegetated freshwater lakes, dams and swamps.	**Unlikely** – habitat not present within or near Project area.
Ardea alba (Great Egret)	Marine, migratory (CAMBA, JAMBA)	IA	Estuaries, tidal flats, rivers, freshwater lakes, sewage ponds and dams.	**Unlikely** – Project area does not comprise wetlands. Possibly present as a vagrant within adjacent wetlands but unlikely to be permanently reliant on these due to their poor quality.
Ardea ibis (Cattle Egret)	Marine, migratory (CAMBA, JAMBA)	IA	Paddocks, pastures, wetlands, and tidal mudflats.	**Unlikely**.
Ixobrychus minutus (Little Bittern)	Not listed	P4	Dense vegetation (reeds, rushes, sedges) in or adjacent to freshwater wetlands.	**Unlikely** – lack of suitable habitat within Project area and adjacent wetlands.
Botaurus poiciloptilus (Australasian Bittern)	**Threatened** (Endangered)	**Threatened**	Dense vegetation (reeds, rushes, sedges) in or adjacent to freshwater wetlands, drains and, occasionally, salt marshes.	**Unlikely** – lack of suitable habitat within Project area and adjacent wetlands.
Falco peregrinus (Peregrine Falcon)	Not listed	Schedule 4 (Other specially protected fauna)	Cliffs, gorges, timbered watercourses, and tall man-made infrastructure.	**Unlikely** – known from the area but unlikely to be resident in Project area.
Tringa nebularia (Common Greenshank)	Marine, migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	IA	Estuaries, tidal flats, mangroves, rivers, wetlands, sewage ponds and salt fields.	**Unlikely** – lack of suitable habitat within Project area and adjacent wetlands.
Actitis hypoleucos (Common Sandpiper)	Marine, migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	IA	Estuaries, tidal flats, mangroves, rivers, wetlands, sewage ponds and salt flats.	**Unlikely** – lack of suitable habitat within Project area and adjacent wetlands.

Calyptorhynchus banksii subsp. *naso* (Forest Red-tailed Black-Cockatoo)	**Threatened** (Vulnerable)	**Threatened**	Open forests and woodlands, suburban gardens.	**Likely** – known to breed in the Baldivis area.
Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo)	**Threatened** (Endangered)	**Threatened**	Open forests and woodlands, Kwongan heath, sand plains, suburban vegetation and pine plantations.	**Likely** – known to breed in the Baldivis area.
Calyptorhynchus baudinii (Baudin`s Cockatoo)	**Threatened** (Vulnerable)	**Threatened**	Jarrah, Marri and Karri forests, woodlands, coastal scrub.	**Likely** – though may forage in the general area during the non-breeding season.
Ninox connivens connivens (Barking Owl)	Not listed	P2	Open forests, woodlands, dense scrub and timbered watercourses.	**Unlikely**.
Merops ornatus (Rainbow Bee-eater)	Marine, migratory (JAMBA)	IA	Open woodlands, sand ridges, sand pits, riverbanks, beaches, dunes, cliffs, mangroves and man-made grassed fields.	**Likely** – known to be present in the area.
Tringa glareola (Wood Sandpiper)	Marine, migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	IA	Well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes.	**Unlikely** – due to lack of suitable habitat.
Mammals				
Dasyurus geoffroii (Chuditch)	**Threatened** (Vulnerable)	**Threatened**	Wet and dry sclerophyll forest, mallee.	**Unlikely** – to be present due to lack of large remnants.
Isoodon obesulus fusciventer (Southern Brown Bandicoot, Quenda)	Not listed	P5	Sandy soils with low ground cover. Prefers areas that are regularly burnt. Highest densities occur in association with wetlands and damplands.	**Possible**.
Macropus irma (Brush Wallaby)	Not listed	P4	Open dry sclerophyll forests with open, seasonal wet flats with low grasses and open scrub.	**Unlikely** – due to lack of large remnants.
Falsistrellus mackenziei (Western False Pipistrelle)	Not listed	P4	Karri, Jarrah and Tuart forests and Banksia woodlands.	**Unlikely** – due to lack of large remnants.
Hydromys chrysogaster (Water Rat, Rakali)	Not listed	P4	Permanent bodies of fresh or brackish water.	**Unlikely** – due to lack of permanent water bodies.

Source: BCE 2006, DotE 2015c, DotE 2015e, Parks and Wildlife 2007, Parks and Wildlife 2014.

[1] Bonn – Bonn Convention, CAMBA – China – Australia Migratory Birds Agreement, JAMBA – Japan – Australia Migratory Birds Agreement, ROKAMBA – Republic of Korea – Australia Migratory Birds Agreement, IA – International Agreement.

Results of the desktop assessment (Table 7) identified three EPBC Act listed black cockatoo species as the most likely species to occur. The field component of the survey assessed the Project footprint in terms of its potential as habitat for these species.

In addition to the black cockatoo species, the Rainbow Bee-eater is likely to occur in the general area in sandy soiled areas and surrounding wetlands. The habitat most likely to support the Rainbow Bee-eater is associated with wetland areas that will not be affected by the Project; therefore, a detailed habitat assessment for the species was not undertaken. Threatened native mammals and ground-dwelling birds are unlikely to occur due to lack of suitable habitat and presence of introduced predators and competitors (cat footprints were observed and the area is home to a large number of goats).

2.3.1 Black cockatoo habitat assessment

A summary of the value of each vegetation type as foraging habitat for black cockatoo species contained within the Project footprint is presented in Table 8 (Groom 2011, Johnstone 2010b, Johnstone 2010c, Johnstone et al. 2011).

The highest quality foraging habitat for black cockatoos was noted within VT 2, which contained high densities of black cockatoo food species including eucalypts and *Banksia* spp. at canopy and midstorey levels. Signs of CBC foraging were observed in scattered occurrences within VT 2. VT2 represents the only habitat of value for Black Cockatoo species. with VT1 providing Poor quality habitat.

Of the 7.91 ha of VT2 identified in the Survey Area, the Project footprint proposes to clear 6.54 ha.

Table 8: Vegetation types and black cockatoo foraging species within the Project footprint

Vegetation type	Description	Black cockatoo foraging species	Black cockatoo habitat value	Project footprint (ha)
1	*Macrozamia fraseri, Daviesia triflora* and *Acacia stenoptera* mid open shrubland over *Lyginia barbata, Conostylis aculeata* and *Phlebocarya ciliata* low open sedgeland with *Xylomelum occidentale* and *Eucalyptus rudis* occurring as isolated trees.	CBC – *E. rudis* BBC – Nil FRTBC – Nil.	Poor	22.97
2	*Banksia menziesii, B. attenuata, Allocasuarina fraseriana* and *Eucalyptus marginata* open woodland over *Kunzea glabrescens, Acacia pulchella* and *Macrozamia fraseri* mid sparse shrubland over *Hibbertia hypericoides, Conostephium pendulum* and *Gompholobium tomentosum* low sparse shrubland. Including 1.02 ha inferred VT2 within Explosives Reserve.	CBC – *B. menziesii, B. attenuata, A. fraseriana, E. marginata* BBC – *A. fraseriana, E. marginata* FRTBC – *A. fraseriana, E. marginata* .	High	6.54[3]
3	*Jacksonia sternbergiana* and *Adenanthos cygnorum* subsp. *cygnorum* mid shrubland over *Conostylis aculeata* and *Lyginia barbata* low sparse sedgeland.	CBC – Nil BBC – Nil FRTBC – Nil.	None	1.32
C	Cleared areas.	CBC – Nil BBC – Nil FRTBC – Nil.	None	1.77
-	Explosives Reserve. Excluding 1.02 ha inferred VT2 within Explosives Reserve.	Cleared vegetation and wetland area.	None	9.36[4]

[3] 1.02 ha of VT2 is located within the boundary of the Explosives Reserve Facility which was not surveyed during the Strategen assessment (2015). The area was not traversed due to the Explosives Reserve Facility buffer, however, the vegetation was observed from the boundary and can be inferred to be VT2.

[4]

Table 9: Quality of black cockatoo foraging habitat within the Mining area and site compound

Vegetation type	Foraging quality	Justification
1	Poor	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy).
2	High	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) and presence of food sources at several strata (i.e. canopy, midstorey and understorey).
3	Nil	No suitable foraging species for black cockatoos present.
Cleared areas	Nil	Cleared areas - no vegetation present.

2.4 Hydrology

2.4.1 Surface water

The Project area lies in the catchment of the Peel Main Drain, which flows into the Serpentine River and into the Peel-Harvey Estuary approximately 20 km south of the Project area. The north-western boundary of the Project area is located within the 1 in 100-year Average Return Interval (ARI) floodway and flood fringe of the Peel Main Drain. The surface water flows would characteristically follow the natural topography of the Project area. The most easterly portion of the Site, adjacent to the Serpentine River, is likely to be subject to inundation (Golder Associates 2006a).

The Project area is characterised by a chain of seasonally damp and inundated wetlands. The wetlands range from 0.3 ha to 3.1 ha in size and the vegetation predominantly comprises remnant paperbark. Three of the wetlands are categorised under the *Environmental Protection Swan Coastal Plain Lakes Policy 1992* as 'Resource Enhancement' and two as 'Conservation'.

2.4.2 Groundwater

The Project area is located within the Stakehill Mound groundwater subregion of the Perth Basin (GHD 2014). The subregion covers an area of approximately 150 km^2 and occurs within the superficial formations flow system that is recharged directly by rainfall infiltration (Golder Associates 2010). The average thickness of the aquifer is estimated to be approximately 20 m with a minimum transmissivity of approximately 1000 m^2/day (Golder Associates 2010).

Golder Associates conducted monthly groundwater level monitoring of the Project area and surrounds between March 2007 and March 2010. Further monitoring was undertaken by Strategen in April 2013 and January 2014 to support the LandCorp Karnup residential development. LandCorp provided the Golder Associates (2010) data to City of Rockingham for use in groundwater modelling undertaken by GHD for the District Water Management Strategy (GHD 2014).

Additional groundwater monitoring was undertaken by Strategen in early 2015 to confirm findings of the previous monitoring events and groundwater model. The most recent monitoring undertaken by Strategen generally confirmed previous monitoring results. Monitoring found the assessment groundwater level (AGL) varies from approximately 3 mAHD. Groundwater flow is in a westerly direction toward the Indian Ocean.

2.4.3 Riparian vegetation

No riparian vegetation has been identified in or around the Project area and clearing will consequently not have any impact on riparian vegetation.

2.5 Vegetation degradation

2.5.1 Weeds

Six weed species were recorded during the Strategen (2015) survey of the Project area:

- **Briza maxima*
- **Carpobrotus edulis*

- **Conyza sumatrensis*
- **Eragrostis curvula*
- **Hypochaeris glabra*
- **Lagurus ovatus.*

None of these species is a Declared Plant species in Western Australia pursuant to Section 22 of the *Biosecurity and Agriculture Management Act 2007* according to the Western Australian Department of Agriculture and Food (DAFWA; now Department of Primary Industries and Regional Development [DPIRD] 2014).

2.5.2 Dieback

Dieback has not been assessed for the Project area.

2.6 Land degradation

Potential processes associated with land degradation include soil compaction and erosion.

Soil compaction may occur following construction of hardstand areas and on-site infrastructure. Given that the soil of the Project area is characterised as being predominately sand, soil compaction is not anticipated to be significant and any compaction can be reduced following the removal of infrastructure by ripping soil.

Soil erosion may occur during mining activities when soil is removed and/or displaced through wind and water. Following displacement of the sand, dust impacts are likely to result, which may have the potential to impact on surrounding residents and land-users if not managed appropriately. Urban Resources will implement management measures to reduce emissions as detailed in Section 3 below and in the Mining Proposal.

3. Environmental management measures and rehabilitation

3.1 Environmental management

Urban Resources will minimise any potential environmental and social impacts in accordance with measures detailed in the Mining Proposal. Factors that require management include:

- Visual amenity
- Surface water
- Hydrocarbon, dangerous goods and hazardous substances
- Flora and fauna
- Weeds
- Topsoil and overburden
- Waste management
- Noise
- Dust
- Traffic.

3.2 Rehabilitation

Urban Resources proposed to develop agreed final landforms and post-mining land use(s) that is consistent with the site's combination of areas zoned for Urban Deferred development and Parks and Recreation. DevelopmentWA represents the State's requirement to develop significant areas of the site for residential development, and the City of Rockingham have proposed overlapping areas for regional sporting facilities and open space associated with the broader regional catchment. Subject to the final requirements of the State, the areas will contain a mix of Urban Development, Regional Infrastructure, parklands suitable for active recreation. The key considerations in determining the final land use are:

1. Relevant to the environment in which the mine will operate.
2. Achievable in the context of post-mining land capability.
3. Acceptable to key stakeholders.
4. Ecologically sustainable in the context of the local and regional environment.

The objective of rehabilitation at the site is attainment of a stable landform, consistent with DevelopmentWA's and the City of Rockingham's requirements. Completion criteria will be developed and refined, where applicable and appropriate, through the lifetime of the Project.

To achieve closure, the following processes will be implemented:

- Stockpiling of cleared vegetation for use during rehabilitation
- Stockpiling of topsoil in windrows to enable the soil profile to be reinstated during rehabilitation
- Decommissioning and removal of mine and ancillary infrastructure
- Treatment (or removal) of any localised soil contamination if required
- Re-profiling of surfaces using site specific criteria developed from studies conducted to determine final design and levels in accordance with the Mine Plan

- Any batters will be contoured at a 3:1 (hv) slope.
- Mechanical treatment of compacted surfaces (ripping and scarifying)
- Replacement of topsoil
- Spreading of stockpiled vegetation
- Direct seeding of future development areas with pasture species
- Monitoring to collect data on revegetation and to demonstrate the ability of the area to support the post-mining land use
- Development of contingency actions to address any deficiencies identified from the rehabilitation monitoring.

Detailed strategies for rehabilitation of the Project area following mining are described in the Mine Closure Plan. The Mine Closure Plan will continue to be developed through the life of the Project. Completion criteria will be developed and refined, where applicable, throughout the lifetime of the mine.

4. Assessment against the EP Act clearing principles

There are 10 clearing principles defined under Schedule 5 of the EP Act. The Project complies with all of the 10 clearing principles; the assessment of which is detailed in Table 10.

Table 10: Compliance with the 10 principles of EP Act Schedule 5 for clearing native vegetation

Principle	Assessment	Conclusion
Native vegetation should not be cleared if it comprises a high level of biological diversity.	The Project footprint proposes to impact 30.83 ha of the 78.66 ha of vegetation mapped in the Survey area. The majority of the Project footprint has been subjected to a long history of disturbance, with all but 6.54 ha having been a pine plantation until sometime between 2006 and 2010, when the pines were cleared. The majority of the Project footprint was observed to be in various states of natural regeneration following clearing of historical pine plantations with vegetation comprised of *Macrozamia fraseri*, *Daviesia triflora* and *Acacia stenoptera* open shrubland with emergent *Xylomelum occidentale* and *Eucalyptus rudis* trees. The strip of vegetation that runs along the western boundary of the Project footprint represented a different vegetation structure which was primarily Jarrah-Banksia woodland, relatively undisturbed by the historical pine plantation. None of the vegetation types are unique to the Survey area. A total of 41 native species were recorded across the entire Survey area. The most diverse area would be expected to be the strip of remnant banksia woodland found along the western Project area boundary. Gibson *et al*. (1994) found that the highest diversity in banksia woodlands alone was approximately 60 species, well above that found across the entire Survey area. Therefore the vegetation within the Survey area is considered to be of only moderate biological diversity. Vegetation Type 2 is considered likely to be representative of Banksia dominated woodlands of the Swan Coastal Plain IBRA region; a Priority 3(iii) listed community under the BC Act. Part of this ecological community is proposed to be cleared to facilitate sand mining operations. The community is also representative of the Commonwealth listed Banksia Woodlands of the Swan Coastal Plain TEC. The project was referred to the Commonwealth and has been granted approval by way of 'Not a Controlled Action' decision. In support of the mining proposal, a Mine Closure Plan has been prepared which details a strategy of rehabilitating as much of the site as practicable prior to cessation of mining. In addition to the MCP, Urban Resources have committed to the preparation of a Rehabilitation Management Plan, covering the full range of actions to be implemented in rehabilitation, including the following: • Soil handling: o topsoil stripping o salvage o stockpiling o replacement. • Rehabilitation works: o landform design and reconstruction o erosion control o mine areas o roads and tracks o infrastructure area.	The Project is not at variance with this principle. The Mining area does not comprise a high level of biological diversity because there were only 41 native species of native vegetation recorded in the entire Survey area (comprised of various woodlands and shrublands) which is significantly less than the number of species (60) recorded by Gibson *et al*. (1994) in banksia woodlands (equivalent to VT 2) alone.

