



BHP Nickel West Kwinana Pre-clearing Survey
Targeted Flora Survey and Black Cockatoo
Habitat Assessment

Biologic Environmental Survey
Report to BHP Nickel West

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1 BACKGROUND

1.1 Introduction

BHP Nickel West (BHP NiW) operates the Kwinana Nickel Refinery in Kwinana, approximately 45 kilometres (km) south of Perth, Western Australia (Figure 1.1). Nickel West proposes to clear up to 10 hectares (ha) of native and remnant vegetation located in the City of Rockingham and Kwinana and has applied for a Purpose Permit (CPS 9105) with the Department of Water and Environmental Regulation (DWER). This clearing will support maintenance for the infrastructure at Kwinana and Baldivis including the existing pipeline between the two facilities.

The current area proposed for clearing under CPS 9105 is associated with:

- Threatened Ecological Community (TEC) Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain (SCP) (the Tuart TEC);
- Threatened flora; and
- Known nesting habitat for endangered fauna, specifically black cockatoo (Carnaby's cockatoo *Zanda latirostris*¹, Baudin's cockatoo *Zanda baudinii*², and forest red-tailed black cockatoo *Calyptorhynchus banksii naso*).

Biologic Environmental Survey Pty Ltd (Biologic) was commissioned by Nickel West to complete two stages of field assessment and associated reporting for separate Survey Areas encompassing the infrastructure corridor and facilities. Stage 1 assessed the presence and extent of the Tuart TEC and Stage 2 comprised a targeted survey for significant flora and black cockatoo habitat. This report presents the findings from Stage 2. For the purpose of this report, the proposed clearing area associated with the Purpose Permit CPS 9105 will be referred to as the Survey Area.

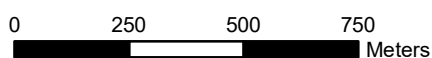
¹ Synonymous with *Calyptorhynchus latirostris*

² Synonymous with *Calyptorhynchus baudinii*



Legend

- Targeted Flora Survey Area
- Black Cockatoo Survey Area



Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 05/11/2021



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Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 1.1: Survey Area

2 METHODOLOGY

2.1 Desktop Assessment

2.1.1 Database Searches

Database searches were undertaken to generate a list of vascular flora and vertebrate fauna taxa (black cockatoo records) of significance previously recorded within the Survey Area and surrounds. Conservation codes for flora and fauna of significance are provided in Appendix A.

Seven database searches were conducted around a central coordinate (32°17'3" S; 115°47'49" E) with varying buffers as appropriate. Two of the database searches contain information on all species previously recorded (NatureMap and Atlas of Living Australia), four identify locations of species/ ecological communities of significance previously recorded (DBCA Threatened Flora, Fauna and Ecological Communities Databases, and Birdlife custom black cockatoo roost database), one identifies species/ ecological communities of conservation significance known or likely to occur within the region based on habitat modelling (Protected Matters Search Tool), and one identifies a list of environmentally significant weeds that may occur in the local government area (Western Australia Organism List) (Table 2.1).

Table 2.1: Details of database searches conducted.

Provider	Reference	Database	Parameters
Flora			
DBCA	DBCA (2021b)	Internal Database: Threatened & Priority Flora.	Circle of radius 5 km centred on the coordinates: 115° 47' 49" E, 32° 17' 3" S
DBCA	DBCA (2021a)	NatureMap. Accessed December 2020.	Circle of radius 5 km centred on the coordinates: 115° 47' 49" E, 32° 17' 3" S
ALA	ALA (2021)	Atlas of living Australia	Circle of radius 5 km centred on the coordinates: 115° 47' 49" E, 32° 17' 3" S
DAWE	DAWE (2021)	Protected Matters Database Search Tool	Circle of radius 5 km centred on the coordinates: 115° 47' 49" E, 32° 17' 3" S
DPIRD	DPIRD (2021)	Western Australian Organism List	Search within City of Kwinana
Fauna			
DBCA	DBCA (2021a)	NatureMap. Accessed August 2021.	Circle of radius 5 km centred on the coordinates: 115° 47' 49" E, 32° 17' 3" S
Birdlife Australia (Birdlife)	BirdLife Australia (2021a)	Custom black cockatoo roost database. Accessed July 2021.	Circle of 12 km radius centred on the coordinates: 115° 47' 49" E, 32° 17' 3" S

2.1.2 Literature Review

A review of available literature relevant to the Survey Area was undertaken, utilising publicly available searches and the Index of Biodiversity Surveys for Assessment (IBSA) portal. A total of four reports were reviewed (Table 2.2) including one vertebrate fauna report, and three combined flora and fauna reports. This literature review was undertaken to compile a list of significant flora species that may occur in the Survey Area, and to determine the likelihood of occurrence for each species based on habitat preference. The literature review was also used to determine the occurrence of black cockatoos in the local region. The search radius was restricted to 5 km from the Survey Area for flora and vegetation surveys; however, this was increased to 10 km for vertebrate fauna for greater contextual knowledge because black cockatoos are migratory and have high dispersal capabilities. None of the previous surveys overlapped the Survey Area boundary.

Table 2.2: Literature sources used for the review.

Survey Title	Reference	Survey Type	Distance from Survey Area
Fauna			
Lots 5 -8 Kerosene Lane, Baldivis Level 1 Fauna Survey and Targeted Search	PGV (2015)	Basic and targeted terrestrial vertebrate fauna survey	400 m SW of southern section
Combined flora and fauna			
Rockingham Lakes Regional Park Management Plan.	Overman <i>et al.</i> (2010)	Management plan	Immediately adjacent
Kwinana Nickel Refinery, Flora, Vegetation and Fauna Assessment	Biologic (2019)	Reconnaissance flora survey Basic terrestrial fauna survey Targeted black cockatoo habitat assessment	400 m W of northern section
Flora and Fauna Assessment of Proposed Kwinana Ethanol Bio-Refinery	Umwelt (2006)	Reconnaissance flora survey Basic terrestrial fauna survey	1.4 km W of northern section

2.2 Field Survey Methodology

2.2.1 Significant Flora Survey

A targeted flora survey for significant flora taxa was conducted via foot-traversed transects across the entire Survey Area in a manner consistent with the Western Australian guidelines for the environmental surveying and reporting of flora and vegetation (EPA, 2016a, 2016b, 2018).

The field survey was led by Biologic's Principal Botanist Clinton van den Bergh, who meets the minimum requirements to lead and manage a flora survey on the Swan Coastal Plain, as prescribed by the EPA (EPA, 2016b). Flora specimens were collected under permit number FB62000105, pursuant to the *Biodiversity Conservation Act 2016* (Regulation 61).

The survey was undertaken over two days (29-30 September 2021), totalling approximately 24 person hours. The weather during the survey was comparable to long-term averages for the area, with daily

maximum temperatures of 25.1 and 23.2°C respectively (Jandakot Aero, Station 9172) (BoM, 2021). A total of 2.6 mm of rain fell on 30 September (Anketell, Station 9258) (BoM, 2021). This field survey timing was adequate to identify any flowering significant taxa.

The Survey Area was traversed on foot (Figure 2.1). Where conservation significant flora taxa were located, a GPS coordinate of the individual was taken, or, if the species existed within a small population, a central coordinate with an approximate 10 m radius was used. Generalised information was collected for each occurrence, including an estimate of the number of individuals, reproductive status, condition and broad vegetation community and condition.

Any flora specimens were confirmed at the Western Australian Herbarium and *Threatened and Priority Flora Report Forms* will be provided to the Parks and Wildlife Division of DBCA as required under the flora collecting permits held by the survey team.

384200

384800

6431200

6431200

6430800

6430800

6430400

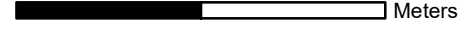
6430400



Legend

- Targeted Flora Survey Area
- Traverse

0 100 200 Meters



Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 24/11/2021



biologic
 Environmental Survey

Scale: 1:4,100



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Habitat Assessment

Figure 2.1a: Targeted
flora traverses

385400

386000

6431200

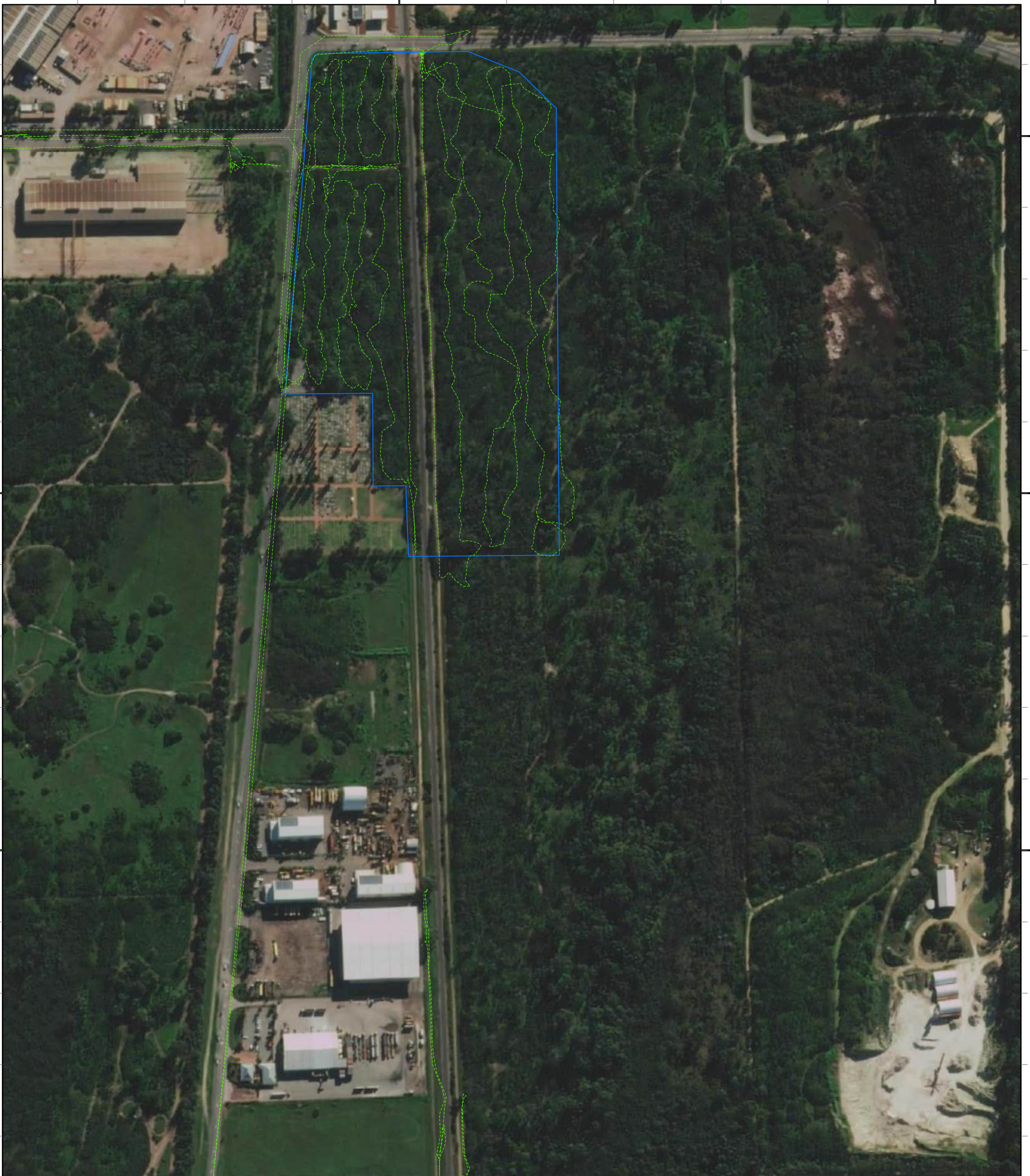
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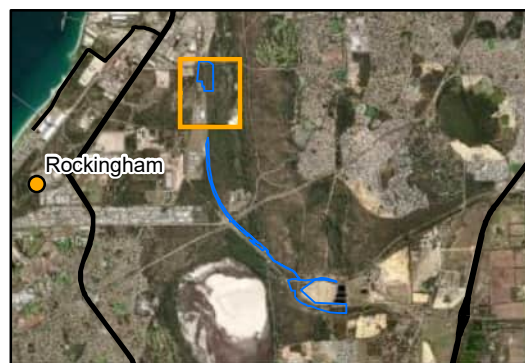