Principle	Assessment	Conclusion
	• Revegetation: o species selection o establishment o seed collection, processing and storage o weed control • Monitoring	
Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	Given the high level of historical disturbance across the overall Project footprint, the Project is not considered to contain a significant area of fauna habitat. The Project will result in the clearing of 6.54 ha of High quality foraging habitat for Carnaby's Black-Cockatoo, Baudin's Black-Cockatoo and Forest Red-tailed Black-Cockatoo. There are no known breeding sites for any of the three Black Cockatoo species within the Survey area. Various conservation reserves are present around the Project area and contain much larger and greater value habitat than the habitat in the Project area. These reserves include Rockingham Lakes Regional Park approximately 5 km southwest, Lake Walyungup approximately 5 km northwest and Serpentine National Park approximately 22 km east of the Project area.	The Project is not at variance with this principle. The Mining area does not comprise of significant habitat that is necessary for the maintenance of fauna indigenous to Western Australia as the Project area does not contain any roosting or breeding trees and the foraging habitat is mainly of low value. Additionally, the Project area is surrounded by numerous conservation reserves that contain much larger and greater value habitat than the Mining area.
Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No Threatened or Priority flora species have been identified or are expected to be impacted by the proposed clearing for the Project. Threatened and Priority Flora species identified in the broader area (identified from database records) are restricted to wetland areas. These areas have been excluded from the Project footprint. The targeted orchid survey identified potential habitat for *C. huegelii* and *D. Micrantha*, however both species were not identified during the field survey which was undertaken during the optimal survey period (September) and consistent with Commonwealth Guidelines for the survey of orchids. Results of the survey and previous surveys over the site therefore conclude that these species do not occur on site.	The Project is not at variance with this principle. The Mining area does not comprise of vegetation that includes or is necessary for continued existence of rare flora. No rare flora or suitable habitat for rare flora was identified as occurring within the proposed areas of disturbance.
Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	No State listed TECS will be impacted by clearing within the Survey area. No State listed TECs are known from, or were recorded within, the Survey area. The closest known TEC is over 1 km away from the Survey area. Vegetation Type 2 is considered likely to be representative of Banksia dominated woodlands of the Swan Coastal Plain IBRA region; a Priority 3(iii) listed community under the BC Act. Part of this ecological community is proposed to be cleared to facilitate sand mining operations. The community is also representative of the Commonwealth listed Banksia Woodlands of the Swan Coastal Plain TEC. The project was referred to the Commonwealth and has been granted approval by way of 'Not a Controlled Action' decision.	The Project is not at variance with this principle. The Mining area does not comprise of vegetation that comprises part of, or is necessary for the maintenance of, a State listed TEC as no State listed TECs are known from, or were recorded within, the Survey area.
Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area	The majority of the Project footprint has been historically disturbed and, as such, does not represent remnant vegetation. Remnant vegetation within the Project area is located along the western Project boundary and is comprised of vegetation association 1001 (Bassendean and Spearwood systems), as	The Project is not at variance with this principle. Vegetation within the Mining area does not represent a significant

Principle	Assessment	Conclusion
that has been extensively cleared.	mapped by Beard (1981), and VT2. The project will clear <1% of the current extent of vegetation association 1001. The significance of this remnant is limited it is a narrow, isolated strip which terminates approximately 250 m south of the Project footprint and does not connect with other remnants to form an ecological linkage. Additionally, mining activities on the western side of this remnant vegetation have the potential to reduce the long-term viability of this remnant as mining changes ground levels adjacent to the remnant, altering the local hydrological processes and potentially increasing edge effects.	remnant of native vegetation within the region (vegetation association 1001 [Bassendean and Spearwood systems], as mapped by Beard [1981]) and will not substantially affect the percentage remaining of the relevant vegetation associations.
Native vegetation should not be cleared if it is growing in or in association with a watercourse or wetland.	Limited assessment was made of the vegetation associated with the wetlands as none of the six wetlands and their 50 m buffer areas will be impacted by the Project.	The Project is not at variance with this principle No native vegetation that is growing in or is associated with the six wetlands that occur within the Project area will be cleared or disturbed by the Project.
Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The Mining area has historically been heavily disturbed and, as such, clearing of largely regrowth vegetation is unlikely to cause any further disturbance to surrounding land. The Mining area is bounded by road (Kwinana Freeway to the east and an extension to Baldivis Rd to the north) and existing sand mining operations to the west. Urban Resources employs standard management procedures during construction and operational activities that include measures to minimise land degradation, such as soil compaction and erosion. Detailed measures relating to the management of soil compaction and erosion are included in the Mining Proposal.	The Project is not at variance with this principle The clearing of vegetation within the Mining area is not expected to cause appreciable land degradation in surrounding areas because the Project area is already degraded due to historical pine plantation operations and the construction of the Kwinana Freeway. Furthermore, Urban Resources will employ further management measures to minimise land degradation.
Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	The closest conservation area is Bush Forever site 277, River, Stakehill and Harvey Roads Bushland, Karnup. This is situated on the opposite side of the Kwinana Freeway to the Mining area. Clearing within the Mining area is unlikely to create any additional impact on the environmental values of this conservation area.	The Project is not at variance with this principle Clearing of vegetation within the Mining area is not expected to cause any impact on any conservation areas as none exist within proximity of the proposed clearing.
Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	Hydrological impacts were considered as part of the Mining Proposal, which was recently approved by DMIRS. The Mining area has long been subjected to disturbance including clearing and replanting with pine plantation. No wetlands are being cleared as part of the Project. Vegetation surrounding wetlands has previously been cleared for pine plantations; however a 50 m buffer surrounding each wetland will be maintained during the proposed mining operations. Urban Resources will employ dust management measures to ensure dust generated from operational activities are minimised	The Project is not at variance with this principle. Clearing of vegetation within the Mining area is not expected to cause any deterioration in the quality of surface or underground water as the project will not be undertaken within 50 m of wetlands. no below underground water mining

Principle	Assessment	Conclusion
	to ensure impacts to surrounding wetlands and vegetation are reduced. Sand mining activities will not be undertaken below the water table; therefore no impacts to underground water are anticipated. Furthermore, hydrocarbons and chemicals will not be stored on site, further reducing the potential for impacts to underground water quality. Urban Resources will employ measures to manage the use of hydrocarbons and other potential groundwater and surface water contaminants while also applying measures to control surface water flows from the Mining area.	is proposed as part of the Project, therefore impacts to groundwater are unlikely. Urban Resources will employ management measures to minimise any potential impacts to surface water and underground quality.
Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the intensity of flooding.	The Mining area has long been subjected to disturbance including clearing and replanting with pine plantation. As a result of historical clearing, the majority of remnant vegetation has already been removed. Clearing for the Project is consequently unlikely to result in additional flood risk or exacerbation of flooding intensity. Clearing will be undertaken in stages as mining progress along the Mining area to the south which is expected to minimise the temporary loss of vegetation loss during the Project. Rehabilitation of mining areas will be undertaken progressively throughout mining operations. The Mining area is characterised by free-draining sand that enables drainage to occur readily on site, in addition, adjacent drainage structures are in place on the boundary of the Kwinana Freeway, further reducing flood risk to the Mining area.	The Project is not at variance with this principle Clearing of vegetation within the Mining area is not expected to cause, or exacerbate, the intensity of flooding because the Project area vegetation has already been removed and the amount of vegetation to be cleared is considered to be a small amount in comparison to retained vegetation within the remainder of the Project area. Progressive clearing and rehabilitation and the presence of free-draining sand is also expected to ensure the intensity of flooding (if any) does not increase.

5. Conclusion

The Project will entail clearing of 30.83 ha of native vegetation. Of this, 6.54 ha is remnant vegetation. The remainder has been heavily disturbed in the past and is regrowth following the clearing of a pine plantation.

Clearing of vegetation within the Mining area will not result in a substantial decrease in the remaining area of any vegetation associations, with a loss of <1% of Association 1001 on each of the Bassendean and Spearwood systems.

Urban Resources will minimise any potential environmental and social impacts in accordance with measures detailed in the Mining Proposal. Factors that require management include:

- Visual amenity
- Surface water
- Hydrocarbon, dangerous goods and hazardous substances
- Flora and fauna
- Weeds
- Topsoil and overburden
- Waste management
- Noise
- Dust
- Traffic.

The following conclusions can be made with regards to the proposed clearing of no more than 30.83 ha:

1. The proposed clearing will not impact any State listed Threatened Ecological Communities or Threatened or Priority flora species.
2. The vegetation types and flora species located within the Project area are well represented in the local area and clearing consequently presents a low risk to flora and vegetation and fauna habitat.
3. No additional environmental impact such as loss of biodiversity, habitat loss, appreciable land degradation, impact to hydrology or water quality, impact to nearby conservation areas, or impact to conservation significant species will result from the proposed clearing.
4. The proposed clearing of vegetation conforms to all of the 10 principles for clearing native vegetation, as described in Schedule 5 of the *Environmental Protection Act 1986* (Table 10).

6. Limitations

Scope of services

This report ("the report") has been prepared by Strategen-JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen-JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

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Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

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Appendix A Karnup Sand Mining Project Environmental Investigations (Strategen 2015a)

Karnup Sand Mining Project

Environmental Investigations

Prepared for
Urban Resources
by Strategen

June 2015

STRATEGEN
environmental consultants

Karnup Sand Mining Project

Environmental Investigations

Strategen is a trading name of
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June 2015

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The report is based on conditions encountered and information reviewed at the time of preparation. Strategen disclaims responsibility for any changes that may have occurred after this time.

Environmental conclusions

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Client: Urban Resources

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1. Introduction

1.1 Background

Urban Resources Pty Ltd proposes to operate the Karnup Sand Mining Project located between Stakehill Road and the Kwinana Freeway in Karnup, approximately 48 km south of Perth, Western Australia (the Project; Figure 1). The Project involves the mining of 1 553 800 m^3 of sand from the Project area. The Project area is defined as the portion of M70/1262 that is west of the Kwinana Freeway boundary, as outlined by Figure 1. Urban Resources will rehabilitate the landscape post mining to a form suitable for the future land parks and recreation use as proposed by LandCorp.

The proposed mining area occurs within Mining Tenement M70/1262 comprising remnant native woodland vegetation, historical pine plantations and natural regeneration in areas which were previously cleared. Wetland areas which occur within M70/1262 do not fall into the proposed mining area and therefore will not be impacted by the Project.

The proposed mining will require clearing of native vegetation which could contain species of, or habitat for conservation significant flora as well as Threatened species of black cockatoos. A flora, vegetation and black cockatoo habitat assessment was deemed necessary to determine the environmental values of the potential clearing area.

1.2 Scope

Strategen was commissioned to undertake a flora and vegetation assessment and black cockatoo habitat assessment by Urban Resources within the western portion of M70/1262 in May 2015 (the Survey area; Figure 4).

Wetland areas were not included within the area surveyed as they will not be impacted by the proposed mining.

1.3 Legislative context

This assessment has been conducted with reference to the following Australian and Western Australian legislation:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – Australian Government
- *Wildlife Conservation Act 1950* (WC Act) – State
- *Environmental Protection Act 1986* (EP Act) – State
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) – State.

1.3.1 Conservation significant flora and ecological communities

Threatened species are listed under the EPBC Act at the Australian Government level and under the WC Act at the State level (Appendix 4). Priority species are listed by the Department of Parks and Wildlife (Parks and Wildlife) and include species of 'significant conservation value' (Appendix 4).

Threatened Ecological Communities (TECs) are listed under both the EPBC Act and EP Act (Appendix 4). Priority Ecological Communities (PECs) are listed by Parks and Wildlife and include species of significant conservation value (Appendix 4).

1.3.2 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are protected under the EP Act, and include the following:

- World Heritage areas
- areas included on the National Estate Register
- defined wetlands and associated buffers
- vegetation within 50 m of a listed threatened species
- TECs.

1.3.3 Protection of native vegetation

Native vegetation is defined under the EP Act as "indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation".

This definition of native vegetation does not include vegetation that was intentionally sown, planted or propagated unless wither of the following apply:

(a) the vegetation was sown, planted or propagated as required under the EP Act or another written law

(b) the vegetation is of a class declared by regulation to be included in this definition.

Native vegetation can only be cleared with a clearing permit, unless for some circumstances where exemptions apply pursuant to the EP Act and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (the Regulations). Clearing permits issued pursuant to the Regulations may be issued as area permits or purpose permits. Exemptions for clearing under Regulation 5 of the Regulations do not apply within ESAs.

1.3.4 Introduced species

The BAM Act provides for management and control of listed organisms, including introduced flora species (weeds). Species listed as declared pests under the BAM Act are classified under three categories:

1. C1 Exclusion: Pests assigned under this category are not established in Western Australia, and control measures are to be taken to prevent them entering and establishing in the State.
2. C2 Eradication: Pests assigned under this category are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
3. C3 Management: Pests assigned under this category are established in Western Australia, but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area that is currently free of that pest.

Under the BAM Act, land managers are required to manage populations of declared pests as outlined under the relevant category.

1.3.5 Regulatory guidance

The flora and vegetation survey component of this investigation has been designed to address the recommendations of the EPA as described in the following guidance:

- EPA Position Statement No. 2 *Environmental Protection of Native Vegetation in Western Australia* (EPA 2000)
- EPA Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002)
- EPA Position Statement No. 10 *Level of Assessment for Proposals Affecting Natural Areas Within the System 6 Region and Swan Coastal Plain Portion of the System 1 Region* (EPA 2006)
- EPA Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004).

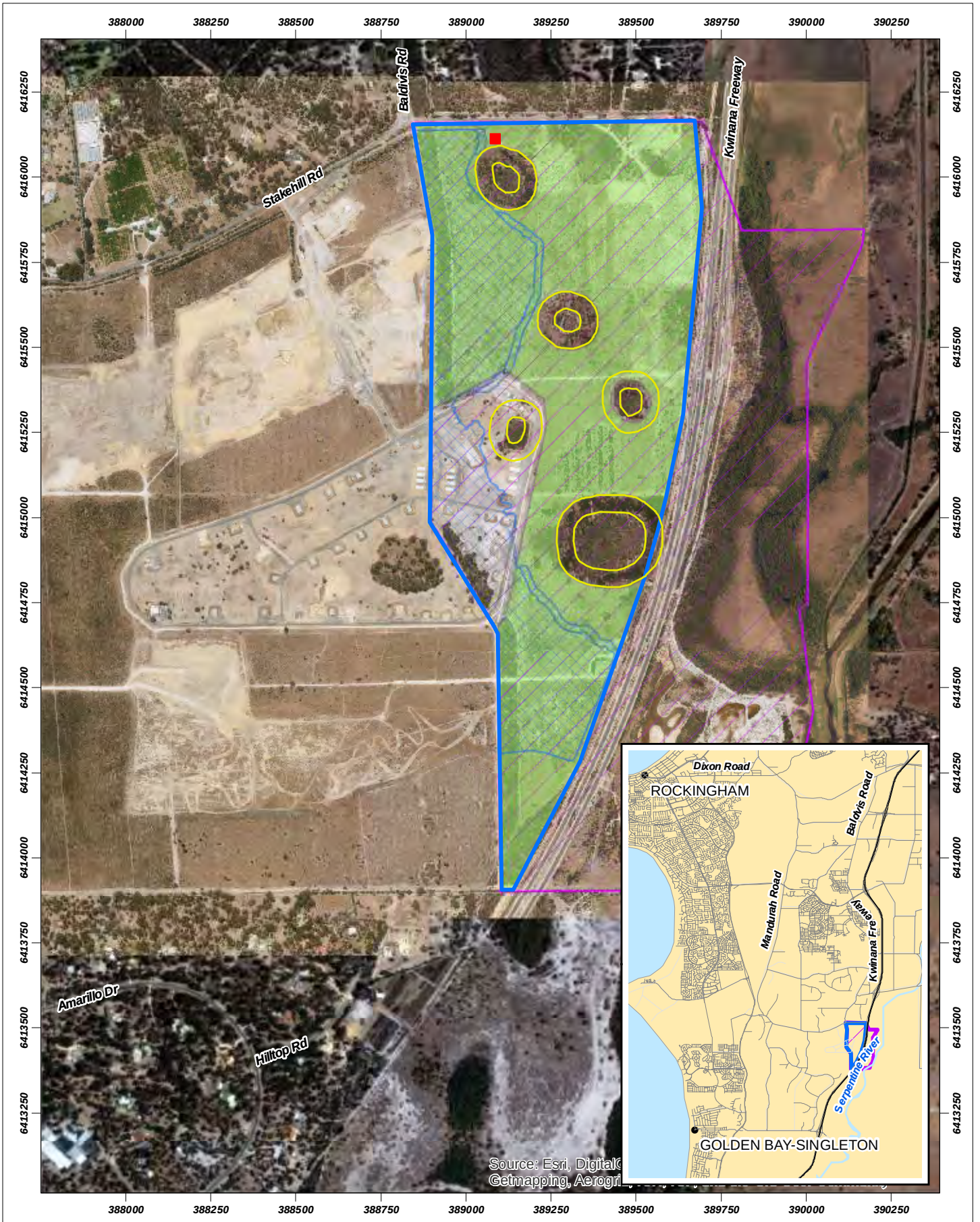

Figure 1: Regional location of the Project

Scale 1:15,000 at A4

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 23/06/2015

Author: JCrute

Source: Aerial image: Landgate, flown 11/2014. Aerial image background: ESRI approx. 2010.

Legend

- Site compound boundary
- 50m wetland buffer
- Project area
- Mining area
- Tenement M70/1262
- Survey area

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1.4 Environmental setting

1.4.1 Soils and topography

The Survey area is located within the Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion) of Western Australia (Mitchell et al. 2002). The Swan Coastal Plain comprises five major geomorphological systems that lie parallel to the coast, namely (from west to east) the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf (Churchward & McArthur 1980; Gibson et al. 1994). Each major system is composed of further subdivisions in the form of detailed geomorphological units (Churchward & McArthur 1980; Semeniuk 1990; Gibson et al.1994). Beard (1990) describes the Swan Coastal Plain as a low-lying coastal plain, often swampy, with sandhills also containing dissected country rising to the duricrusted Dandaragan plateau on Mesozoic, mainly sandy, yellow soils. The Survey area itself is situated predominately on Bassendean sand.

1.4.2 Climate

The Karnup locality experiences a Mediterranean climate characterised by mild, wet winters and warm to hot, dry summers. The nearest Bureau of Meteorology (BoM) weather station at Medina Research Station (Station No. 9194) provides average monthly climate statistics for the Karnup locality (Figure 2). Average annual rainfall recorded at Medina since 1983 is 752.5 mm (BoM 2015). Rainfall may occur at any time of year; however, most occurs in winter in association with cold fronts from the southwest. Highest temperatures occur between December and March, with average monthly maximums ranging from 28.2°C in December to 31.5°C in February (BoM 2015). Lowest temperatures occur between June and September, with average monthly minimums ranging from 8.2°C in July and August to 9.2°C in September (BoM 2015).

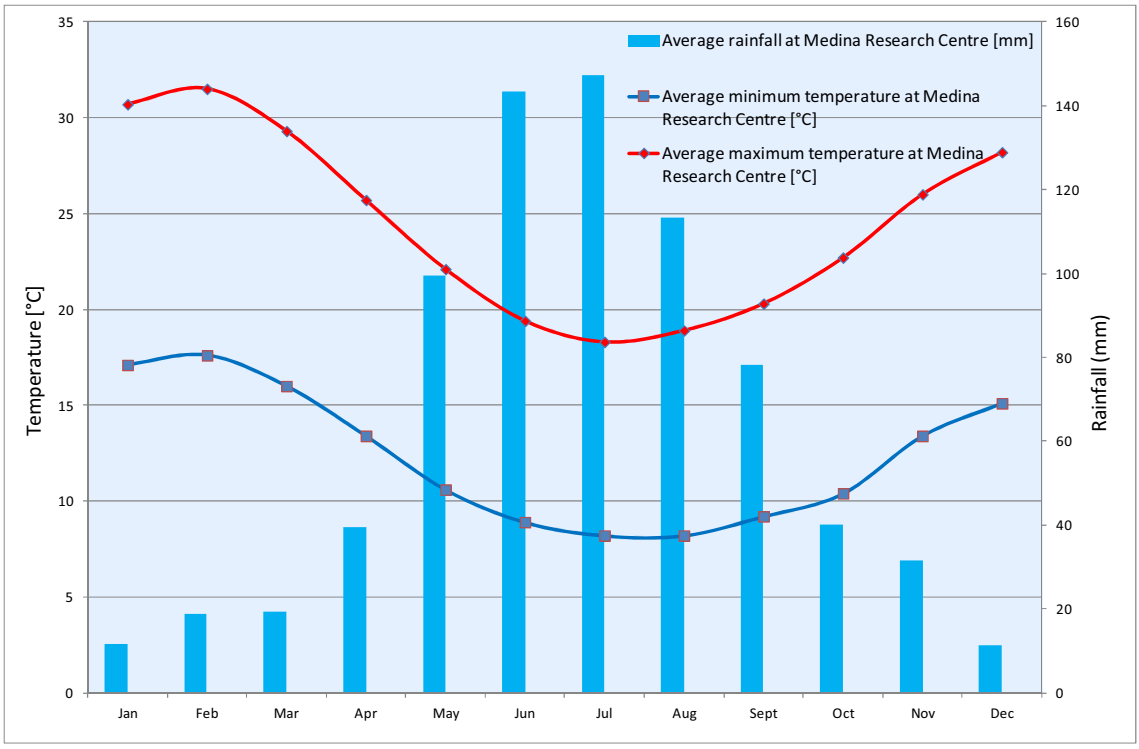

Figure 2: Mean monthly climatic data (temperature and rainfall) for Medina Research Centre

1.4.3 Regional vegetation

Vegetation occurring within the region was initially mapped at a broad scale (1:1 000 000) by Beard during the 1970s. This dataset has formed the basis of several regional mapping systems, including physiographic regions defined by Beard (1981); System 6 Vegetation Complex mapping undertaken by Heddle et al. (1980); the biogeographical region dataset (Interim Biogeographic Regionalisation for Australia, IBRA) for Western Australia (DotE 2015a).

IBRA subregion

The Survey area occurs within the Swan Coastal Plain 2 IBRA subregion which is dominated by *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains and paperbark (*Melaleuca*) in swampy areas (Mitchell et al. 2002).

Beard (1990) Botanical Subdistrict

The Survey area occurs within the Drummond Botanical Subdistrict which is characterised by low *Banksia* woodlands on leached sands; *Melaleuca* swamps on poorly-drained depressions; and *Eucalyptus gomphocephala* (Tuart), *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) woodlands on less leached soils (Beard 1990).

System 6 mapping

System 6 mapping refers to vegetation mapping undertaken at a Vegetation Complex scale by Heddle *et al.* (1980). This is the primary source of information used to calculate potential impacts of proposals to clear native vegetation on the Swan Coastal Plain. The Survey area occurs at the interface between the Serpentine River and Karrakatta vegetation complexes. These complexes can be described as:

- Serpentine River – closed scrub of *Melaleuca* spp. and fringing woodland of *Eucalyptus rudis* and *M. rhaphiophylla* along streams
- Karrakatta – predominantly open forest of *Eucalyptus gomphocephala – E. marginata – C. calophylla* and woodland of *E. marginata – Banksia* spp.

2. Objectives

The general aim of this survey was to undertake an environmental investigation of the Survey area. The objectives were to:

- conduct a desktop survey for Threatened and Priority flora which have been identified as being present in or around the Survey area
- collect and identify the vascular plant species present within the Survey area
- search areas of suitable habitat for Threatened and/or Priority flora
- define and map the native vegetation communities present within the Survey area
- provide recommendations on the local and regional significance of the vegetation communities
- identify habitat for Threatened species of black cockatoos within the Survey area
- prepare a report summarising the findings.

3. Methods

3.1 Desktop Assessment

A desktop assessment was conducted using Florabase, Parks and Wildlife, and Department of the Environment (DotE) databases to identify the possible occurrence of TECs, PECs, Threatened and Priority flora, and conservation significant fauna species potentially occurring within the Survey area. Reports that document regional flora, vegetation and fauna within the surrounds of the Survey area were also reviewed prior to the field assessment.

A database search request was also submitted to the Threatened Communities Branch of Parks and Wildlife to identify any potential TECs or PECs within 5 km of the Survey area.

3.2 Field assessment

3.2.1 Flora and vegetation

Assessment of flora and vegetation within the Survey area was undertaken by an experienced ecologist from Strategen and senior ecologist from Mattiske Consulting on 1 May 2015 (Table 1). Five vegetation mapping sites were surveyed and the entire site was traversed on foot to record changes in vegetation structure and type (Appendix 1; Appendix 2). The field survey was conducted according to standards set out in Guidance Statement 51 (EPA 2004).

Table 1: Personnel

Name	Project involvement	Flora collection permit
Mr. D. Panickar Strategen (Experienced Ecologist)	Planning, fieldwork, data interpretation and report preparation	SL010993
Mr. J. Cargill Mattiske Consulting (Senior Ecologist)	Fieldwork and plant identification	SL011297

Site selection for vegetation mapping was based on differences in structure and species composition of the communities present within the Survey area. Vegetation mapping sites were determined from aerial photographs and opportunistic sites were selected in the field where a change in vegetation structure or composition was observed.

Flora and vegetation was described and sampled systematically at each survey site and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each site the following floristic and environmental parameters were noted:

- GPS location
- topography
- soil type and colour
- outcropping rocks and their type
- percentage cover and average height of each vegetation stratum
- presence of significant trees.

For each vascular plant species, the average height and percent cover (both live and dead material) were recorded.

All plant specimens collected during the field surveys were dried and fumigated in accordance with the requirements of the Western Australian Herbarium. The plant species were identified through comparisons with pressed specimens housed at the Western Australian Herbarium where necessary. Nomenclature of the species recorded is in accordance with Western Australian Herbarium (1998-).

3.2.2 Black cockatoo habitat assessment

Desktop assessments identified the potential presence of all three species of Threatened species of black cockatoos (Forest Red-tailed Black-Cockatoos [FRTBC], Baudin's Black-Cockatoos [BBC] and Carnaby's Black-Cockatoos [CBC]) within the Survey area. A foraging and significant tree assessment was undertaken simultaneously with the flora and vegetation assessment to quantify the value of the Survey area as potential habitat for black cockatoos.

Foraging assessment

The Survey area was traversed on foot to record any flora species with the potential to provide a food source for black cockatoos. Data from this assessment were combined with vegetation mapping units defined during the flora and vegetation assessment. Vegetation units were then assigned a foraging value based on the presence and quantity of potential food species and any evidence of foraging by black cockatoos.

Significant tree assessment

Significant trees are defined as trees of suitable species with a diameter at breast height (DBH) greater than 500 mm (> 300 mm for salmon gum and wandoo) (DSEWPaC [now DotE] 2012). Tree species which are considered to be potential breeding or roosting trees are outlined in Table 2. Trees with a DBH greater than 500 mm (or >300 mm for salmon gum and wandoo) are large enough to potentially contain hollows suitable for nesting black cockatoos, or have the potential to develop suitable hollows over the next 50 years. Trees of this size may also be large enough to provide roosting habitat (i.e. trees which provide a roost or rest area for the birds). The locations of such trees within the Survey area were recorded using a Global Positioning System (GPS) device. In addition to the location and DBH, the species of each tree was also recorded.

Table 2: Black cockatoo potential breeding tree species (Groom 2011, DSEWPaC 2012)

Scientific name	Common name	Breeding	Roosting
Corymbia calophylla	Marri	Yes	Yes
Corymbia maculata	Spotted Gum		Yes
Eucalyptus accedens	Powderbark	Yes	
Eucalyptus camaldulensis	River Red Gum		Yes
Eucalyptus citriodora	Lemon Scented Gum		Yes
Eucalyptus diversicolor	Karri	Yes	
Eucalyptus globulus	Tasmania Blue Gum		Yes
Eucalyptus gomphocephala	Tuart	Yes	Yes
Eucalyptus grandis	Flooded Gum, Rose Gum		Yes
Eucalyptus longicornis	Red Morrell	Yes	
Eucalyptus loxophleba	York Gum	Yes	
Eucalyptus marginata	Jarrah	Yes	Yes
Eucalyptus megacarpa	Bullich	Yes	Yes
Eucalyptus occidentalis	Swamp Yate	Yes	
Eucalyptus patens	Blackbutt	Yes	Yes
Eucalyptus robusta	Swamp Mahogany		Yes
Eucalyptus rudis	Flooded Gum	Yes	Yes
Eucalyptus salmonophloia	Salmon Gum	Yes	
Eucalyptus salubris	Gimlet	Yes	
Eucalyptus wandoo	Wandoo	Yes	Yes
Pinus pinaster	Pinaster, Maritime Pine		Yes
Pinus radiata	Monterey, Radiata Pine		Yes

3.3 Data analysis and vegetation mapping

Due to the degraded nature and uniform distribution of vegetation within the Survey area, quadrat data were grouped into a species by site matrix to delineate individual vegetation types (VTs) present within the Survey area. Aerial photography interpretation and field notes taken during the survey were then used to develop VT mapping polygon boundaries over the Survey area. These polygon boundaries were then digitised using Geographic Information System (GIS) software.

VT descriptions (though floristic in origin) have been adapted from the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 6.0 (ESCAVI 2003), a system of describing structural vegetation units (based on dominant taxa). This model follows nationally-agreed guidelines to describe and represent vegetation types, so that comparable and consistent data is produced nation-wide. For the purposes of this report, a VT is considered equivalent to a NVIS sub-association as described in ESCAVI (2003).

Vegetation condition was recorded at all quadrats, and also opportunistically within the Survey area during the field assessment where required. Vegetation condition was described using the vegetation condition scale for the South West Botanical Province (Keighery 1994). Vegetation condition polygon boundaries were developed using this information in conjunction with aerial photography interpretation, and were digitised as for vegetation type mapping polygon boundaries.

3.4 Flora and vegetation assessment limitations and constraints

Table 3 displays the evaluation of the flora and vegetation assessment against a range of potential limitations that may have an effect on that assessment. Based on this evaluation, the assessment has not been subject to constraints that would affect the thoroughness of the assessment and the conclusions reached.