Legend

- Targeted Flora Survey Area
- Traverse

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 24/11/2021



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and Black Cockatoo
Habitat Assessment

Figure 2.1b: Targeted flora traverses

385400

386000

6430000

6430000

6429600

6429600

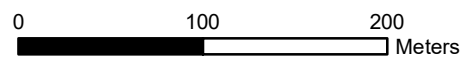
6429200

6429200



Legend

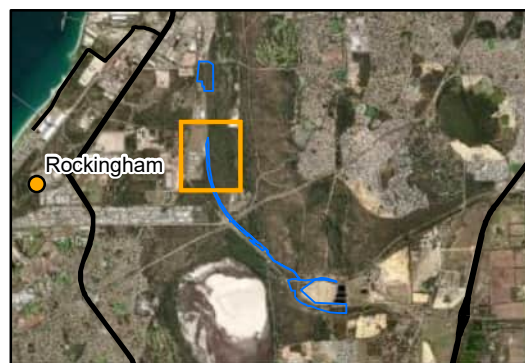
- Targeted Flora Survey Area
- Traverse



Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 24/11/2021




 Scale: 1:4,100



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Figure 2.1c: Targeted flora traverses



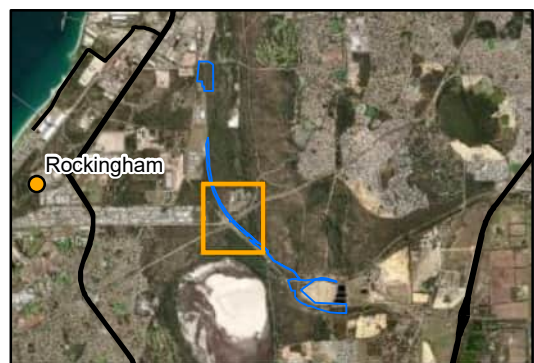
Legend

- Targeted Flora Survey Area
- Traverse

0 100 200 Meters
 Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 24/11/2021




Scale: 1:4,100



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Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 2.1d: Targeted flora traverses

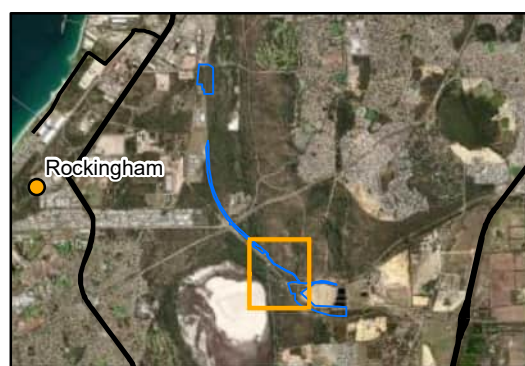


Legend

- Targeted Flora Survey Area
- Traverse

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 24/11/2021



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and Black Cockatoo
Habitat Assessment

Figure 2.1e: Targeted flora traverses

387200

387800

6427200

6427200

6426800

6426800

6426400

6426400

6426000

6426000



Legend

- Targeted Flora Survey Area
- Traverse

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 24/11/2021



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and Black Cockatoo
Habitat Assessment

Figure 2.1f: Targeted flora traverses

2.2.2 Terrestrial Fauna Assessment

Habitat Assessments and Mapping

Fauna habitat assessments were undertaken in the field to characterise and define habitats and their significance to vertebrate fauna. Habitat assessments were undertaken at five locations across the survey area (Figure 2.2).

Habitat assessments were conducted using methodology and terminology modified from the *Australian Soil and Land Survey Field Handbook* (National Committee on Soil and Terrain, 2009). The characteristics recorded during the habitat assessments were:

- site information, photo and location;
- landform: slope, relative inclination of slope, morphological type and landform type;
- vegetation: leaf litter %, wood litter, hollow bearing trees, broad floristic formation, vegetation structure (tall, mid and low), and dominant species;
- land surface: micro relief, sheet erosion, rill erosion, gully erosion, gully depth, abundance and size of coarse fragments, rock outcropping, water bodies, comments on nests, burrows, roosts and diggings;
- soil: texture, colour;
- substrate: bare ground, rock size, rock type, rock outcropping; and
- disturbance: time since last fire, evidence of weeds, grazing, or human disturbances.

The mapping and nomenclature of broad fauna habitats undertaken across the entirety of the survey area was finalised from the completed habitat assessments, high-resolution aerial imagery, and vegetation mapping from the previous TEC survey.

Black Cockatoo Assessment

Black cockatoo habitat assessments were conducted via foot-traversed transects (Figure 2.2) across the entire Survey Area in line with the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC, 2012) *EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species* and the Department of Environment and Energy (DoEE (2017) *Revised draft referral guideline for three threatened black cockatoo species*. In comparison to standardised vertebrate fauna habitat assessments, which characterise and define habitats, these black cockatoo habitat assessments identified the potential for the Survey Area to support night roosting and breeding and identified the quality of foraging habitat present. The survey was undertaken outside the timing recommended to detect Carnaby's cockatoo (January to July) (DoEE, 2017); however, the potential for the Survey Area to support breeding, night roosting, and foraging was able to be assessed during the survey period.

Potential Foraging Habitat

Foraging habitat quality was assessed throughout the Survey Area using the habitat scoring tool provided by DoEE (2017) (refer to Table 2.3 and Table 2.4). In determining the quality of foraging habitat for each of the black cockatoo species, the scoring tool considers key attributes of foraging habitat for

each species. An assessment was made within each habitat type present (Figure 2.2), which categorised the foraging quality within the Survey Area between “Very High quality” (score of >10) and “Low quality” (score of 1) for each of the black cockatoo species. Scores that are below “Low quality” (score <1) were not mapped. This includes connectivity and proximity of the foraging habitat to other foraging habitat in the area, as well as other threats that can reduce the functionality of that habitat for respective species. DoEE (2017) defines ‘High quality’ foraging habitat as habitat scoring of 7 or above, which, particularly in proximity to roosting and/ or breeding sites, is considered important for the long-term survival and recovery of black cockatoos.

Any tree and shrub species known to be staple food resources for black cockatoos (i.e., *Corymbia* and *Banksia* species) or any evidence of foraging (i.e., chewed nuts or *Banksia* cones and / or flowers) within the Survey Area were also documented.

Table 2.3: Habitats used by black cockatoos for breeding, night roosting and foraging (DoEE, 2017)

	Baudin's cockatoo	Carnaby's cockatoo	Forest red-tailed black cockatoo
Description of foraging habitat	Primarily seeds of marri <i>Corymbia calophylla</i> and jarrah <i>Eucalyptus marginata</i> in woodlands and forest, and seeds of native proteaceous plant species (for example, <i>Banksia</i> spp., <i>Hakea</i> spp. and <i>Dryandra</i> spp.). During the breeding season feed primarily on native vegetation, particularly marri (seeds, flowers, nectar and grubs). Also, insects and insect larvae; pith of kangaroo paw (<i>Anigozanthos flavidus</i>); juice of ripe persimmons; tips of <i>Pinus</i> spp.; and seeds of apples and pears.	Native shrubland, Kwongan heathland and woodland on seeds, flowers and nectar of native proteaceous plant species (<i>Banksia</i> spp., <i>Hakea</i> spp., <i>Dryandra</i> spp., and <i>Grevillea</i> spp.), as well as <i>Callistemon</i> spp. and marri. Also seeds of introduced species including <i>Pinus</i> spp., <i>Erodium</i> spp., wild radish, canola, almonds and pecan nuts; insects and insect larvae; occasionally flesh and juice of apples and persimmons.	Primarily seeds of jarrah and marri in woodlands and forest, and edges of karri forests, including wandoo and blackbutt. Forages on <i>Eucalyptus caesia</i> , <i>E. erythrocorys</i> , Allocasuarina cones, fruits of snotty gobble (<i>Persoonia longifolia</i>) and mountain marri (<i>Corymbia haematoxylon</i>). Also, some introduced eucalypts such as river red gum (<i>E. camaldulensis</i>) and flooded or rose gum (<i>E. grandis</i>). On the Swan Coastal Plain, often feeds on introduced Cape lilac (<i>Melia azedarach</i>).
Base habitat score			
10 (Very high quality)	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of, successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10 .	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10 .	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10 .
7 (High quality)	Native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly marri, including along roadsides. Does not include orchards or areas under an RFA.	Native shrubland, Kwongan heathland and woodland dominated by proteaceous plant species such as <i>Banksia</i> spp. (including <i>Dryandra</i> spp.), <i>Hakea</i> spp. and <i>Grevillea</i> spp., as well as native eucalypt woodland and forest that contains foraging species, including along roadsides. Does not include orchards, canola, or areas under an RFA.	Jarrah and marri woodlands and forest, and edges of karri forests, including wandoo and blackbutt, within the range of the subspecies, including along roadsides. Does not include areas under an RFA.
5 (Quality)	Pine plantation or introduced eucalypts.	Pine plantation or introduced eucalypts.	Introduced eucalypts as well as the introduced Cape lilac (<i>Melia azedarach</i>).
1 (Low quality)	Individual foraging plants or small stand of foraging plants.	Individual foraging plants or small stand of foraging plants	Individual foraging plants or small stand of foraging plants
Additions	Context adjustor - attributes improving functionality of foraging habitat	Context adjustor - attributes improving functionality of foraging habitat	Context adjustor - attributes improving functionality of foraging habitat
+3	Is within the known foraging area.	Is within the Swan Coastal Plain (important foraging area).	Jarrah and/or marri show good recruitment (i.e. evidence of young trees).
+3	Contains trees with suitable nest hollows.	Contains trees with suitable nest hollows.	Contains trees with suitable nest hollows.
+2	Primarily contains marri.	Primarily comprises marri.	Primarily contains marri and/or jarrah.
+2	Contains trees with potential to be used for breeding (DBH ≥ 500 mm or ≥ 300 mm DBH for salmon gum and wandoo).	Contains trees with potential to be used for breeding (DBH ≥ 500 mm or ≥ 300 mm DBH for salmon gum and wandoo).	Contains trees with potential to be used for breeding (DBH ≥ 500 mm or ≥ 300 mm DBH for salmon gum and wandoo).
+1	Is known to be a roosting site.	Is known to be a roosting site.	Is known to be a roosting site.
Subtractions	Context adjustor - attributes reducing functionality of foraging habitat	Context adjustor - attributes reducing functionality of foraging habitat	Context adjustor - attributes reducing functionality of foraging habitat
-2	No clear evidence of feeding debris.	No clear evidence of feeding debris.	No clear evidence of feeding debris.
-2	No other foraging habitat within 6 km.	No other foraging habitat within 6 km.	No other foraging habitat within 6 km.
-1	Is > 12 km from a known breeding location.	Is > 12 km from a known breeding location.	Is > 12 km from a known breeding location.
-1	Is > 12 km from a known roosting site.	Is > 12 km from a known roosting site.	Is > 12 km from a known roosting site.
-1	Is > 2 km from a watering point.	Is > 2 km from a watering point.	Is > 2 km from a watering point.
-1	Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker).	Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker).	Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker).

Table 2.4: Habitat quality scoring totals for black cockatoo foraging habitat

Final habitat quality score	9 - 10	6 - 8	3 - 5	1 - 3
Habitat Quality Category	Very High Quality	High Quality	Quality	Low Quality

Potential Night Roosting

The potential for night roosting to occur within the Survey Area was extrapolated from the presence of potential breeding trees and potential breeding habitat, proximity to suitable watering spots, and knowledge of any known roosting sites within the vicinity of the Survey Area. Additionally, a Birdlife black cockatoo search was conducted within the Survey Area to identify the presence of any known roosting locations (refer to Table 2.1). As the Birdlife roost list does not specify between the two white-tailed black cockatoo species, it was assumed that both Carnaby's and Baudin's cockatoos may be present at roosts within and nearby their known distribution outside of the Survey Area.

Any evidence of possible roosting events (i.e., clipped leaves and branches or droppings under suitable trees) was searched for during the field survey.

Potential Breeding Trees

Breeding habitat for black cockatoos is defined as “trees of species known to support breeding within the range of the species which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow” (DSEWPaC, 2012b) (Table 2.5). For most tree species, suitable DBH is 500 mm, while for salmon gum and wandoo, suitable DBH is 300 mm (DSEWPaC, 2012b). Breeding habitat for all three black cockatoo species generally consists of woodland or forest; however, breeding is also known to occur in former woodland or forest now comprising of isolated or small patches of trees (DSEWPaC, 2012b).

Table 2.5: Known breeding trees for black cockatoo species

Species ¹	DBH (mm)
<i>Corymbia calophylla</i> (marri)	500
<i>Eucalyptus marginata</i> (jarrah)	
<i>Eucalyptus rudis</i> (flooded gum)	
<i>Eucalyptus camaldulensis</i> (river red gum)	
<i>Eucalyptus diversicolor</i> (karri)	
<i>Eucalyptus gomphocephala</i> (tuart)	
<i>Eucalyptus patens</i> (Swan River blackbutt)	
<i>Eucalyptus megacarpa</i> (bullich)	
<i>Eucalyptus accedens</i> (powderbark wandoo)	
<i>Eucalyptus salmonophloia</i> (salmon gum)	300
<i>Eucalyptus wandoo</i> (wandoo)	

¹ List excludes species for which Survey Area occurs outside the known distribution of the species, as provided in Florabase (WAH, 1998-)

The location and attributes of all potential black cockatoo habitat trees (as defined by DAWE) within the Survey Area were recorded during the field survey. Attributes recorded included tree species (where discernible), DBH, condition (i.e., living or dead), presence of hollows, and dimensions of hollows (where discernible).

Where suitably sized hollows were recorded, further inspections were undertaken with binoculars and, where possible, with a camera mounted on a telescopic pole to identify the presence/ absence of any known breeding signs (i.e., hollows showing evidence of wear and chew marks around the hollow entrance that may be attributed to black cockatoos). Where possible, hollow usage by fauna was also assessed, including use by introduced honeybees *Apis mellifera* or rainbow lorikeets *Trichoglossus*

moluccanus. Potentially suitable nest hollows were considered to be those that appeared to be deep enough with an opening diameter large enough to be used by black cockatoos (>100 mm diameter), of both natural and artificial origin, as determined by the criteria shown below in Table 2.6.

Table 2.6: Hollow suitability criteria for potential use by black cockatoo species

Overall hollow suitability	Hollow present?	Suitable diameter? (> 100 mm and unobstructed)	Suitable depth? (> 250 mm)	Evidence of chewing around hollow rim?	Other factors to alter suitability?
Active (Currently in use)	Yes	Yes	Yes	Yes	<ul style="list-style-type: none"> • Orientation (vertical is preferred) • Diameter at base (>30 cm) • Evidence of bees • Common breeding tree species • Height above ground (> 2m)
Suitable (No evidence of use)	Yes	Yes	Yes	No	
Possible (Potential to support black cockatoos but cannot confirm)	Yes	Yes	Potential	No	
Not suitable	Yes	No	No	No	

Opportunistic Vertebrate Fauna Records

Opportunistic records of all vertebrate species encountered during the survey were documented. Identification methods included direct observation, calls, or secondary evidence (i.e., tracks, feathers, nests, scats, and diggings). Birds were recorded on a presence/ absence basis, determined by call identification, visual identification, and/ or tracks and traces. Efforts were made to target likely microhabitats by turning rocks, logs, and anthropogenic debris, where present.

Taxonomy and Nomenclature

The latest checklist of mammal, reptile and amphibian names published by the WAM (2021) was used as a guide to the current taxonomy and nomenclature of these groups, with the exception of taxonomic changes published subsequent to the checklist. For birds, the current checklist of Australian birds maintained by the Australian Faunal Directory (ABRS, 2021) was used in conjunction with the WAM (2021) species list.

384200

384800

6431200

6431200

6430800

6430800

6430400

6430400



Legend

Black Cockatoo Survey Area

Sampling Type

Black Cockatoo Habitat Assessment

Habitat Assessment

Traverse

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 08/11/2021



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 2.2a: Fauna sample sites and traverses

385400

386000

6431200

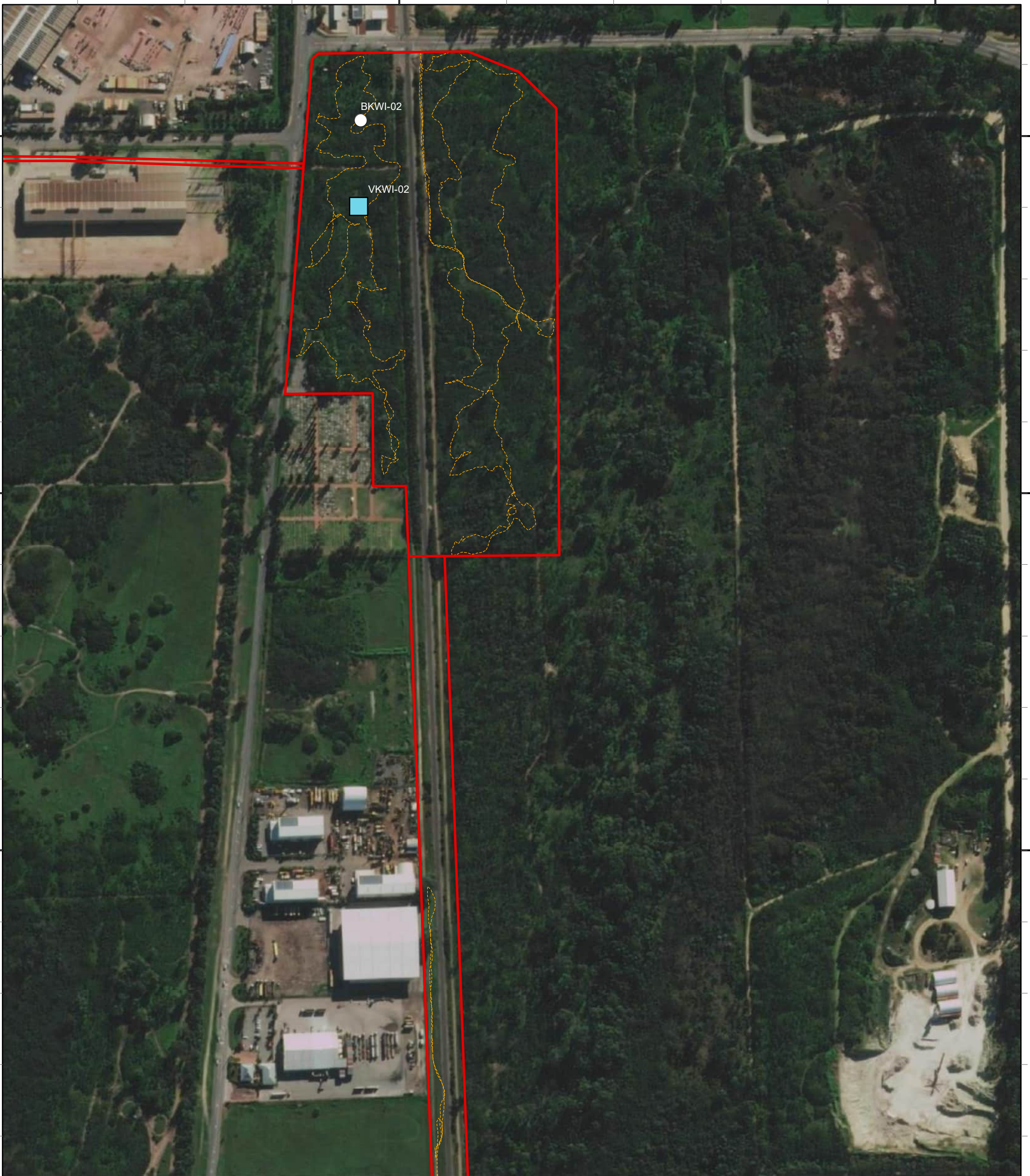
6431200

6430800

6430800

6430400

6430400



Legend

Black Cockatoo Survey Area

Sampling Type

Black Cockatoo Habitat Assessment

Habitat Assessment

Traverse

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 08/11/2021



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 2.2b: Fauna sample sites and traverses