Table 3: Flora and vegetation assessment potential limitations and constraints

Potential limitation	Impact on assessment	Comment
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	**Not a constraint.**	The study has been undertaken in the Drummond Botanical Subdistrict on the Swan Coastal Plain which has been well studied and documented with ample literature available (Beard 1990).
Scope (i.e. what life forms, etc., were sampled).	**Not a constraint.**	Due to the degraded nature and uniform distribution of vegetation within the Survey area, most life forms are likely to have been sampled adequately during the time of the survey.
Proportion of flora collected and identified (based on sampling, timing and intensity).	**Not a constraint.**	The proportion of flora surveyed was adequate. The entire site was traversed and all species observed were recorded in accordance with a Level 1 survey.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	**Not a constraint**	The information collected during the survey was sufficient to assess the vegetation that was present during the time of the survey.
Mapping reliability.	**Not a constraint.**	Aerial photography of a suitable scale was used to map the Survey area. Sites were chosen from these aerials to reflect changes in community structure. Opportunistic sites were also used if differences were observed during on ground reconnaissance. Vegetation types were assigned to each site based on topography, soil type, presence/absence and percent foliage cover of vegetation.
Timing, weather, season, cycle.	**May be a constraint.**	Flora and vegetation surveys are normally conducted following winter rainfall in the South-West Province, ideally during spring (EPA 2004). The field assessment was conducted in May and as such, some annual herb and forb species may not have been recorded during the assessment.
Disturbances (fire flood, accidental human intervention, etc.).	**Not a constraint.**	The Survey area and regional surrounds have been subject to disturbance over a significant period of time. Given the wide range of this disturbance, this is not considered to be a limitation within the Survey area.
Intensity (in retrospect, was the intensity adequate).	**Not a constraint.**	The entire site was traversed on foot and differences in vegetation structure were recorded appropriately.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	**Not a constraint.**	The available resources were adequate to complete the survey.
Access problems (i.e. ability to access survey area).	**Not a constraint.**	Existing tracks enabled adequate access to survey the vegetation within the Survey area. Where access was not available by car, the area was easily traversed by foot.
Experience levels (e.g. degree of expertise in plant identification to taxon level).	**Not a constraint.**	All survey personnel have the appropriate training in sampling and identifying the flora of the region.

4. Results

4.1 Desktop assessment results

4.1.1 Flora and vegetation

A total of 108 native vascular plant taxa from 40 plant families have the potential to occur within the vicinity of the Survey area (Parks and Wildlife 2007-). The majority of taxa were from within the *Cyperaceae* (15 taxa), *Myrtaceae* (9 taxa) and *Fabaceae* (8 taxa) families (Appendix 3).

Threatened and Priority Ecological Communities

A TEC is defined under the EP Act as an ecological community listed, designated or declared under a written law or a law of the Australian Government as Threatened, Endangered or Vulnerable. There are four State categories of TECs (DEC 2010)[1]:

- presumed totally destroyed (PD)
- critically endangered (CR)
- endangered (EN)
- vulnerable (VU).

A description of each of these TEC categories is presented in Appendix 4. TECs are gazetted as such (Parks and Wildlife 2014a) and some Western Australian TECs are listed as Threatened under the EPBC Act.

Under the EPBC Act, a person must not undertake an action that has or will have a significant impact on a listed TEC without approval from the Australian Government Minister for the Environment, unless those actions are not prohibited under the EPBC Act. A description of each of these categories of TECs is presented in Appendix 4. The current EPBC Act list of TECs can be located on the DotE (2015b) website.

Ecological communities identified as threatened, but not listed as TECs, are classified as Priority Ecological Communities (PECs). These communities are under threat, but there is insufficient information available concerning their distribution to make a proper evaluation of their conservation status. Parks and Wildlife categorises PECs according to their conservation priority, using five categories, P1 (highest conservation significance) to P5 (lowest conservation significance), to denote the conservation priority status of such ecological communities. Appendix 4 defines PECs (DEC 2010). A list of current PECs can be viewed at the Parks and Wildlife (2014b) website.

No TECs or PECs were identified as having the potential to occur within the Survey area (Figure 3). The closest PEC identified in proximity to the Survey area was SCP 25 (Southern *Eucalyptus gomphocephala* – *Agonis flexuosa* woodlands) which had a buffer of approximately 1.3 km from the Survey area.

[1] The Department of Environment and Conservation is still listed as the author of all TEC and PEC databases and have been referred to as such in this document instead of the Department of Parks and Wildlife (Parks and Wildlife).

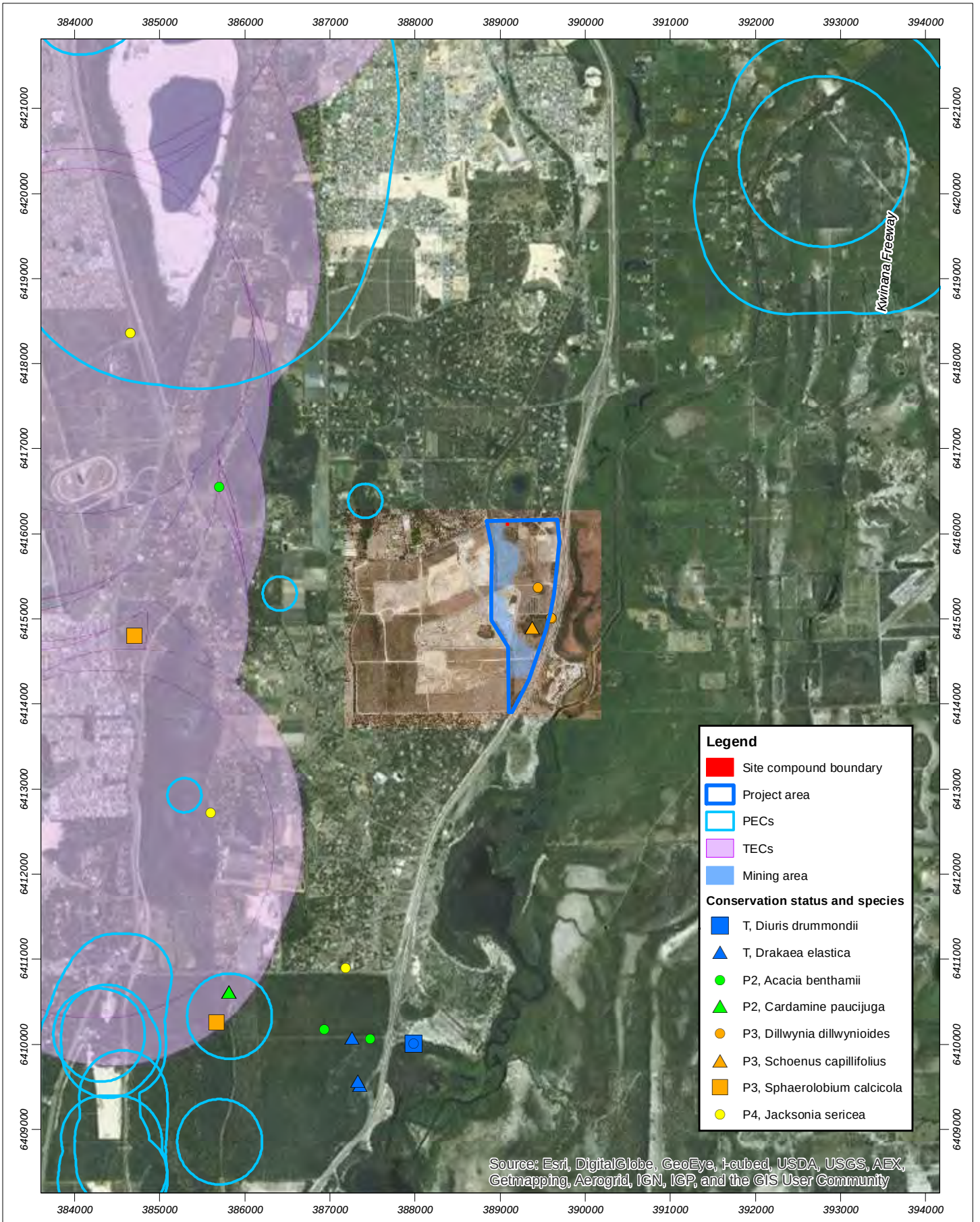

Figure 3: Location of Threatened and Priority Flora, TECs and PECs

Scale 1:60,000 at A4

0 0.5 1 1.5 2 km

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 23/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Background aerial image: : ESRI online, approx. 2010. TEC/PEC & Flora: DPAW 2015.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R004\RevC\URE15096_01_R004_RevC_F002.mxd

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Threatened and Priority flora

A desktop survey for Threatened and Priority flora that may potentially occur within the Survey area was undertaken using NatureMap (Parks and Wildlife 2007-), the Western Australian Herbarium (Western Australian Herbarium 1998-), and the DotE Protected Matters Search Tool (DotE 2015c).

Flora within Western Australia that is considered to be under threat may be classed as either Threatened flora or Priority flora. Where flora has been gazetted as Threatened flora under the WC Act, the taking of such flora without the written consent of the Minister is an offence. The WC Act defines "to take" flora as to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means.

Priority flora are considered to be species which are potentially under threat, but for which there is insufficient information available concerning their distribution and/or populations to make a proper evaluation of their conservation status. Parks and Wildlife categorises Priority flora according to their conservation priority using five categories, P1 (highest conservation significance) to P5 (lowest conservation significance), to denote the conservation priority status of such species. Priority flora species are regularly reviewed and may have their priority status changed when more information on the species becomes available. Appendix 4 defines levels of Threatened and Priority flora (Western Australian Herbarium 1998-).

At the national level, the EPBC Act lists Threatened species as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent. Appendix 4 defines each of these categories of Threatened species. The EPBC Act prohibits an action that has or will have a significant impact on a listed Threatened species without approval from the Australian Government Minister for the Environment. The current EPBC Act list of Threatened flora may be found on the DotE (2015d) website.

Table 4 shows the Threatened and Priority flora potentially occurring within the Survey area. The desktop assessment identified ten Threatened flora and three Priority flora species that have the potential to occur within the area. Of these, based on specific habitat requirements, three Threatened flora species (*Caladenia huegelii, Drakaea elastica* and *Drakaea micrantha*) and four Priority flora species (*Cardamine paucijuga, Sphaerolobium calcicola, Dillwynia dillwynioides* and *Jacksonia sericea*) were considered to have the potential to occur. Figure 3 shows occurrences of *Dillwynia dillwynioides* and *Schoenus capillifolius* within wetlands in proximity to the Survey area (Bennett 2006). As the proposed mining will not occur within wetland areas, these occurrences will not be impacted by the Proposal.

Table 4: Threatened and Priority flora potentially occurring within the Survey area

Species	Conservation status		Description	Potential to occur
	EPBC Act	WC Act		
Andersonia gracilis	**Threatened** - Endangered	Threatened	A slender shrub to 50 cm tall with few, spreading branches. Flowers are pink to pale mauve. Habitat for this species occurs within seasonally damp, black sandy clay flats near swamps (Western Australian Herbarium 1998-, DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area– wetland areas will not be impacted by the proposed mining.
Caladenia huegelii	**Threatened** – Endangered	Threatened	A slender orchid from 30 to 50 cm tall. One or two striking flowers characterised by a greenish-cream lower petal with a maroon tip. Other petals are cream with red or pink suffusions. Habitat for this species occurs within well-drained, deep sandy soils in low mixed Banksia, Allocasuarina and Jarrah woodlands (Western Australian Herbarium 1998-, DotE 2015e).	**Possible –** Preferred soil type/habitat occurs within the Survey area.
Centrolepis caespitosa	**Threatened** – Endangered	Priority 4	A diminutive, densely tufted, glabrous annual herb. Flowers are red/brown and are singular. Habitat for this species is relatively unknown. Brown et al. (1998) identified that this species occurs within winter-wet claypans dominated by low shrubs and sedges.	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area– wetland areas will not be impacted by the proposed mining. It is worth noting that Parks and Wildlife have removed this species from its Threatened flora listing and is now classed as Priority 4.
Darwinia foetida	**Threatened** – Critically Endangered	Threatened	An erect, spreading shrub to 70 cm tall. Green flowers, visible from October to November. Habitat for this species occurs within wet/winter-damp clay under Myrtaceous shrubland (DotE 2015e).	**Highly unlikely –** Preferred habitat does not occur within the Survey area as wetland areas will not be impacted by the proposed mining. Additionally, both Western Australian Herbarium (1998-) and DotE (2015e) list this species' distribution to be highly restricted within the Muchea area (approximately 70 km north of Perth).
Diuris drummondii	**Threatened** – Vulnerable	Threatened	A perennial orchid to 105 cm tall. Often forms dense colonies with individuals displaying between three and eight widely spaced yellow flowers. Habitat for this species occurs in low-lying depressions in peaty and sandy clay swamps (DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area– wetland areas will not be impacted by the proposed mining.
Diuris micrantha	**Threatened** – Vulnerable	Threatened	A slender orchid to 60 cm tall. Yellow flowers with reddish-brown markings measuring 1.3 cm across. Habitat for this species occurs within clay-loam substrates in winter-wet depressions or swamps (DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area– wetland areas will not be impacted by the proposed mining.
Diuris purdiei	**Threatened** – Endangered	Threatened	A slender orchid to 45 cm tall. Unusually flattened flowers, marked with brown blotches on their under surface. Habitat for this species occurs in areas subject to winter inundation within dense heath with scattered Myrtaceous trees (DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area – wetland areas will not be impacted by the proposed mining.
Drakaea elastica	**Threatened** – Endangered	Threatened	A slender orchid to 30 cm tall with a prostrate, round to heart shaped leaf. Singular, bright green, glossy flower. Habitat for this species is within bare patches of white sand over dark sandy loams on damp areas (DotE 2015e).	**Possible –** Preferred soil type/habitat occurs within the Survey area.

Species	Conservation status		Description	Potential to occur
	EPBC Act	WC Act		
Drakaea micrantha	**Threatened** – Vulnerable	Threatened	A tuberous, terrestrial orchid to 30 cm tall. Silvery-grey heart shaped leaf with prominent green veins. Red and yellow singular flower. Habitat for this species occurs within cleared, open sandy patches (Brown et al. 1998).	**Possible –** Preferred soil type/habitat occurs within the Survey area.
Lepidosperma rostratum	**Threatened** – Endangered	Threatened	A rhizomatous sedge to 30 cm in diameter. Stems are circular in cross section and flowers are spike-like and up to 4 cm long. Habitat for this species occurs in sandy soils among low heath comprised of *Banksia telmatiaea* and *Calothamnus hirsutus* in winter-wet swamps.	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area – wetland areas will not be impacted by the proposed mining.
Synaphea stenoloba	**Threatened** – Endangered	Threatened	A caespitose shrub to 45 cm tall. Yellow flowers visible from August to October. Habitat for this species occurs within loamy soils in low lying areas that are seasonally inundated (DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area – wetland areas will not be impacted by the proposed mining.
Acacia benthamii	Not listed	Priority 2	A shrub to 1 m tall. Flowers are yellow and visible from August to September (Western Australian Herbarium 1998-). Habitat for this species is typically on limestone breakaways.	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area.
Cardamine paucijuga	Not listed	Priority 2	A slender, erect annual herb to 0.4 m tall. Flowers are white and visible from September to October (Western Australian Herbarium 1998-). Habitat for this species occurs in a broad range of settings.	**Possible –** Preferred soil type/habitat could occur within the Survey area.
Sphaerolobium calcicola	Not listed	Priority 3	A slender, multi-stemmed, scandent or erect shrub to 1.5 m tall. Flowers are orange-red and visible in June or from September to November (Western Australian Herbarium 1998-). Habitat for this species occurs in a broad range of settings.	**Possible –** Preferred soil type/habitat could occur within the Survey area.
Dillwynia dillwynioides	Not listed	Priority 3	A decumbent or erect, slender shrub to 1.2 m tall. Flowers are red and yellow/orange and visible in August to December (Western Australian Herbarium 1998-). Habitat for this species is in winter-wet depressions and sandy soils.	**Possible –** Preferred soil type/habitat occurs within the Survey area.
Schoenus capillifolius	Not listed	Priority 3	A semi-aquatic, tufted, annual grass-like herb to 5 cm tall. Flowers are green and visible from October to November (Western Australian Herbarium 1998-). Habitat for this species is in brown mud in claypans.	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area – wetland areas will not be impacted by the proposed mining.
Stylidium longitubum	Not listed	Priority 3	An erect annual herb to 12 cm tall. Flowers are pink and visible from October to December (Western Australian Herbarium 1998-). Habitat for this species occurs in sandy clay in seasonal wetlands.	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area – wetland areas will not be impacted by the proposed mining.
Jacksonia sericea	Not listed	Priority 4	A Low spreading shrub to 0.6 m tall. Flowers are orange and visible from December to February (Western Australian Herbarium 1998-). Habitat for this species occurs in calcareous and sandy soils.	**Possible –** Preferred soil type/habitat occurs within the Survey area.