385400

386000

6430000

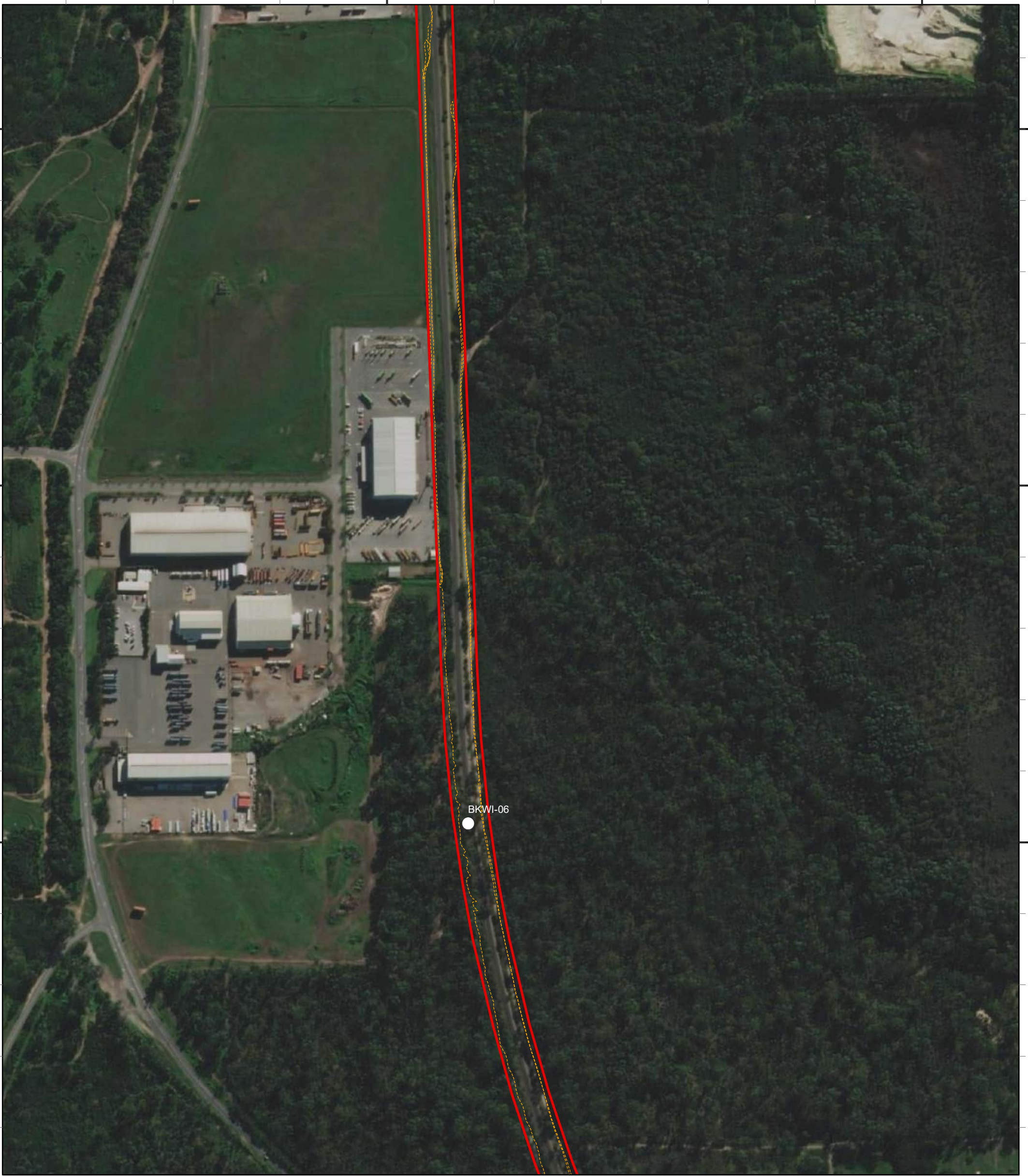
6430000

6429600

6429600

6429200

6429200



Legend

Black Cockatoo Survey Area

Sampling Type

Black Cockatoo Habitat Assessment

Habitat Assessment

Traverse

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 08/11/2021

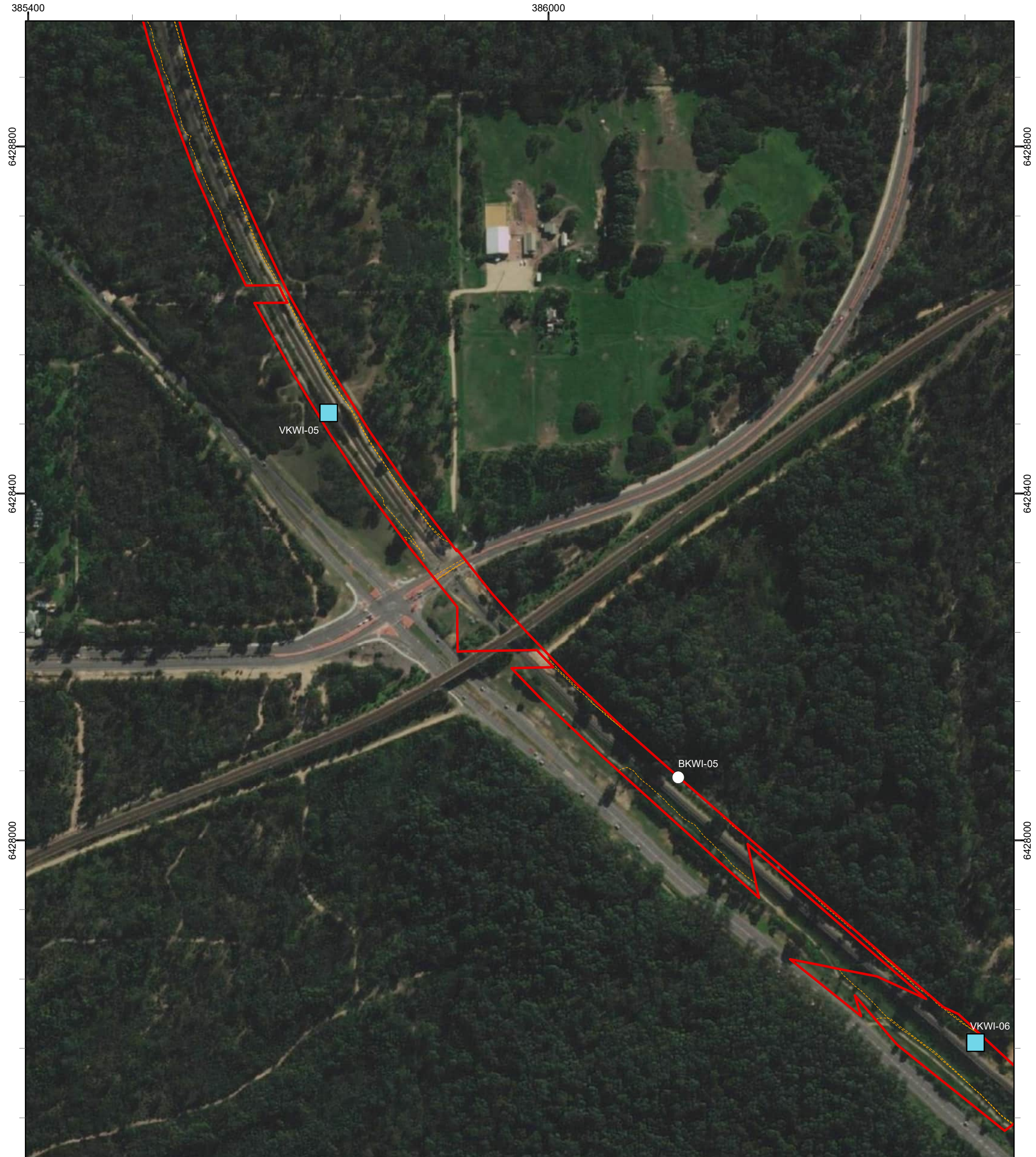


Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 2.2c: Fauna sample sites and traverses



Legend

Black Cockatoo Survey Area

Sampling Type

- Black Cockatoo Habitat Assessment
- Habitat Assessment
- Traverse

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 08/11/2021

N

biologic
 Environmental Survey

Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 2.2d: Fauna sample sites and traverses



Legend

Black Cockatoo Survey Area

Sampling Type

Black Cockatoo Habitat Assessment

Habitat Assessment

Traverse

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 08/11/2021

N

biologic
 Environmental Survey

Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 2.2e: Fauna sample sites and traverses

387200

387800

6427200

6427200

6426800

6426800

6426400

6426400

6426000

6426000



Legend

Black Cockatoo Survey Area

Sampling Type

Black Cockatoo Habitat Assessment

Habitat Assessment

Traverse

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 08/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 2.2f: Fauna sample sites and traverses

3 RESULTS AND DISCUSSION

3.1 Flora Desktop Assessment

The results and outcomes of the review of three flora and vegetation reports identified from the literature review are presented in Appendix B. The literature review identified no conservation significant flora taxa located within the Survey Area.

The results of the database search Occurrence Assessment (Appendix C) identified no conservation significant flora species previously confirmed to occur within the Survey Area, however the taxon *Pimelea calcicola* (P3) was determined to likely to occur (Table 3.1). A further 42 species were considered possible (3), unlikely (20) and highly unlikely (19) to occur within the Survey Area prior to the field survey (Table 3.1).

Table 3.1: Occurrence Assessment Preliminary Classification

Con Sig Ranking	Taxa
Likely	
P3	<i>Pimelea calcicola</i>
Possible	
P1	<i>Acacia</i> sp. Binningup (G. Cockerton et al. WB 37784)
P4	<i>Dodonaea hackettiana</i> , <i>Jacksonia sericea</i>
Unlikely	
T	<i>Diuris micrantha</i> , <i>Drakaea elastica</i> , <i>Synaphea</i> sp. Serpentine (G.R. Brand 103), <i>Caladenia huegelii</i>
P1	<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026), <i>Lachnagrostis nesomytica</i> subsp. <i>paralia</i> , <i>Boronia juncea</i> subsp. <i>juncea</i>
P2	<i>Acacia benthamii</i>
P3	<i>Carex tereticaulis</i> , <i>Cyathochaeta teretifolia</i> , <i>Beyeria cinerea</i> subsp. <i>cinerea</i> , <i>Dillwynia dillwynioides</i> , <i>Jacksonia gracillima</i> , <i>Sphaerolobium calcicola</i> , <i>Austrostipa mundula</i> , <i>Stylidium paludicola</i>
P4	<i>Parsonsia diaphanophleba</i> , <i>Aponogeton hexatepalus</i> , <i>Stylidium ireneae</i> , <i>Stylidium longitubum</i>
Highly Unlikely	
T	<i>Lepidosperma rostratum</i> , <i>Diuris drummondii</i> , <i>Diuris purdiei</i> , <i>Synaphea</i> sp. Pinjarra Plain (A.S. George 17182)
P2	<i>Calectasia grandiflora</i> , <i>Johnsonia pubescens</i> subsp. <i>cygnorum</i>
P3	<i>Eryngium pinnatifidum</i> subsp. <i>Palustre</i> (G.J. Keighery 13459), <i>Angianthus drummondii</i> , <i>Schoenus capillifolius</i> , <i>Schoenus</i> sp. Waroona (G.J. Keighery 12235), <i>Calandrinia oraria</i> , <i>Babingtonia urbana</i> , <i>Stylidium aceratum</i>
P4	<i>Lepidium puberulum</i> , <i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S. George 14234), <i>Kennedia beckxiana</i> , <i>Eucalyptus rudis</i> subsp. <i>cratyantha</i> , <i>Verticordia lindleyi</i> subsp. <i>lindleyi</i> , <i>Grevillea olivacea</i>

3.2 Fauna Desktop Assessment

Black cockatoos rely upon the availability of foraging resources across their range, particularly to build condition in the post-breeding period (DSEWPaC, 2012a). Black cockatoos will forage up to 12 km from breeding hollows during the breeding season; they rely on this proximity of foraging resources to

breeding hollows to successfully raise chicks (DSEWPaC, 2012a). The literature review identified potential black cockatoo foraging habitat within the immediate surrounds of the Survey Area, including records of Carnaby's cockatoo utilising the habitat in the Rockingham Lakes Regional Park (adjacent to the Survey Area) for foraging (Biologic, 2019; Overman *et al.*, 2010; PGV, 2015; Umwelt, 2006) (Table 3.2). DBCA (2021a) identifies 495 previous records of Carnaby's cockatoo, one record of Baudin's cockatoo, and 59 records of forest red-tailed black cockatoo within 12 km of the Survey Area.

Roosting habitat is defined as a suitable tree (generally the tallest) or group of tall trees, native or introduced, usually close to an important water source, and within an area of quality foraging habitat within the range of the black cockatoo species (DoEE, 2017). Significant roost sites exist for Carnaby's cockatoo and forest red-tailed black cockatoo in the Greater Perth-Peel region (Peck *et al.*, 2019). Database searches did not record any roost sites within the boundaries of the Survey Area; however, there are seven confirmed white-tailed black cockatoo (Carnaby's and/ or Baudin's black cockatoo) roosts, one forest-red tailed black cockatoo roost, and five joint roost sites within 12 km of the Survey Area (13 active roosts in total) (BirdLife Australia, 2021a).

The nearest roosts to the Survey Area are (from BirdLife Australia, 2021a) (Figure 3.1):

- ROCBALR004 (white-tailed black cockatoo; located 500 m south of the southern section of the Survey Area);
- KWIWELR003 (joint roost; located 2.2 km north-east of the southern section);
- KWIWELR002 (white-tailed black cockatoo; located 2.4 km north of the southern section); and
- KWIWELR001 (joint roost; located 2.6 km east of the central section).

ROCBALR004 has not been recorded as a utilised roost site by BirdLife Australia (2021a) for white-tailed black cockatoos or forest red-tailed black cockatoos since 2011 when 40 birds were recorded. However, the other roosts in proximity have had white-tailed black cockatoo roosting observed in 2021 (KWIWELR002, $n = 24$ birds in 2021, $n = 133$ birds in 2019; KWIWELR003, $n = 15$ birds in 2021). KWIWELR001 was last recorded as utilised for night roosting in 2019 ($n = 40$ birds); the roost may have also been used in 2020, however no night roost surveys were undertaken in that year (BirdLife Australia, 2021a).

Modelled distributions show the Survey Area lies within the non-breeding range for Carnaby's cockatoo, and does not fall within a buffered confirmed breeding area for the species (DBCA, 2018). The Survey Area is within the 'Likely to Occur' range for the forest red-tailed black cockatoo, and on the boundary of the modelled distribution of Baudin's cockatoo (DoEE, 2017, 2019). No confirmed evidence of black cockatoo breeding has been recorded near the Survey Area (Table 3.2). BirdLife Australia (2021a) noted breeding attempts by Carnaby's cockatoo in four artificial hollows within 12 km of the Survey Area during the 2020 breeding season.

Table 3.2: Summary of black cockatoo literature from the surrounding area

Reference	Foraging results	Night roosting results	Breeding results	Distance from Survey Area
PGV (2015)	No black cockatoo foraging observed. Habitat was assessed as low value foraging habitat.	No roosting evidence	98 trees of appropriate DBH recorded. Four hollows were recorded; however, no evidence of breeding was observed.	400 m SW of southern section
Biologic (2019)	Seven Carnaby's cockatoos observed flying over. Habitat was assessed as "Quality" for Carnaby's cockatoo and "Low Quality" for Baudin's cockatoo and forest red-tailed black cockatoo.	No roosting evidence	48 trees of appropriate DBH recorded. Five hollows recorded; however, none were suitable	400 m W of northern section
Overman <i>et al.</i> (2010)	Carnaby's cockatoo have been recorded as using the Rockingham Lakes Regional Park.	Not described	Not described	Immediately adjacent
Umwelt (2006)	Potential foraging habitat for Carnaby's cockatoo observed. No potential habitat for forest red-tailed black cockatoo.	No roosting evidence	No tree hollows observed.	~ 1.4 km W of northern section



Legend

Black Cockatoo Survey Area

Nature Reserve

Geomorphic Wetlands of the Swan Coastal Plain

Wetland Management Category

Conservation

Multiple Use

Resource Enhancement

Roost Type

Forest red-tailed black cockatoo

White-tailed black cockatoo

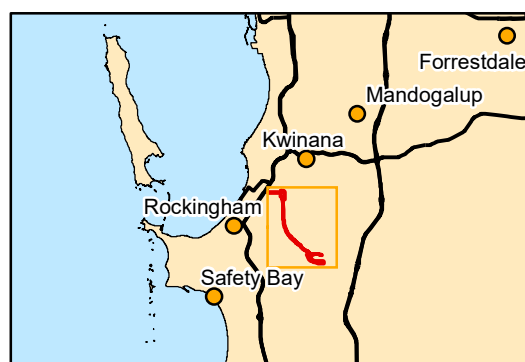
Joint Forest red-tailed and White-tailed blackcockatoo

0 1 2 3 Km

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 16/11/2021



Scale: 1:58,376



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and Black Cockatoo
Habitat Assessment

Figure 3.1: Black cockatoo night roosts in the vicinity of the Survey Area

3.3 Significant Flora Survey Results

3.3.1 Field Survey

One conservation significant flora taxon, *Pimelea calcicola* (P3) (Plate 3.1), was recorded within the Survey Area. A total of three individuals from three locations were recorded (Figure 3.2). *Pimelea calcicola* (P3) is an erect to spreading shrub that grows 0.2-1m high. It produces white to pink flowers from September through to November, and can be found in sandy, coastal limestone ridge habitats (WAH, 1998-).

The new point locations recorded during the field survey of this taxa were located within the Threatened Ecological Community (TEC) Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain, that occur along the rail corridor north of Gilmore Avenue. These points were also located opposite a Bushforever reserve (reserve 349). *Pimelea calcicola* (P3) can be found along coastal habitats spanning approximately 213km from north of Gilderton to the south of Preston Beach Western Australia. The Survey Area and new point locations recorded during the field survey are located within the current known range and distribution of *Pimelea calcicola* (P3).



Plate 3.1: *Pimelea calcicola* (P3) recorded within the Survey Area (Biologic Photos)

3.3.2 Review of Occurrence Assessment

Following the completed of the field survey, the Occurrence Assessment was reviewed, and 16 significant taxa were assigned a different classification of occurrence (Appendix C). The revised Occurrence Assessment is presented at Table 3.3 and the taxa with a changed classification are presented in bold underlined text. *Pimelea calcicola* (P3) is now confirmed as occurring within the Survey Area while, three taxa changed from possible to unlikely, and 12 taxa changed from unlikely to highly unlikely to occur within the Survey Area.

Dodonaea hackettiana (P4), *Jacksonia sericea* (P4) and *Acacia* sp. Binningup (G. Cockerton et al. WB 37784) (P1) were changed post field survey from possible to unlikely to occur within the Survey Area. This is because the Survey Area was sufficiently covered, however no individuals from these taxa were observed. *Dodonaea hackettiana* (P4) is a relatively large shrub that would have been easily identifiable within the Survey Area if it was present, while *Jacksonia sericea* is fairly conspicuous and would have been easily sighted if it were to be present within the Survey Area. *Acacia* sp. Binningup (G. Cockerton et al. WB 37784) (P1) is a little harder to identify in the field due to limited information being available, however its habit of suckering and climbing would have been observed if it was present within the Survey Area.

Table 3.3: Updated Occurrence Assessment post field survey.