4.1.2 Black cockatoo habitat

All three species of Threatened black cockatoos occurring in Western Australia were identified as having the potential to occur within the Survey area based on a desktop survey for Threatened fauna (DotE 2015c; Appendix 3). Table 5 displays the current conservation status for the three identified species within the Survey area. Desktop surveys also identified the presence of Jarrah-*Banksia* woodland within the Survey area which may provide both foraging and breeding habitat for black cockatoos.

Table 5: Threatened species of black cockatoos potentially occurring within the Survey area

Species		Conservation status	
Common name	Scientific name	EPBC Act	WC Act
Carnaby's Black-Cockatoo	*Calyptorhynchus latirostris*	Endangered	Threatened
Baudin's Black-Cockatoo	*Calyptorhynchus baudinii*	Vulnerable	Threatened
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii* naso	Vulnerable	Threatened

Foraging and breeding habits of black cockatoos

Carnaby's Black-Cockatoos feed on the seeds, nuts and flowers, of a variety of native and introduced plant species and insect larvae (DotE 2015e). Food plants generally occur within proteaceous genera such as *Banksia, Dryandra, Hakea* and *Grevillea*, though are known to forage on eucalypt species in woodland areas. Carnaby's black cockatoos have also adapted to feeding on exotic species such as pines and cape lilac and weeds such as wild radish and wild geranium (DotE 2015e). Carnaby's black cockatoos usually breed between July and December in the hollows of live or dead eucalypts; primarily in Salmon Gum and Wandoo, but also within Jarrah, Marri and other eucalypt species (Johnstone 2010a). Hollows are usually at least 2 m above ground, sometimes over 10 m and the depth of the hollow vary from 0.25 m to 6 m (DotE 2015e). The Western Australian Department of Parks and Wildlife (Parks and Wildlife), renewed the Carnaby's Cockatoo Recovery Plan in 2013, clearly mapping the distribution of likely breeding and non-breeding areas in south-west WA for CBC (Parks and Wildlife 2013). Based on this map, the Survey area is situated within the CBC breeding range.

Baudin's Black-Cockatoos primarily occur in eucalypt forests and forage at all strata levels within the forests with a tendency to favour areas containing Marri (Johnstone and Kirkby 2008, DotE 2015e). Breeding generally occurs in the Jarrah, Marri and Karri forests of the southwest of Western Australia in areas averaging more than 750 mm of rainfall annually (DotE 2015e). As with the other two species of Threatened black cockatoos in Western Australia, breeding habitat also occurs in former woodland or forest that has been reduced to isolated trees (DotE 2015e).

Forest Red-tailed Black-Cockatoos depend primarily on Marri and Jarrah trees for both foraging and nesting. The seeds of both eucalypts are the favoured food source of the birds and hollows within live or dead individual trees are utilised for nesting purposes (Johnstone and Kirkby 1999). Breeding varies between years and occurs at times of Jarrah and Marri fruiting. These black cockatoos breed in woodland or forest, but may also breed in former woodland or forest that has been reduced to isolated trees (DotE 2015e).

4.2 Field survey results

4.2.1 Native flora

A total of 41 native vascular plant taxa from 34 plant genera and 18 plant families were recorded within the Survey area. The majority of taxa were recorded within the Fabaceae (8 taxa), Myrtaceae (6 taxa) and Proteaceae (5 taxa) families (Appendix 5). The relatively low number of plant genera recorded reflects the disturbed nature of the site.

4.2.2 Threatened and Priority flora

No Threatened flora species pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2014c) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the Survey area (Appendix 5).

4.2.3 Threatened and Priority Ecological Communities

No TECs as listed by Parks and Wildlife (2014a) or PECs as listed by Parks and Wildlife (2014b) were identified within the Survey area. The closest PEC identified in proximity to the Survey area was SCP 25 (Southern *Eucalyptus gomphocephala – Agonis flexuosa* woodlands) which had a buffer of approximately 1.3 km from the Survey area (refer to section 4.1.1), but was not inferred to occur within the Survey area based on floristic composition.

4.2.4 Introduced (exotic) flora

A total of six introduced (exotic) taxa were recorded within the Survey area (Appendix 5):

- **Briza maxima*
- **Carpobrotus edulis*
- **Conyza sumatrensis*
- **Eragrostis curvula*
- **Hypochaeris glabra*
- **Lagurus ovatus.*

None of these species is a Declared Plant species in Western Australia pursuant to Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) according to the Western Australian Department of Agriculture and Food (DAFWA 2014).

4.3 Vegetation Types

Five native vegetation types (VTs) were defined and mapped within the Survey area (Appendix 1; Figure 4) and are summarised in Table 6. Areas containing pine plantations or cleared vegetation have not been counted as unique VTs. The flora and vegetation assessment and black cockatoo habitat assessment surveyed the majority of the Project area however did not include the Explosives Reserve Facility due to restricted access. The vegetation associated with this area has been inferred and a high level of confidence on this inference exists.

Total areas occupied within the Survey area by each of the identified VTs are set out in Table 7.

Table 6: Vegetation Types

Vegetation Type	Description
1	*Macrozamia fraseri, Daviesia triflora* and *Acacia stenoptera* mid open shrubland over *Lyginia barbata, Conostylis aculeata* and *Phlebocarya ciliata* low open sedgeland with *Xylomelum occidentale* and *Eucalyptus rudis* occurring as isolated trees.
2	*Banksia menziesii, B. attenuata, Allocasuarina fraseriana* and *Eucalyptus marginata* open woodland over *Kunzea glabrescens, Acacia pulchella* and *Macrozamia fraseri* mid sparse shrubland over *Hibbertia hypericoides, Conostephium pendulum* and *Gompholobium tomentosum* low sparse shrubland. Including 1.02 ha inferred VT2 within Explosives Reserve.
3	*Jacksonia sternbergiana* and *Adenanthos cygnorum* subsp. *cygnorum* mid shrubland over *Conostylis aculeata* and *Lyginia barbata* low sparse sedgeland.
4[1]	*Banksia menziesii, B. attenuata, Eucalyptus marginata* and *Allocasuarina fraseriana* low open woodland over *Jacksonia furcellata, Regelia ciliata* and *B. sessilis* mid sparse shrubland over *Tetraria octandra* and *Ficinia nodosa* low sparse sedgeland.
5	*Eucalyptus* sp. (planted) open woodland over *Acacia saligna, Jacksonia furcellata* and *Kunzea glabrescens* tall sparse shrubland over **Eragrostis curvula* low sparse tussock grassland.
P[2]	Pine plantation (*Pinus pinaster*).
C[2]	Cleared areas.

1 This vegetation type appears to be the result of rehabilitation activities.

2 Cleared areas and pine plantations have been mapped but are not counted as a unique VT.

4.3.1 Vegetation Type coverage

The total area mapped within the Survey area was 94.94 ha which includes cleared areas and pine plantations (Table 7). The dominant VT within the Survey area was VT 1 which can be broadly described as an open shrubland of *Macrozamia fraseri, Daviesia triflora* and *Acacia stenoptera* with isolated *Xylomelum occidentale* and *Eucalyptus rudis* trees.

Table 7: Area (ha) covered by each VT within the Survey area

VT	Area (ha)	Percentage of the Survey area
1	59.37	62.53
2	7.91	8.33
3	2.02	2.12
4	9.36	9.85
5	7.11	7.50
Pine plantation	3.29	3.47
Cleared areas	5.88	6.20
TOTAL	**94.94**	**100.00**

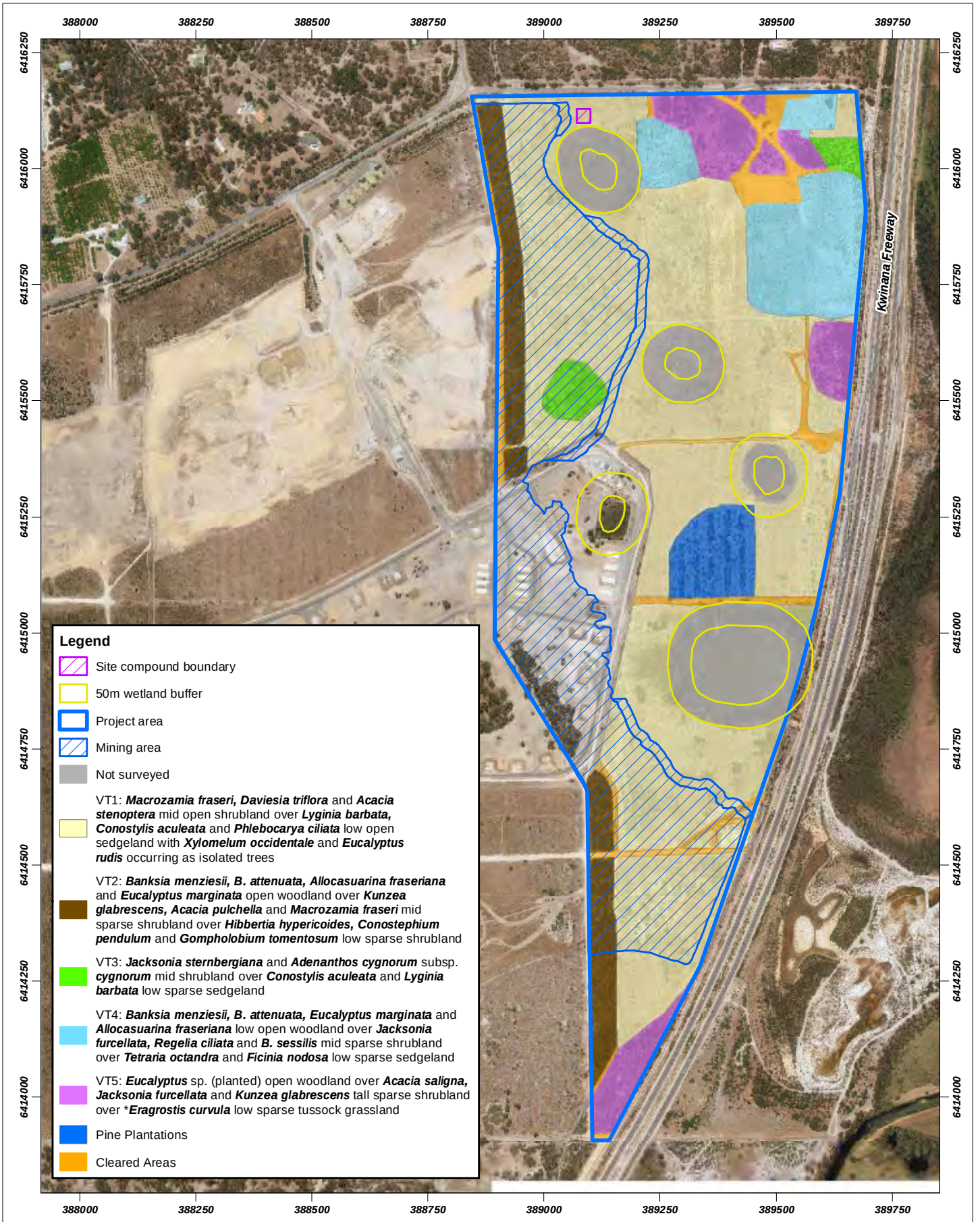

Figure 4: Vegetation types mapped within the Project area

Scale 1:10,997 at A4

0 50 100 150 200 250 Meters

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 23/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R004\RevC\URE15096_01_R004_RevC_F004.mxd

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4.4 Vegetation condition

The majority of the Survey area is in various stages of natural regeneration following the clearing of existing pine plantations from 2004 (approx.). Natural regeneration has been largely successful throughout majority of the Survey area and as such, vegetation condition within these areas was mapped as Good (Keighery 1994; Table 8). Vegetation condition throughout the remainder of the Survey area was mapped as follows:

- Very good: retained *Banksia* woodland in the vegetated strip on the western boundary of the Survey area
- Good: retained *Eucalyptus*/*Acacia* woodland along the southern boundary of the Survey area
- Completely Degraded: Cleared areas and pine plantations.

A summary of vegetation condition within the Survey area is displayed in Figure 5. Table 9 gives a numerical breakdown of the area occupied by each vegetation condition rating within the Survey area.

Table 8: Vegetation condition scale (Keighery 1994)

Condition rating	Description
Pristine (1)	Pristine or nearly so, no obvious sign of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by 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, grazing.
Degraded (5)	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.
Completely Degraded (6)	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.

Table 9: Area (ha) covered by each vegetation condition rating category within the Survey area

Vegetation Condition	Area (ha)	Percentage of the Survey area
Excellent	-	-
Very Good	7.91	8.33
Good	77.86	82.01
Completely Degraded	9.17	9.66
Total	**94.94**	**100.00**

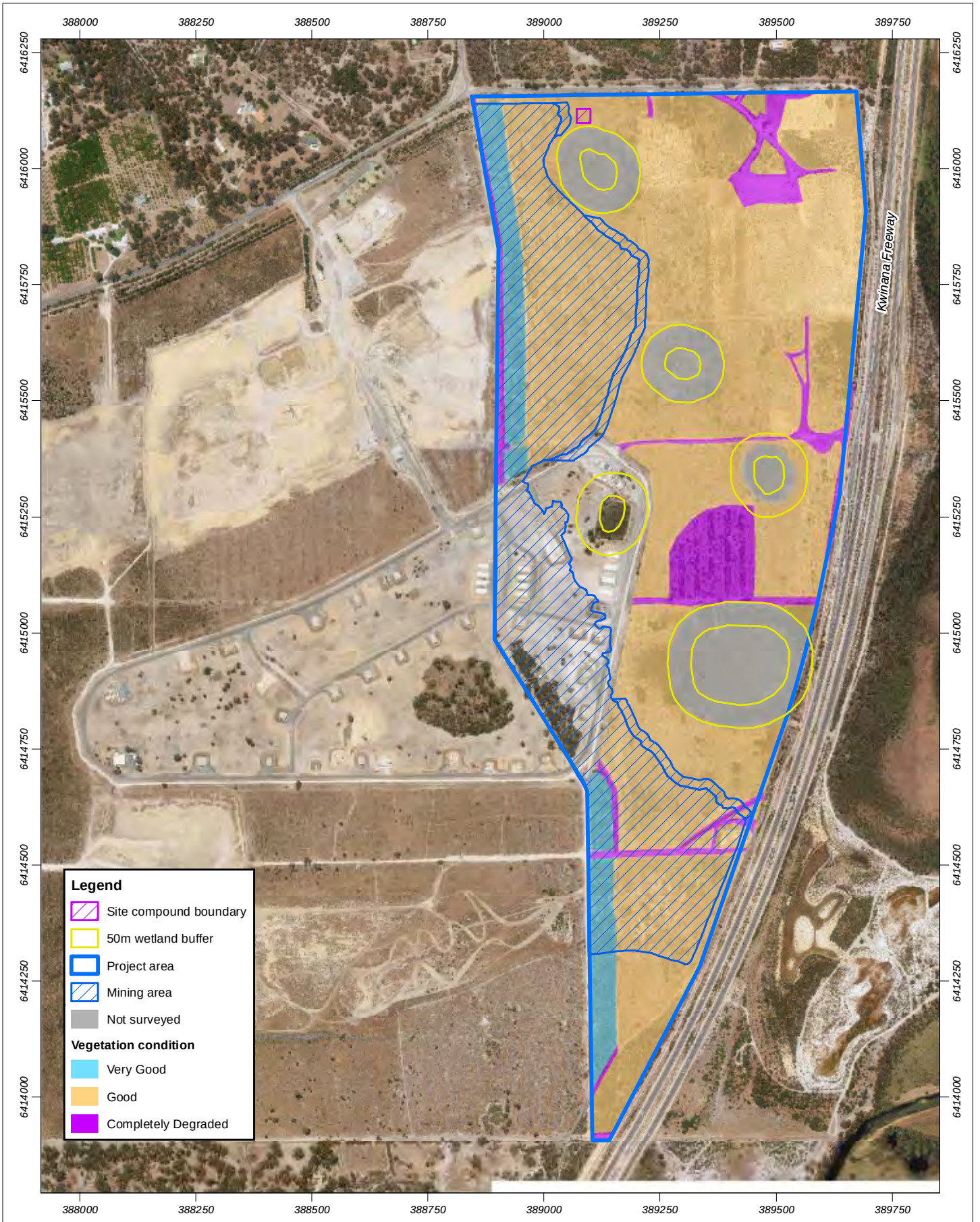

Figure 5: Vegetation condition mapped within the Project area

Scale 1:10,997 at A4

0 50 100 150 200 250 Meters

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 23/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R004\RevC\URE15096_01_R004_RevC_F005.mxd

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4.5 Black cockatoo habitat

4.5.1 Foraging assessment

The Survey area was divided into six different vegetation types (VTs) (including pine plantations) and cleared areas, as informed outlined in section 4.3. A summary of the value of each vegetation type as foraging habitat for black cockatoo species is presented in Table 10 (Groom 2011, Johnstone 2010b, Johnstone 2010c, Johnstone ***et al.*** 2011).

Foraging habitat for black cockatoos is generally defined as the availability of plant food sources within an area (Finn 2012). Food availability for black-cockatoos is a function of the diversity, abundance, distribution, energetic and nutritional qualities, and seasonality (phenology) of the food sources within a particular area. Table 11 summarises the value of each vegetation type in terms of the quality of foraging habitat provided for black cockatoos.

The highest quality foraging habitat for black cockatoos was noted within VT 2 which contained high densities of black cockatoo food species including eucalypts and ***Banksia*** spp. at canopy and midstorey levels. The lowest quality foraging habitat for black cockatoos (not including cleared areas) was noted within VT 5 which contained limited potential food resources for all three species of black cockatoos (refer to footnote following Table 10) and in the pine plantation which provides limited food resources for CBC only.

Based on the results of the foraging assessment, the Survey area is considered to contain 7.91 ha of very good quality foraging habitat, 9.36 ha of good quality foraging habitat and 66.48 ha of low quality foraging habitat for CBC, BBC and FRTBC. The Survey area also contains an additional 3.29 ha of low quality foraging habitat for CBC only (within the pine plantation).

Signs of CBC foraging were observed in scattered occurrences within VT 2.

Table 10: Vegetation types and black cockatoo foraging species within the Survey area

Vegetation type	Description	Black cockatoo foraging species	Area (ha)
1	***Macrozamia fraseri, Daviesia triflora*** and ***Acacia stenoptera*** mid open shrubland over ***Lyginia barbata, Conostylis aculeata*** and ***Phlebocarya ciliata*** low open sedgeland with ***Xylomelum occidentale*** and ***Eucalyptus rudis*** occurring as isolated trees.	CBC – ***E. rudis*** BBC – Nil FRTBC – Nil.	59.37
2	***Banksia menziesii, B. attenuata, Allocasuarina fraseriana*** and ***Eucalyptus marginata*** open woodland over ***Kunzea glabrescens, Acacia pulchella*** and ***Macrozamia fraseri*** mid sparse shrubland over ***Hibbertia hypericoides, Conostephium pendulum*** and ***Gompholobium tomentosum*** low sparse shrubland. Including 1.02 ha inferred VT2 within Explosives Reserve.	CBC – ***B. menziesii, B. attenuata, A. fraseriana, E. marginata*** BBC – ***A. fraseriana, E. marginata*** FRTBC – ***A. fraseriana, E. marginata***.	7.91
3	***Jacksonia sternbergiana*** and ***Adenanthos cygnorum*** subsp. ***cygnorum*** mid shrubland over ***Conostylis aculeata*** and ***Lyginia barbata*** low sparse sedgeland.	CBC – Nil BBC – Nil FRTBC – Nil.	2.02
4	***Banksia menziesii, B. attenuata, Eucalyptus marginata*** and ***Allocasuarina fraseriana*** low open woodland over ***Jacksonia furcellata, Regelia ciliata*** and ***B. sessilis*** mid sparse shrubland over ***Tetraria octandra*** and ***Ficinia nodosa*** low sparse sedgeland.	CBC – ***B. menziesii, B. attenuata, B. sessilis, A. fraseriana, E. marginata, J. furcellata*** BBC – ***B. sessilis, A. fraseriana, E. marginata*** FRTBC – ***A. fraseriana, E. marginata***.	9.36

Vegetation type	Description	Black cockatoo foraging species	Area (ha)
5	***Eucalyptus*** sp. (planted) open woodland over ***Acacia saligna, Jacksonia furcellata*** and ***Kunzea glabrescens*** tall sparse shrubland over ****Eragrostis curvula*** low sparse tussock grassland.	CBC – ***A. saligna, J. furcellata, E.*** sp. (planted)* BBC – ***E.*** sp. (planted)* FRTBC – ***E.*** sp. (planted)*.	7.11
P	Pine plantation (***Pinus pinaster***).	CBC – ***P. pinaster*** BBC – Nil FRTBC – Nil.	3.29
C	Cleared areas.	CBC – Nil BBC – Nil FRTBC – Nil.	5.88

*The ***Eucalyptus*** species present in this vegetation type was unable to be identified at the time of assessment. The species did not appear to be native to Western Australia and was likely planted in the Survey area. All three species of black cockatoos may forage on this species; however this is not likely to constitute significant foraging species for black cockatoos.

Table 11: Quality of black cockatoo foraging habitat within the Survey area

Vegetation type	Foraging quality	Justification
1	Low	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy).
2	Very good	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) and presence of food sources at several strata (i.e. canopy, midstorey and understorey).
3	Nil	No suitable foraging species for black cockatoos present.
4	Good	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) but food sources only present at one or two strata (i.e. canopy and midstorey).
5	Low	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy).
Pine plantation	Low (CBC only)	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy).
Cleared areas	Nil	Cleared areas - no vegetation present.

5. Discussion

Vegetation within the Survey area comprises five native VTs and a remnant pine plantation. Transitions between VTs were generally discontinuous, though occasionally abrupt with margins representing admixtures of more than one VT. This discontinuity is primarily due to changes in soil profile and topography, and presence of cleared areas. At a broad scale, the majority of the Survey area was observed to be in various states of natural regeneration following clearing of historical pine plantations with vegetation comprised of ***Macrozamia fraseri, Daviesia triflora*** and ***Acacia stenoptera*** open shrubland with emergent ***Xylomelum occidentale*** and ***Eucalyptus rudis*** trees. The linear strip of vegetation which runs along the western and southern boundaries of the Survey area represented a different vegetation structure which was primarily a Jarrah-***Banksia*** woodland which was relatively undisturbed by the historical pine plantation.

The flora and vegetation assessment conducted within the Survey area was undertaken during autumn, outside the prime flowering time for majority of species within the area. Field reconnaissance involved traversing the majority of the Survey area, which ensures that an accurate representation of all VTs and potential conservation significant flora were obtained.

The number of native and exotic species recorded on the Survey area totalled 47 vascular plant taxa from 40 genera and 20 families. The relatively low number of plant genera recorded reflects the disturbed nature of the site. Six of these taxa were introduced (exotic species) which were present in moderate to high densities throughout the Survey area. No Declared Plant species pursuant to Section 22 of the BAM Act were recorded within the Survey area (DAFWA 2014).

No conservation significant species or ecological communities were recorded within the Survey area. Effort was made during the field assessment to look for areas of suitable habitat for conservation significant species but none were found, which is likely related to both the disturbed and regenerative nature of the Survey area and the time of year at which the survey was conducted. Given that the survey was conducted outside the prime flowering time for majority of the conservation significant species, there is a possibility that some of these species may occur on the Survey area – however majority of these are likely to be restricted to wetland areas which will not be impacted by the proposed mining.

Conservation significant flora species potentially occurring on the Survey area that may have been missed due to the survey timing are likely to be the three Threatened orchids; ***Caladenia huegelii, Drakaea elastica*** and ***Drakaea micrantha*** which are all diminutive in stature and are at their most visible when in flower. Both ***Drakaea*** species are likely to be restricted to wetland/damp areas and thus are highly unlikely to be impacted by the proposed mining. ***C. huegelii*** has the potential to occur outside of these wetland areas. Given the disturbed nature of the site and the relatively low number of plant genera recorded on the site it is considered unlikely that the species would be located.

All five native VTs appear to be well represented within the local area based on surrounding vegetation and are consistent with the vegetation expected to be found within the region. Levels of species diversity within each VT is likely to be a reflection of the regenerative nature of majority of the Survey area and impacts from historical pine plantations.

Vegetation condition within the Survey area ranged from Very Good to Completely Degraded (Keighery 1994), with majority of the Survey area (approximately 62%) mapped to be in “Good” condition.

Approximately 7.91 ha of very good quality foraging habitat, 9.36 ha of good quality foraging habitat and 66.48 ha of low quality foraging habitat for CBC, BBC and FRTBC was recorded within the Survey area. The Survey area also contains an additional 3.29 ha of low quality foraging habitat for CBC only (within the pine plantation). No potentially significant trees which could potentially be used by black cockatoos for roosting or breeding purposes in the future were recorded within the Survey area.

6. Recommendations

6.1 Black cockatoos

All three black cockatoo species with the potential to occur within the Survey area are classed as Threatened under the EPBC Act and impact to the breeding or foraging habitats of these species can require referral to, and possible assessment by, DotE.

The ***Referral Guidelines for Three Threatened Black Cockatoo Species*** (DSEWPaC 2012) assists in determining whether an action needs to be referred under the EPBC Act and has been used to identify whether an EPBC Act referral is recommended for the proposal.

Table 12 outlines the whether the proposal meets any of the trigger levels for referral. From the guidelines, a criterion that could be triggered is the clearing of more than 1 ha of good quality habitat; however, it is considered that no other criteria would be triggered. This indicates that the clearing of vegetation associated with the proposal may require referral under the EPBC Act.

Table 12: Assessment of the proposal against the black cockatoo Referral Guidelines

Referral trigger	Assessment of proposal against referral trigger	Significant impact triggered
High risk of significant impacts: referral recommended		
Clearing of any known nesting tree	No known nesting trees to be cleared.	No
Clearing or degradation of any part of a vegetation community known to contain breeding habitat	The Survey area does not contain breeding habitat or potentially significant trees which could potentially be used by black cockatoos for roosting or breeding purposes in the future.	No
Clearing or degradation of more than 1 ha of quality foraging habitat	Up to 6.54 ha of very good quality foraging habitat and 24.29 ha of low quality foraging habitat for all three species of black cockatoos may be cleared as a result of the proposal.	**Yes**
Clearing or degradation of a known night roosting tree	No known night roosting trees have been recorded within the Proposal Area.	No
Creating a gap of more than 4 km between patches of Black Cockatoo habitat	The Survey area is located in close proximity to a number of existing reserves within Rockingham Lakes Regional Park containing potential black cockatoo habitat including: • Anstey Swamp (4 km) • Paganoni Swamp (3.8 km). As such, the proposal will not create a gap of more than 4 km between patches of habitat.	No

6.2 Conservation significant flora

One conservation significant flora species, ***Caladenia huegelii***, whilst unlikely due to disturbance, could potentially occur within the Survey area and may not have been recorded during the flora and vegetation survey due to timing constraints.

The abovementioned species is diminutive in stature and is most visible when in flower. A targeted spring survey in accordance with methodology outlined in DotE (2013) would determine if these species is present within the Survey area.

All other conservation significant flora species (listed in the survey report) are unlikely to occur within the Survey area. Most of these species should either have been visible during time of survey or have habitat requirements which do not occur within the Survey area (i.e. wetland areas).

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Appendix 1
Vascular plant taxa recorded by site and vegetation type

Species	Site					Legend
	1	2	3	4	5	VT1
Acacia pulchella var. ***glaberrima***		x	x			VT2
Acacia saligna					x	VT3
Acacia stenoptera	x					VT4
Adenanthos cygnorum subsp***. cygnorum***			x	x		VT5
Allocasuarina fraseriana		x		x		
Banksia attenuata		x		x		
Banksia menziesii		x		x		
Banksia sessilis				x		
Brachyloma preissii		x				
****Briza maxima***	x	x	x			
Burchardia congesta		x				
****Carpobrotus edulis***	x	x	x	x	x	
Conostephium pendulum		x				
Conostylis aculeata subsp. ***aculeata***	x	x	x			
****Conyza sumatrensis***				x		
Corymbia calophylla					x	
Dampiera linearis		x				
Dasypogon bromeliifolius	x	x				
Daviesia triflora	x	x				
Desmocladus flexuosus	x	x	x			
****Eragrostis curvula***		x		x	x	
Eucalyptus marginata		x		x		
Eucalyptus rudis	x					
Eucalyptus sp. (planted)				x	x	
Ficinia nodosa				x		
Gompholobium tomentosum	x	x	x			
Hemiandra pungens			x			
Hibbertia hypericoides		x				
****Hypochaeris glabra***	x			x		
Jacksonia furcellata				x	x	
Jacksonia sternbergiana			x	x		
Kennedia prostrata	x	x				
Kunzea glabrescens	x	x			x	
Lagenophora huegelii		x				
****Lagurus ovatus***					x	
Lechenaultia biloba	x					
Lepidosperma pubisquameum		x				
Lyginia barbata	x	x	x			
Macrozamia fraseri	x	x	x			
Olearia axillaris	x					
Patersonia occidentalis	x	x				
Phlebocarya ciliata	x					
Poaceae sp.	x		x			
Regelia ciliata				x		
Stylidium sp.	x					
Tetraria octandra		x		x		
Xylomelum occidentale	x					

*** denotes introduced (exotic) species (Western Australian Herbarium 1998-)**

Appendix 2
Photographic record of site and vegetation types

Plate 1: Site 01 (VT 1)

Plate 2: Site 02 (VT 2)

Plate 3: Site 03 (VT 3)

Plate 4: Site 04 (VT 4)

Plate 5: Site 05 (VT 5)

Plate 6: Pine plantation

Plate 7: Cleared areas

Appendix 3
Desktop assessment results (Parks and Wildlife 2007-, DotE 2015c)

URE15096.01_flora_3km

Created By Daniel Panickar on 11/05/2015

Kingdom	Plantae
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115°49' 27'' E,32°23' 07'' S
Buffer	3km
Group By	Family