Con Sig Ranking	Taxa
Confirmed	
P3	<u><i>Pimelea calcicola</i></u>
Unlikely	
T	<i>Diuris micrantha</i> , <i>Synaphea</i> sp. Serpentine (G.R. Brand 103), <i>Caladenia huegelii</i>
P1	<i>Boronia juncea</i> subsp. <i>juncea</i> , <u><i>Acacia</i> sp. Binningup (G. Cockerton et al. WB 37784)</u>
P3	<i>Cyathochaeta teretifolia</i> , <i>Jacksonia gracillima</i> , <i>Sphaerolobium calcicola</i>
P4	<i>Stylidium ireneae</i> , <u><i>Dodonaea hackettiana</i>, <i>Jacksonia sericea</i></u>
Highly Unlikely	
T	<i>Lepidosperma rostratum</i> , <i>Diuris drummondii</i> , <i>Diuris purdiei</i> , <u><i>Drakaea elastica</i></u> , <i>Synaphea</i> sp. Pinjarra Plain (A.S. George 17182)
P1	<u><i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026), <i>Lachnagrostis nesomytica</i> subsp. <i>paralia</i></u>
P2	<i>Calectasia grandiflora</i> , <u><i>Acacia benthamii</i></u> , <i>Johnsonia pubescens</i> subsp. <i>cygnorum</i> ,
P3	<i>Eryngium pinnatifidum</i> subsp. <i>Palustre</i> (G.J. Keighery 13459), <i>Angianthus drummondii</i> , <u><i>Carex tereticaulis</i></u> , <i>Schoenus capillifolius</i> , <i>Schoenus</i> sp. Waroona (G.J. Keighery 12235), <u><i>Beyeria cinerea</i> subsp. <i>cinerea</i>, <i>Dillwynia dillwynioides</i></u> , <i>Calandrinia oraria</i> , <i>Babingtonia urbana</i> , <u><i>Austrostipa mundula</i></u> , <i>Stylidium aceratum</i> , <u><i>Stylidium paludicola</i></u>
P4	<u><i>Paersonsia diaphanophleba</i>, <i>Aponogeton hexatepalus</i></u> , <i>Lepidium puberulum</i> , <i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S. George 14234), <i>Kennedia backxiana</i> , <i>Eucalyptus rudis</i> subsp. <i>cratyantha</i> , <i>Verticordia lindleyi</i> subsp. <i>Lindleyi</i> , <i>Grevillea olivacea</i> , <u><i>Stylidium longitubum</i></u>

text denotes the taxa that have changed classification upon review.

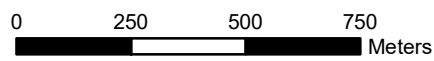


Legend

Targeted Flora Survey Area

Conservation Significant Taxon

Pimelea calcicola - P3



Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:16,500



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Habitat Assessment

Figure 3.2: Flora of conservation significance recorded in the Survey Area

3.4 Vertebrate Fauna Survey Results

3.4.1 Black Cockatoo Habitat Assessment

Potential Foraging Habitat

The fauna habitat types mapped within the Survey Area (Table 3.5 for summary descriptions, Figure 3.3, and Appendix E for full habitat assessments) have been assessed in regard to potential foraging habitat (as described in Section 2.2.2). One assessment was made within each habitat type; the overall foraging quality categorised as “Nil”, “Low”, “Medium”, “High”, or “Very High” for each of the black cockatoo species (Table 3.5). Overall, a high proportion of the Survey Area was not considered to have good foraging value (being “Nil” or “Low” Quality) for black cockatoos at the time of the survey, ranging from 47.4% (for Carnaby’s cockatoo) to 91.8 % (for Baudin’s and forest red-tailed black cockatoo) of the total area. Overall, the habitats of the Survey Area categorised as Very High or High Quality were considered significant for Carnaby’s cockatoo only, calculated as 52.6% of the of the total area (Table 3.5). Numerous flora species present in the Survey Area are known to provide foraging resources for black cockatoo, as provided in Table 3.4.

Overall, the habitat of greatest foraging quality was the Tuart and Marri Woodland (4.4 ha, 8.2% of the Survey Area), which scored as “Very High” quality for both Carnaby’s cockatoo and forest red-tailed cockatoo, and “High” quality for Baudin’s cockatoo (Table 3.5). This habitat type provides core primary resources for all three cockatoo species, with both jarrah *Eucalyptus marginata* and marri *Corymbia calophylla* present. Secondary food resources for Carnaby’s cockatoo were also present, with tuart *Eucalyptus gomphocephala* as the dominant tree species, and *Banksia sessilis* present in the midstory. Marri and jarrah comprise 90% of the diet of the forest red-tailed black cockatoo (Johnstone *et al.*, 2013b) and are a core component of foraging diet for Baudin’s cockatoo as well (Weerheim, 2008). A single instance of black cockatoo foraging evidence was recorded from this habitat type during the survey; marri nuts, attributed to forest red-tailed black cockatoo (Plate 3.2, Figure 3.5, Appendix E).

The Tuart Woodland (10.8 ha, 20.1 %) and Tuart over Acacia Shrubland (12.7 ha, 23.6 %) was also assessed as “Very High” quality for Carnaby’s cockatoo due to quantity of secondary foraging resources (tuart) and occasional *B. menziesii* tree; however due to the absence of jarrah and marri, these habitat types were only assessed as “Low” quality for forest red-tailed black cockatoo (Table 3.5). A small group of forest red-tailed black cockatoos flew over the Tuart Woodland habitat type during the field survey (Plate 3.2; Appendix D). Some sections of these habitats were considered degraded due to the condition of the understorey; in addition, some sections of the Tuart Woodland habitat in the southern end of the survey area comprised of planted rows of immature tuart trees. Planted street trees are known to support foraging and roosting across the Swan Coastal Plain (EPA, 2019a), and the blossoms from tuarts may also be an important food source across this region (Shah, 2006). Black cockatoos are also known to forage in areas of degraded understorey across the Swan Coastal Plain. As such, these factors are unlikely to impact on the potential of the habitat to support feeding and these habitats remain assessed as “Very High” quality for Carnaby’s cockatoo for the maintenance of foraging habitat across the Perth metropolitan area. The Tuart Woodland and Tuart over Acacia Shrubland was not considered to have any foraging value for Baudin’s cockatoo (Table 3.5).

The Banksia Shrubland (0.4 ha, 0.7%) habitat type scored as “High” quality for Carnaby’s cockatoo due to the presence of mature *Banksia grandis* and *B. sessilis* in the upper midstorey, and secondary foraging species such as occasional tuart and *Allocasuarina fraseriana* present (Figure 3.4) (Table 3.5). Carnaby’s cockatoo are highly associated with Banksia woodlands, and exploit all areas of available *Banksia* food resources on the Swan Coastal Plain (EPA, 2019b; Johnson T.R *et al.*, 2016). The Banksia Shrubland was not considered to have foraging potential for either the forest red-tailed cockatoo or Baudin’s cockatoo due to lack of resources available (Table 3.5).





The Acacia Shrubland habitat (14.2 ha, 26.4 %) was considered of “Low” quality for Carnaby’s cockatoo due to the general characteristic of containing only individual or small stands of foraging plants and was considered to have “Nil” foraging quality for forest red-tailed cockatoo and Baudin’s cockatoo (Table 3.5). The Disturbed habitat (e.g., rail-line, roads and tracks) was considered to be of “Nil” quality for all species due to the general lack of flora species suitable for foraging by black cockatoo (11.3 ha, 21.0 %) (Table 3.5).

Black cockatoo flocks, especially forest red-tailed black cockatoo, show strong site fidelity to particular areas (DSEWPaC, 2012a; EPA, 2019b; Groom, 2015; Johnstone *et al.*, 2017). Black cockatoos rely upon the availability of foraging resources across their range, particularly to build condition in the post-breeding period (DSEWPaC, 2012a). The Swan Coastal Plain is considered a critical foraging area for Carnaby’s cockatoo during the non-breeding season (DoEE, 2017). As discussed in Section 3.2, the Survey Area is in close proximity to several roosts: ROCBALR004, KWIWELR003, KWIWELR002, and KWIWELR001 (Figure 3.1) (BirdLife Australia, 2021a). DSEWPaC (2012a) noted that the maintenance of foraging habitat is particularly important across the Perth metropolitan area due to the role of these areas in the survival of young birds and maintenance of the population between breeding seasons, as well as the connectivity values, particularly given the lack of habitat remaining in this region. Due to the potential for reduced seed set and flowering due to drought, and the irregular or infrequent flowering and fruiting patterns of many of their food sources, large areas of foraging habitat are required to support black cockatoo populations (DSEWPaC, 2012a). As such, any habitat of known foraging potential in the local vicinity should be considered valuable, even where the abundance and cover of primary and secondary resources is low. Other areas of potential foraging habitat are found in the vicinity of the Survey Area, particularly in the Bush Forever sites (e.g., Site 349 and 356), and Leda Nature Reserve (Figure 3.1). The Survey Area is also in the vicinity of multiple water resources, such as Lake Coo loongup (located within one kilometre) and Lake Walyungup, supporting the potential of the Survey Area as foraging habitat (Figure 3.1).



Plate 3.2: Forest red-tailed black cockatoo individuals (left) and chewed marri fruit (right) recorded during the current survey (see Appendix D)

Table 3.4: Black cockatoo food resources present in the Survey Area

Species	Site photo	Carnaby's cockatoo	Baudin's cockatoo	Forest red-tailed black cockatoo
Primary food resources				
Marri <i>Corymbia calophylla</i>		●	●	●
Jarrah <i>Eucalyptus marginata</i>		●	●	●
Firewood banksia <i>Banksia menziesii</i>		●		
Bull banksia <i>Banksia grandis</i>		●		










Species	Site photo	Carnaby's cockatoo	Baudin's cockatoo	Forest red-tailed black cockatoo
Secondary food resources				
Tuart <i>Eucalyptus gomphocephala</i>		●		
Parrotbush <i>Banksia sessilis</i>		●	●	
Sheoak <i>Allocasuarina fraseriana</i>		●		●