Family	Species	Records
Apiaceae	3	5
Araliaceae	3	5
Asparagaceae	3	3
Asteraceae	6	9
Campanulaceae	4	5
Casuarinaceae	1	1
Celastraceae	1	1
Centrolepidaceae	2	3
Colchicaceae	1	1
Commelinaceae	1	1
Crassulaceae	3	4
Cyperaceae	16	23
Dennstaedtiaceae	1	2
Dilleniaceae	1	1
Droseraceae	3	3
Ericaceae	4	6
Euphorbiaceae	1	2
Fabaceae	12	23
Geraniaceae	1	1
Goodeniaceae	3	4
Haemodoraceae	3	5
Haloragaceae	1	2
Hemerocallidaceae	1	1
Juncaceae	1	3
Lamiaceae	1	2
Lauraceae	1	2
Loganiaceae	1	1
Menyanthaceae	2	2
Myrtaceae	10	12
Orchidaceae	5	6
Orobanchaceae	1	1
Poaceae	8	8
Polygalaceae	1	1
Proteaceae	3	3
Ranunculaceae	1	2
Restionaceae	7	15
Rubiaceae	1	2
Scrophulariaceae	2	2
Selaginellaceae	1	1
Stylidiaceae	5	6
Thymelaeaceae	2	2
TOTAL	**128**	**182**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Apiaceae					
1.	15446	***Eryngium pinnatifidum subsp. pinnatifidum***			
2.	6222	***Homalosciadium homalocarpum***			
3.	6289	***Xanthosia huegelii***			
Araliaceae					
4.	6229	***Hydrocotyle diantha***			
5.	19041	***Trachymene coerulea subsp. coerulea***			
6.	6280	***Trachymene pilosa (Native Parsnip)***			
Asparagaceae					
7.	1231	***Lomandra maritima***			
8.	14542	***Lomandra micrantha subsp. micrantha***			
9.	1318	***Thysanotus arbuscula***			
Asteraceae					
10.	7945	***Cotula coronopifolia (Waterbuttons)***	Y		
11.	8092	***Ixiolaena viscosa (Sticky Ixiolaena)***			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
12.	8175	***Podolepis gracilis (Slender Podolepis)***			
13.	8182	***Podotheca angustifolia (Sticky Longheads)***			
14.	8224	***Siloxerus filifolius***			
15.	8230	***Sonchus asper (Rough Sowthistle)***	Y		
Campanulaceae					
16.	9289	***Lobelia anceps (Angled Lobelia)***			
17.	7408	***Lobelia tenuior (Slender Lobelia)***			
18.	37440	***Monopsis debilis var. depressa***	Y		
19.	7389	***Wahlenbergia preissii***			
Casuarinaceae					
20.	1742	***Casuarina obesa (Swamp Sheoak, Kuli)***			
Celastraceae					
21.	4733	***Stackhousia monogyna***			
Centrolepidaceae					
22.	1117	***Aphelia cyperoides***			
23.	1121	***Centrolepis aristata (Pointed Centrolepis)***			
Colchicaceae					
24.	1383	***Burchardia bairdiae***			
Commelinaceae					
25.	1162	***Cartonema philydroides***			
Crassulaceae					
26.	3137	***Crassula colorata (Dense Stonecrop)***			
27.	3140	***Crassula glomerata***	Y		
28.	15706	***Crassula natans var. minus***	Y		
Cyperaceae					
29.	741	***Baumea articulata (Jointed Rush)***			
30.	749	***Bolboschoenus caldwellii (Marsh Club-rush)***			
31.	763	***Chorizandra enodis (Black Bristlerush)***			
32.	768	***Cyathochaeta avenacea***			
33.	783	***Cyperus congestus (Dense Flat-sedge)***	Y		
34.	20200	***Isolepis cernua var. setiformis***			
35.	917	***Isolepis marginata (Coarse Club-rush)***			
36.	921	***Isolepis producta***			
37.	932	***Lepidosperma effusum (Spreading Sword-sedge)***			
38.	940	***Lepidosperma pubisquameum***			
39.	945	***Lepidosperma squamatum***			
40.	955	***Mesomelaena pseudostygia***			
41.	980	***Schoenus capillifolius***		P3	
42.	986	***Schoenus efoliatus***			
43.	1018	***Schoenus subfascicularis***			
44.	1036	***Tetraria octandra***			
Dennstaedtiaceae					
45.	13758	***Histiopteris incisa***			
Dilleniaceae					
46.	5172	***Hibbertia stellaris (Orange Stars)***			
Droseraceae					
47.	3106	***Drosera macrantha (Bridal Rainbow)***			
48.	3114	***Drosera nitidula (Shining Sundew)***			
49.	3131	***Drosera stolonifera (Leafy Sundew)***			
Ericaceae					
50.	6323	***Astroloma ciliatum (Candle Cranberry)***			
51.	30142	***Brachyloma preissii subsp. obtusifolium***			
52.	30136	***Brachyloma preissii subsp. preissii***			
53.	6349	***Conostephium preissii***			
Euphorbiaceae					
54.	4582	***Adriana quadripartita (Bitter Bush)***			
Fabaceae					
55.	3557	***Acacia stenoptera (Narrow Winged Wattle)***			
56.	3688	***Aotus gracillima***			
57.	3845	***Daviesia triflora***			
58.	3863	***Dillwynia dillwynioides***		P3	
59.	3880	***Eutaxia virgata***			
60.	20473	***Gastrolobium ebracteolatum***			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
61.	10909	***Gompholobium confertum***			
62.	3992	***Isotropis cuneifolia (Granny Bonnets)***			
63.	8564	***Lotus subbiflorus***	Y		
64.	4113	***Ornithopus compressus (Yellow Serradella)***	Y		
65.	4292	***Trifolium campestre (Hop Clover)***	Y		
66.	4295	***Trifolium dubium (Suckling Clover)***	Y		
Geraniaceae					
67.	4341	***Geranium solanderi (Native Geranium)***			
Goodeniaceae					
68.	7484	***Dampiera trigona (Angled-stem Dampiera)***			
69.	7538	***Goodenia pulchella***			
70.	7603	***Scaevola canescens (Grey Scaevola)***			
Haemodoraceae					
71.	11826	***Conostylis aculeata subsp. aculeata***			
72.	1472	***Haemodorum simplex***			
73.	1478	***Phlebocarya ciliata***			
Haloragaceae					
74.	34676	***Meionectes brownii (Swamp Raspwort)***			
Hemerocallidaceae					
75.	1276	***Caesia micrantha (Pale Grass Lily)***			
Juncaceae					
76.	1188	***Juncus pallidus (Pale Rush)***			
Lamiaceae					
77.	6886	***Mentha x piperita***	Y		Y
Lauraceae					
78.	11799	***Cassytha racemosa forma racemosa***			
Loganiaceae					
79.	16177	***Phyllangium paradoxum***			
Menyanthaceae					
80.	36160	***Liparophyllum capitatum***			
81.	36179	***Liparophyllum violifolium***			
Myrtaceae					
82.	20283	***Astartea scoparia***			
83.	5439	***Calytrix angulata (Yellow Starflower)***			
84.	13547	***Eucalyptus marginata subsp. marginata (Jarrah)***			
85.	20808	***Eucalyptus petiolaris***	Y		
86.	13273	***Melaleuca incana subsp. incana***			
87.	5926	***Melaleuca lateritia (Robin Redbreast Bush)***			
88.	5952	***Melaleuca preissiana (Moonah)***			
89.	6006	***Pericalymma ellipticum (Swamp Teatree)***			
90.	6033	***Scholtzia involucrata (Spiked Scholtzia)***			
91.	20135	***Taxandria linearifolia***			
Orchidaceae					
92.	15330	***Caladenia arenicola***			
93.	15419	***Microtis media subsp. media***			
94.	1660	***Microtis orbicularis (Dark Mignonette Orchid)***			
95.	1670	***Prasophyllum drummondii (Swamp Leek Orchid)***			
96.	1708	***Thelymitra fuscolutea (Chestnut Sun Orchid)***			
Orobanchaceae					
97.	15037	***Bartsia trixago***	Y		
Poaceae					
98.	202	***Anthoxanthum odoratum (Sweet Vernal Grass)***	Y		
99.	17234	***Austrostipa compressa***			
100.	17240	***Austrostipa flavescens***			
101.	299	***Deyeuxia quadriseta (Reed Bentgrass)***			
102.	476	***Lolium perenne (Perennial Ryegrass)***	Y		
103.	11073	***Lolium x hybridum***	Y		
104.	635	***Sporobolus virginicus (Marine Couch)***			
105.	33101	***Vulpia myuros forma myuros***	Y		
Polygalaceae					
106.	4564	***Comesperma virgatum (Milkwort)***			
Proteaceae					

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
107.	1834	***Banksia menziesii (Firewood Banksia)***			
108.	2197	***Hakea prostrata (Harsh Hakea)***			
109.	2329	***Synaphea spinulosa***			
Ranunculaceae					
110.	2938	***Ranunculus trilobus (Buttercup)***	Y		
Restionaceae					
111.	17691	***Desmocladus fasciculatus***			
112.	16595	***Desmocladus flexuosus***			
113.	17838	***Dielsia stenostachya***			
114.	17841	***Hypolaena pubescens***			
115.	1085	***Lepyrodia glauca***			
116.	17679	***Meeboldina coangustata***			
117.	17694	***Meeboldina scariosa***			
Rubiaceae					
118.	7348	***Opercularia hispidula (Hispid Stinkweed)***			
Scrophulariaceae					
119.	7054	***Dischisma arenarium***	Y		
120.	7055	***Dischisma capitatum (Woolly-headed Dischisma)***	Y		
Selaginellaceae					
121.	6	***Selaginella gracillima (Tiny Clubmoss)***			
Stylidiaceae					
122.	7677	***Levenhookia stipitata (Common Stylewort)***			
123.	7712	***Stylidium despectum (Dwarf Triggerplant)***			
124.	7717	***Stylidium divaricatum (Daddy-long-legs)***			
125.	7756	***Stylidium longitubum (Jumping Jacks)***		P3	
126.	7774	***Stylidium piliferum (Common Butterfly Triggerplant)***			
Thymelaeaceae					
127.	5252	***Pimelea lanata***			
128.	18117	***Pimelea rosea subsp. rosea***			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Australian Government
Department of the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

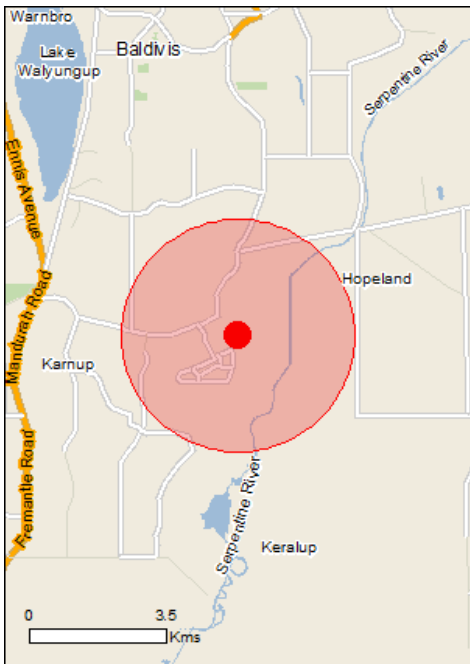
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/05/15 13:12:47

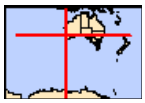
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 3.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	20
Listed Migratory Species:	7

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	8
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	33
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Becher point wetlands	Within 10km of Ramsar
Peel-yalgorup system	Upstream from Ramsar

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir [25911]	Vulnerable	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Centrolepis caespitosa [6393]	Endangered	Species or species habitat likely to occur within area
Darwinia foetida Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Pandion cristatus Eastern Osprey [82411]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		

Name	Status	Type of Presence
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.39 115.82286

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix 4
Conservation significant flora and ecological community definitions

Conservation Codes for Western Australia (Western Australian Herbarium 1998-)

Under the *Wildlife Conservation Act* (1950), the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection. Schedules 1 and 2 deal with those that are threatened and those that are presumed extinct, respectively.

T: Threatened Flora (Declared Rare Flora – Extant)

Species which 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 (Schedule 1 under the *Wildlife Conservation Act 1950*).

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List Criteria:

- CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild
- EN: Endangered – considered to be facing a very high risk of extinction in the wild
- VU: Vulnerable – considered to be facing a high risk of extinction in the wild
- X: Presumed Extinct Flora (Declared Rare Flora – Extinct).

Species that have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the Wildlife Conservation Act 1950).

Priority Flora

Species 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 or fauna. Species 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 species require regular monitoring. Conservation Dependent species are placed in Priority 5.

Priority One: Poorly-known Species

Species that are known from one or a few collections or sight records (generally less than 5), 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. Species 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.

Priority Two: Poorly-known Species

Species 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. Species 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.

Priority Three: Poorly-known Species

Species 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. Species 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 Four: Rare, Near Threatened and other species in need of monitoring

1. Rare: Species that are considered to be 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 species are usually represented on conservation lands.
2. Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
3. Species that have been removed from the list of threatened species during the past 5 years for reasons other than taxonomy.

Priority 5: Conservation Dependent Species

Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within 5 years.

Definition of Threatened Ecological Communities (DEC 2010)

Presumed Totally Destroyed (PD)

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies:

- records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
- all occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria:

1. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply:
   (a) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years)
   (b) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.
2. Current distribution is limited, and one or more of the following apply:
   (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years)
   (b) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
   (c) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.
3. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria:

1. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply:
   (a) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years)
   (b) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

2. Current distribution is limited, and one or more of the following apply”
    (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years)
    (b) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes
    (c) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.
3. The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria:

1. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
2. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
3. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definition of Priority Ecological Communities (DEC 2010)

Priority One: Poorly-known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. 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 Two: Poorly-known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent 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 Three: Poorly known ecological communities

- 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
- communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat
- communities made up of large, and/or widespread occurrences, that may or 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.

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.

Priority Four

Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. These include:

1. 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.
2. 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.
3. Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent 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.

Appendix 5
Vascular plant taxa recorded within the Survey area

Family	Species
Aizoaceae	*Carpobrotus edulis*
Anarthriaceae	*Lyginia barbata*
Asteraceae	*Conyza sumatrensis*
	Hypochaeris glabra
	Lagenophora huegelii
	Olearia axillaris
Casuarinaceae	*Allocasuarina fraseriana*
Colchicaceae	*Burchardia congesta*
Cyperaceae	*Ficinia nodosa*
	Lepidosperma pubisquameum
	Tetraria octandra
Dasypogonaceae	*Dasypogon bromeliifolius*
Dilleniaceae	*Hibbertia hypericoides*
Ericaceae	*Brachyloma preissii*
	Conostephium pendulum
Fabaceae	*Acacia pulchella* var. *glaberrima*
	Acacia saligna
	Acacia stenoptera
	Daviesia triflora
	Gompholobium tomentosum
	Jacksonia furcellata
	Jacksonia sternbergiana
	Kennedia prostrata
Goodeniaceae	*Dampiera linearis*
	Lechenaultia biloba
Haemodoraceae	*Conostylis aculeata* subsp. *aculeata*
	Phlebocarya ciliata
Iridaceae	*Patersonia occidentalis*
Lamiaceae	*Hemiandra pungens*
Myrtaceae	*Corymbia calophylla*
	Eucalyptus marginata
	Eucalyptus rudis
	Eucalyptus sp. (planted)
	Kunzea glabrescens
	Regelia ciliata
Poaceae	*Briza maxima*
	Eragrostis curvula
	Lagurus ovatus
	Poaceae sp.
Proteaceae	*Adenanthos cygnorum* subsp. *cygnorum*
	Banksia attenuata
	Banksia menziesii
	Banksia sessilis
	Xylomelum occidentale
Restionaceae	*Desmocladus flexuosus*
Stylidiaceae	*Stylidium* sp.
Zamiaceae	*Macrozamia fraseri*

Appendix B Targeted threatened orchid survey (Strategen 2015b)

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To: Stephen Elliot

Date: 16 October 2015

Company: Urban Resources

Project No: URE15096.01

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Karnup Sand Mining Project
Targeted Threatened orchid survey

Background

Urban Resources Pty Ltd (Urban Resources) engaged Strategen Environmental (Strategen) to undertake a targeted orchid survey for the Threatened (Declared Rare Flora – Extant) orchid species ***Caladenia huegelii, Drakaea elastica*** and ***Drakaea micrantha*** within their proposed mining expansion area for the Karnup Sand Mining Project (the site). The site is located approximately 48 km south of Perth, Western Australia in the City of Rockingham. Areas of potential habitat for the orchid species were identified within the site during a flora and vegetation survey undertaken by Strategen in May 2015 and are displayed in Figure 1 and Figure 2. Habitat for ***Drakaea elastica*** within the site was confined to wetland areas which will not be impacted by mining. As such, no formal survey for the species was undertaken.