Table 3.5: Summary of foraging habitat scores for black cockatoo

Habitat type	Photo and description	Carnaby's cockatoo foraging score				Baudin's cockatoo foraging score				Forest red-tailed black cockatoo foraging score			
		Starting score	Additions	Subtractions	Total	Starting score	Additions	Subtractions	Total	Starting score	Additions	Subtractions	Total
<p>Tuart Woodland 10.8 ha 20.1 %</p>	 <p>Open woodland of mature tuart, with occasional <i>Banksia</i> (e.g., <i>B. menziesii</i>) and <i>Acacia</i> sp. in the mistorey. Some sections represent Tuart Woodland Threatened Ecological Community. Some sections of this habitat in the southern end of the survey area are planted rows of immature tuart trees. The habitat is very degraded in some sections due to the condition of the understorey. Black cockatoos will forage on planted or immature trees and in areas of degraded understorey; as such, these factors are unlikely to impact on the potential of the habitat to support feeding.</p>	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species (7)	<ul style="list-style-type: none"> -Is within the Swan Coastal Plain (+3) -Contains trees with the potential to be used for breeding (+2) -Contains trees with suitable nest hollows (+3) 	-No clear evidence of feeding debris (-2)	13 Very High quality	Individual foraging plants or small stand of foraging plants (1)	-Contains trees with the potential to be used for breeding (+2)	-No clear evidence of feeding debris (-2) -Is > 12 km from a known breeding location (-1)	0 Not foraging habitat	Individual foraging plants or small stand of foraging plants (1)	<ul style="list-style-type: none"> -Contains trees with suitable nest hollows (+3) -Contains trees with the potential to be used for breeding (+2) 	-No clear evidence of feeding debris (-2) -Is > 12 km from a known breeding location (-1)	3 Low Quality
<p>Tuart over Acacia Shrubland 12.7 ha 23.6%</p>	 <p>Open woodland of both mature and immature tuart over mixed <i>Acacia</i> midstorey. Understorey in general is either patchy or comprised of weeds. Very degraded in some sections due to the condition of the understorey. Black cockatoos will forage on planted or immature trees and in areas of degraded understorey; as such, these factors are unlikely to impact on the potential of the habitat to support feeding..</p>	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species (7)	<ul style="list-style-type: none"> -Is within the Swan Coastal Plain (+3) -Contains trees with the potential to be used for breeding (+2) -Contains trees with suitable nest hollows (+3) 	-No clear evidence of feeding debris (-2)	13 Very High quality	Individual foraging plants or small stand of foraging plants (1)	-Contains trees with the potential to be used for breeding (+2)	-No clear evidence of feeding debris (-2) -Is > 12 km from a known breeding location (-1)	0 Not foraging habitat	Individual foraging plants or small stand of foraging plants (1)	<ul style="list-style-type: none"> -Contains trees with suitable nest hollows (+3) -Contains trees with the potential to be used for breeding (+2) 	-No clear evidence of feeding debris (-2) -Is > 12 km from a known breeding location (-1)	3 Low Quality
<p>Tuart and Marri Woodland 4.4 ha 8.2%</p>	 <p>Open woodland, with an upper canopy comprised of tuart, marri, and occasional jarrah. Understorey ranges from patchy areas of native shrubs, grasses, and macrozamia to areas of dense weeds.</p>	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species (7)	<ul style="list-style-type: none"> -Is within the Swan Coastal Plain (+3) -Contains trees with the potential to be used for breeding (+2) -Contains trees with suitable nest hollows (+3) 	-No clear evidence of feeding debris (-2)	13 Very High quality	Native eucalypt woodlands and forest, and proteaceous woodlands and heath, particularly marri, including along roadsides (7)	-Contains trees with the potential to be used for breeding (+2)	-No clear evidence of feeding debris (-2) -Is > 12 km from a known breeding location (-1)	6 High Quality	Jarrah and marri woodlands and forest, including wandoo and blackbutt, including along roadsides (7)	<ul style="list-style-type: none"> -Jarrah and marri show good recruitment (+3) -Contains trees with suitable nest hollows (+3) -Contains trees with the potential to be used for breeding (+2) 	-No clear evidence of feeding debris (-2) -Is > 12 km from a known breeding location (-1)	12 Very High quality

Habitat type	Photo and description	Carnaby's cockatoo foraging score				Baudin's cockatoo foraging score				Forest red-tailed black cockatoo foraging score			
		Starting score	Additions	Subtractions	Total	Starting score	Additions	Subtractions	Total	Starting score	Additions	Subtractions	Total
	Considered some of the highest quality fauna habitat within the survey area due to presence of native understorey and microhabitat features such as woody litter.												
Banksia Shrubland 0.4 ha 0.7%	 Small patch of open shrubland of mature <i>Banksia</i> trees, in particular <i>B. grandis</i> and <i>B. sessilis</i> . No distinct canopy of eucalypts present. Understorey comprises of areas of dense non-native grasses.	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species (7)	-Is within the Swan Coastal Plain (+3)	-No clear evidence of feeding debris (-2)	8 High quality	Individual foraging plants or small stand of foraging plants (1)	n/a	-No clear evidence of feeding debris (-2) -Is > 12 km from a known breeding location (-1)	0 Not foraging habitat	Individual foraging plants or small stand of foraging plants (1)	n/a	-No clear evidence of feeding debris (-2) -Is > 12 km from a known breeding location (-1)	0 Not foraging habitat
Acacia Shrubland 14.2 ha 26.4 %	 Dense shrubland of mixed Acacia species with occasional mature tuart present. Very degraded in some sections due to the condition of the understorey. Black cockatoos will forage on planted or immature trees and in areas of degraded understorey; as such, these factors are unlikely to impact on the potential of the habitat to support feeding.	Individual foraging plants or small stand of foraging plants (1)	-Is within the Swan Coastal Plain (+3)	-No clear evidence of feeding debris (-2)	2 Low Quality	Individual foraging plants or small stand of foraging plants (1)	-Contains trees with the potential to be used for breeding (+2)	-No clear evidence of feeding debris (-2) -Is > 12 km from a known breeding location (-1)	0 Not foraging habitat	Individual foraging plants or small stand of foraging plants (1)	n/a	-No clear evidence of feeding debris (-2) -Is > 12 km from a known breeding location (-1)	0 Not foraging habitat
Disturbed 11.3 ha 21.0	 Cleared or disturbed areas, including tracks, rail-line, and cleared areas.	Not foraging habitat				Not foraging habitat				Not foraging habitat			
Total 53.8 ha		Very High Quality: 27.9 ha (51.9 %) High Quality: 0.4 ha (0.7 %) Low Quality: 14.2 ha (26.4 %) Nil Quality: 11.3 ha (21.0 %)				Very High Quality: 0 ha High Quality: 4.4 ha (8.2 %) Low Quality: 0 ha Nil Quality: 49.4 ha (91.8 %)				Very High Quality: 4.4 ha (8.2%) High Quality: 0 ha Low Quality: 23.5 ha (43.7 %) Nil Quality: 25.9 ha (48.1 %)			

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Melville Manтурah Hwy



Legend


 Black Cockatoo Survey Area

Fauna Habitat

 Acacia Shrubland

 Disturbed

 Tuart Woodland

 Tuart over Acacia Shrubland

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50

Projection: Transverse Mercator

Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.3a: Fauna habitats
in the Survey Area




Legend


 Black Cockatoo Survey Area

Fauna Habitat

 Acacia Shrubland

 Disturbed

 Tuart Woodland

 Tuart over Acacia Shrubland

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50

Projection: Transverse Mercator

Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.3b: Fauna habitats
in the Survey Area

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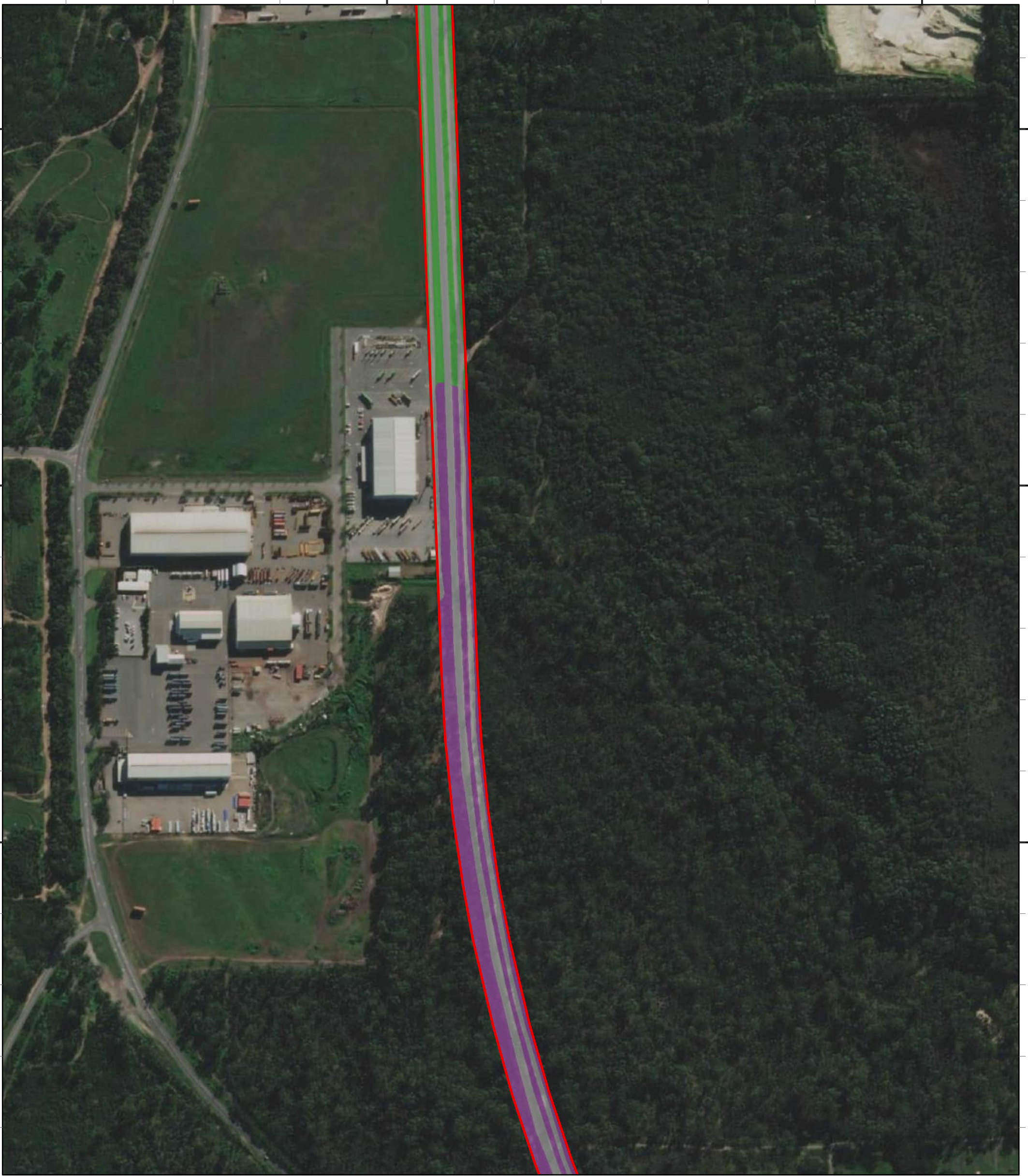
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6429200