Species Information

Caladenia huegelii is a tall orchid with a flowering stem between 50 cm to 1 m high with a single, hairy leaf up to 40 cm long (Brown ***et al.*** 1998). The species produces between one to three flowers per plant and can be distinguished from other ***Caladenia*** species by its large green-cream coloured lip and curved maroon tip (Brown ***et al.*** 1998). Habitat for the orchid occurs in areas of mixed jarrah-banksia woodland with scattered sheoak and marri over dense shrubs (DEC 2008). The species tends to favour areas of dense undergrowth in deep grey-white sand usually associated with the Bassendean sand-dune system. However, rare plants have been known to extend into the Spearwood system which is characterised by calcareous yellow sands (DEC 2008).

Drakaea elastica is a slender orchid with a flowering stem to 30 cm high, and a distinctive bright green, smooth, glossy, heart-shaped leaf, 1 to 2 cm in diameter (Brown ***et al.*** 1998). Habitat for the orchid occurs on bare patches of sand within dense vegetation in low-lying areas alongside winter-wet swamps, typically in banksia woodland or spearwood (***Kunzea glabrescens***) thicket vegetation (DEC 2009). DotE (2015) identifies the prime survey time for ***D. elastica*** as during May - August when the species' distinctive leaf is clearly visible.

Drakaea micrantha is a perennial, tuberous orchid with a diminutive flower between 1.2 cm-2.5 cm long (Brown ***et al.*** 1998). Habitat for the orchid occurs on bare patches of sand on firebreaks and in disturbed sites where competition from other plants has been removed. Prime survey time for this species is when the flower is visible (i.e. September to October).

Methods

Initial identification of potentially suitable habitat for ***C. huegelii*** and ***D. micrantha*** was undertaken during a site visit on 1 May 2015. The targeted survey for ***C. huegelii*** and ***D. micrantha*** was undertaken at the site on 21-22 September 2015, by two Strategen personnel as outlined in Table 1.

An initial reconnaissance of the site was undertaken to verify the exact location and estimated boundaries of potentially suitable habitat, based on vegetation type and structure. Potentially suitable habitat for ***C. huegelii*** across the site was either categorised as 'highly suitable habitat (Banksia-Jarrah woodland)' or 'unlikely habitat (regenerating shrubland)'. Other areas within the site did not contain suitable habitat for ***C. huegelii*** as these areas were either cleared, under rehabilitation or contained unsuitable vegetation types/composition**,** and were not surveyed for this reason. Potentially suitable habitat for ***D. micrantha*** across the site was either categorised as 'highly suitable habitat (Banksia-Jarrah woodland)', 'highly suitable habitat (cleared areas)', or 'unlikely habitat (regenerating shrubland)'. Other areas within the site did not contain suitable habitat for ***D. micrantha*** as these areas were either under rehabilitation or contained unsuitable vegetation types/composition**,** and were not surveyed for this reason.

Following this identification of habitat, consultation with Andrew Brown of the Department of Parks and Wildlife (Parks and Wildlife) was undertaken to determine the appropriate time to undertake a targeted survey for ***C. huegelii*** and ***D. micrantha*** and identify the appropriate methodology given the site's variable condition. A targeted transect survey in accordance with methodologies specified in ***Draft survey guidelines for Australia's Threatened Orchids*** (DotE 2013) was then undertaken in areas mapped as 'highly suitable habitat' and 'unlikely habitat' to search for presence of ***C. huegelii*** and ***D. micrantha*** between 21-22 September 2015 (refer to Figure 1 and Figure 2).

Areas identified as 'unlikely habitat' were surveyed via transects approximately 20-30 m apart. Given the sparse vegetation, visibility to a distance 40 m was excellent and it was not deemed necessary to walk any closer than this (Plate 1, Plate 2, Appendix 1).

Areas mapped as 'highly suitable habitat' contained relatively dense vegetation and were surveyed via transects approximately 10 m apart (Plate 3, Appendix 1). This more intense survey methodology ensured habitat identified as most suitable to support ***C. huegelii*** and ***D. micrantha*** was surveyed in detail. Cleared areas (i.e. tracks) considered to be highly suitable habitat for ***D. micrantha*** were traversed on foot to look for occurrences of the species on both sides of the cleared areas.

Areas mapped as unsuitable habitat were not surveyed (Plate 4, Plate 5, Plate 6, Appendix 1).

Table 1: Survey personnel

Personnel	Title	Scientific licence number
Mr. Daniel Panickar	Experienced ecologist	SL011499
Miss. Sarah Isbister	Graduate environmental scientist	N/A

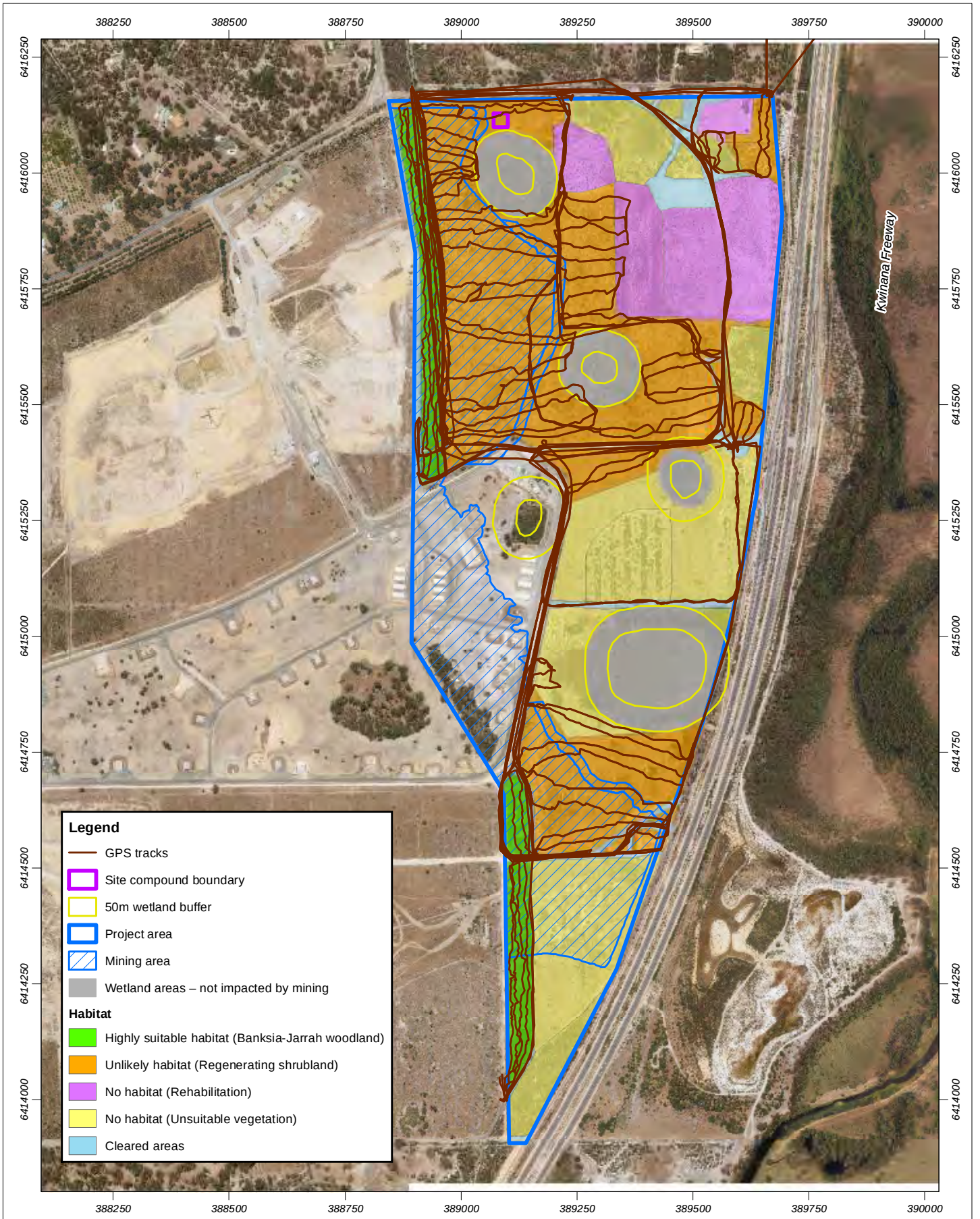

Figure 1: Caladenia huegelii survey

Scale 1:11,000 at A4

0 50 100 150 200 250 Meters

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 1/10/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\M003\RevA\URE15096_01_M003_RevA_F001.mxd

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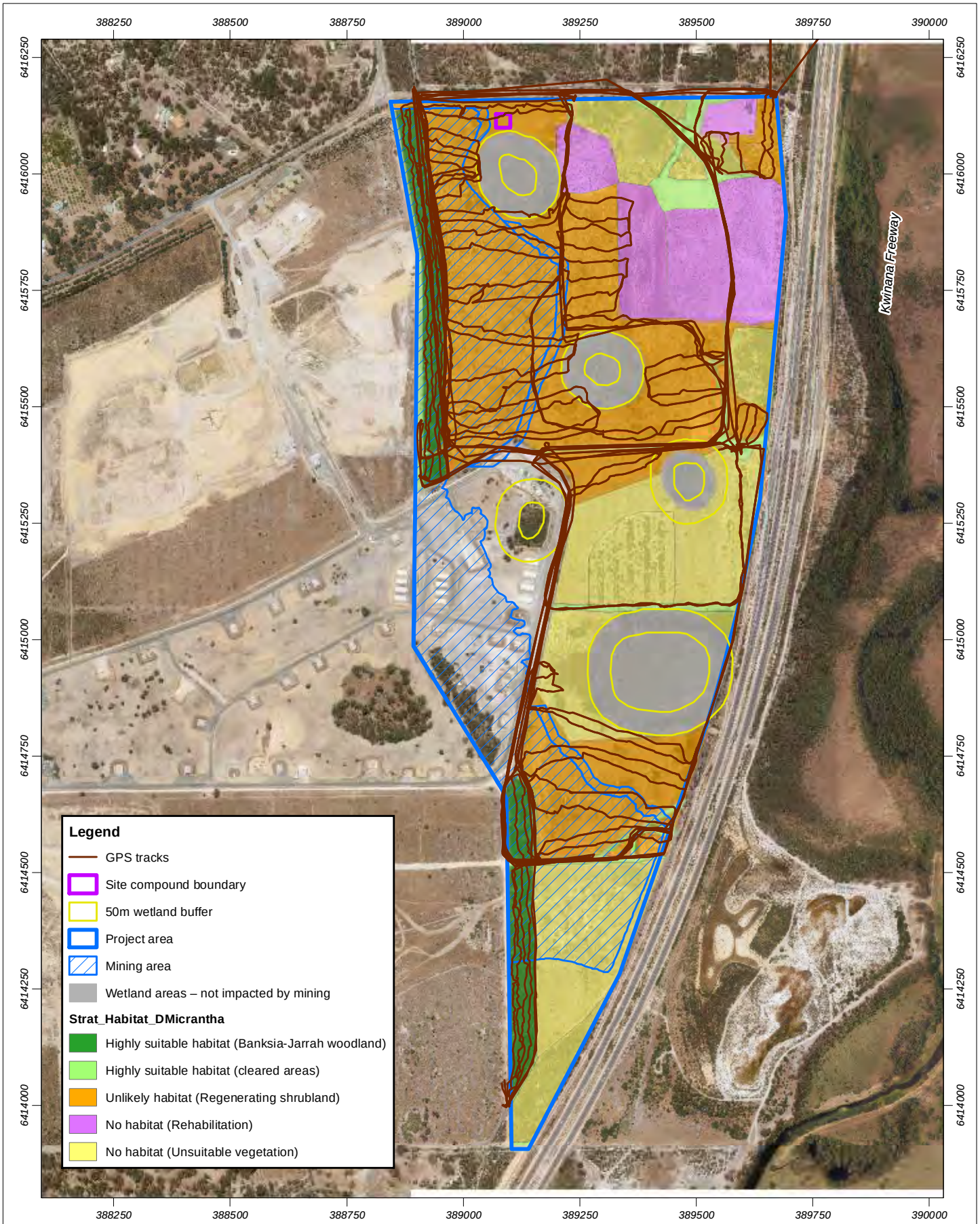

Figure 2: *Drakaea micrantha* survey

Scale 1:11,000 at A4

0 50 100 150 200 250 Meters

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 16/10/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\M003\RevA\URE15096_01_M003_RevA_F002.mxd

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Results and Conclusion

An initial reconnaissance of the site enabled the boundaries of potentially suitable habitat and unsuitable habitat for ***C. huegelii*** and ***D. micrantha,*** to be estimated. Approximately 6.89 ha of 'highly suitable habitat' and 40.77 ha of 'unlikely habitat' for ***C. huegelii*** was identified within the site. Approximately 12.76 ha of 'highly suitable habitat' and 40.77 ha of 'unlikely habitat' for ***D. micrantha*** was identified within the site

Vegetation considered to be 'highly suitable habitat' for both ***C. huegelii*** and ***D. micrantha*** is best described as Jarrah-banksia woodland, with a relatively low-moderate level of weed invasion and degradation in the understorey. Additionally, cleared areas were also considered to be 'highly suitable habitat' for ***D. micrantha***. Given the higher likelihood of these habitat types to support the two Threatened orchid species; the Jarrah-banksia woodland vegetation type was thoroughly surveyed via transects at a maximum distance of 10 m apart and cleared areas were thoroughly traversed to identify potential occurrences of ***D. micrantha*** within and on the periphery of these areas.

'Unlikely habitat' was identified in areas of the site which are experiencing natural regeneration following the cessation of historical pine plantation activities. Vegetation in these areas is best described as regenerating shrubland, with a very open structure and a relatively high level of weed invasion and degradation in the understorey. Even though it was considered unlikely that ***C. huegelii*** or ***D. micrantha*** would be found in vegetation identified as 'unlikely habitat', a visual assessment via transects was still undertaken as it was inferred that these areas were historically Jarrah-banksia woodland, which is a known suitable habitat type for both species***.*** Surveying these areas has ensured a high level of certainty to the findings of the survey.

Remaining areas within the site were comprised of either rehabilitated or highly degraded vegetation (refer to Plate 4-Plate 6). Rehabilitated areas were comprised of planted local species over a limestone dominant base, while highly degraded vegetation contained large weed infestations and thus and these areas were considered highly unsuitable habitat for ***C. huegelii*** or ***D. micrantha***.

No individuals of ***C. huegelii*** or ***D. micrantha*** were recorded within the site. ***C. huegelii*** and ***D. micrantha*** typically flower in September and October (Hoffman and Brown 2011); thus given the survey was undertaken on 21-22 September 2015 and no individuals were identified, it is considered that these species do not occur within the site.

References

Brown A, Thomson-Dans C & Marchant N 1998, ***Western Australia's Threatened Flora***, Department of Conservation and Land Management, Perth.

Department of Environment and Conservation (DEC) 2008, Grand Spider Orchid (***Caladenia huegelii***) Recovery Plan, Department of Environment and Conservation, Perth.

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Department of the Environment (DotE) 2013, ***Draft survey guidelines for Australia's Threatened Orchids – Guidelines for detecting orchids listed as Threatened under the Environment Protection and Biodiversity Conservation Act 1999,*** Australian Government, Canberra.

Hoffman N & Brown A 2011, ***Orchids of South-West Australia***, University of Western Australia, Perth.

Appendix 1
Site photographs

Plate 1: Unlikely habitat

Plate 2: Unlikely habitat

Plate 3: Highly suitable habitat

Plate 4: Unsuitable habitat

Plate 5: Unsuitable habitat

Plate 6: Unsuitable habitat (rehabilitation)

Appendix C Native Vegetation Clearing Permit Application Form (Purpose Permit)

Document Distribution

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B	E. Congear	D. Newsome			13 July 2015
0	W. Oversby	D. Newsome	D. Newsome		26 June 2020
1	E. Bentley	D. Newsome	D. Newsome		07 May 2021
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