Legend

 Black Cockatoo Survey Area

Fauna Habitat

 Acacia Shrubland

 Disturbed

 Tuart Woodland

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.3c: Fauna habitats
in the Survey Area

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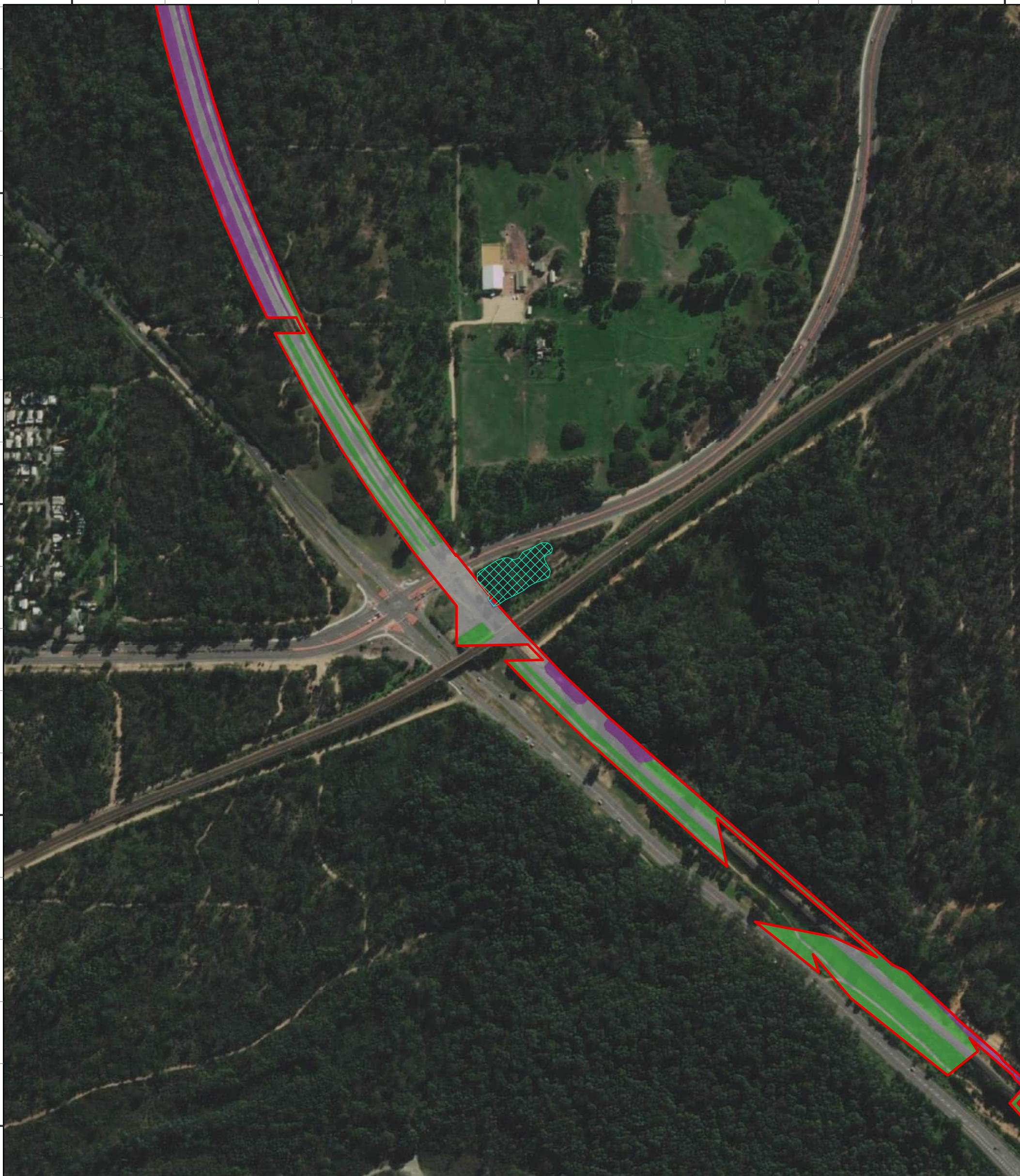
6428400

6428000

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6427600

6427600



Legend

Black Cockatoo Survey Area

Fauna Habitat

Acacia Shrubland

Disturbed

Tuart Woodland

Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021



Scale: 1:4,710



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.3d: Fauna habitats
in the Survey Area



6428000
6427600
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6426800

6428000
6427600
6427200
6426800

- Legend**
- Black Cockatoo Survey Area
- Fauna Habitat**
- Acacia Shrubland
 - Disturbed
 - Tuart Woodland
 - Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 16/12/2021

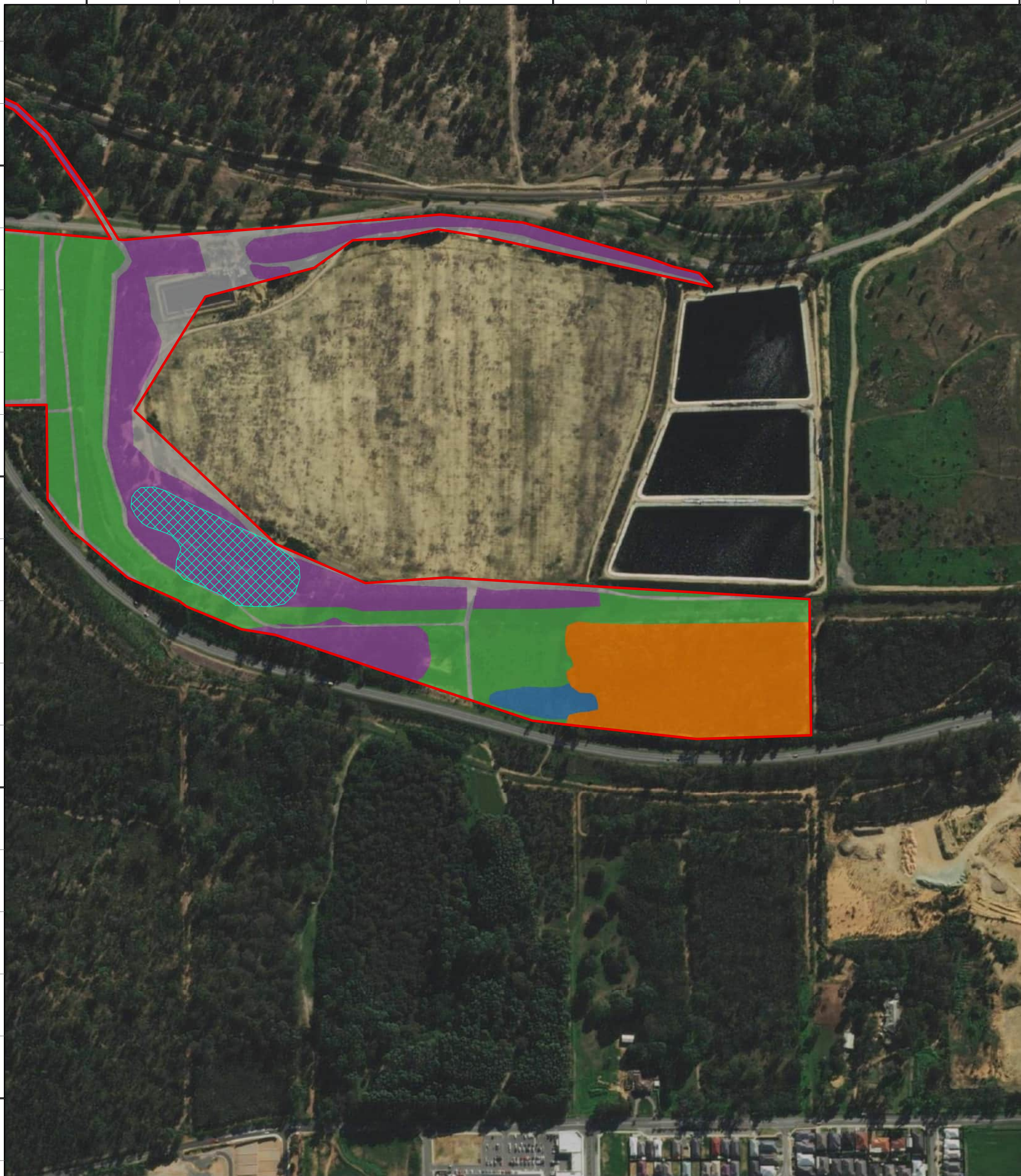
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Scale: 1:4,710



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.3e: Fauna habitats
in the Survey Area



Legend

Black Cockatoo Survey Area

Fauna Habitat

- Acacia Shrubland
- Banksia Shrubland
- Disturbed
- Tuart Woodland
- Tuart and Marri Woodland
- Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.3f: Fauna habitats in the Survey Area

384200

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Melville Manourah Hwy




Legend

 Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

 Very High

 Low

 Nil

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100




BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment
Figure 3.4a: Potential
Carnaby's black cockatoo
foraging habitat within the
Survey Area



Legend

 Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

 Very High

 Low

 Nil

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.4b: Potential Carnaby's black cockatoo foraging habitat within the Survey Area

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6429600


6429600

6429200


6429200



Legend

 Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

 Very High

 Low

 Nil

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.4c: Potential
Carnaby's black cockatoo
foraging habitat within the
Survey Area

385400

386000

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6428400

6428400

6428000

6428000



Legend

Black Cockatoo Survey Area

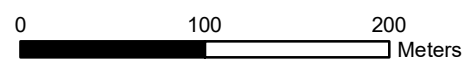
Black Cockatoo Potential Foraging Habitat

Very High

Low

Nil

Degraded Habitat (from Biologic (2021): TEC survey)



Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment
Figure 3.4d: Potential
Carnaby's black cockatoo
foraging habitat within the
Survey Area



Legend

Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

Very High

Low

Nil

Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey and Black Cockatoo
Habitat Assessment
Figure 3.4e: Potential Carnaby's black cockatoo foraging habitat within the Survey Area

387200

387800

6427200

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6426800

6426400

6426400

6426000

6426000



Legend

Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

Very High

High

Low

Nil

Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.4f: Potential Carnaby's black cockatoo foraging habitat within the Survey Area

384200

384800

6431200

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6430800

6430400

6430400



Melville Maudurrah Hwy

Legend

 Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

 Nil

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment
Figure 3.5a: Potential
Baudin's black cockatoo
foraging habitat within the
Survey Area

385400

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6430800

6430400

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Legend

 Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

 Nil

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment
Figure 3.5b: Potential
Baudin's black cockatoo
foraging habitat within the
Survey Area

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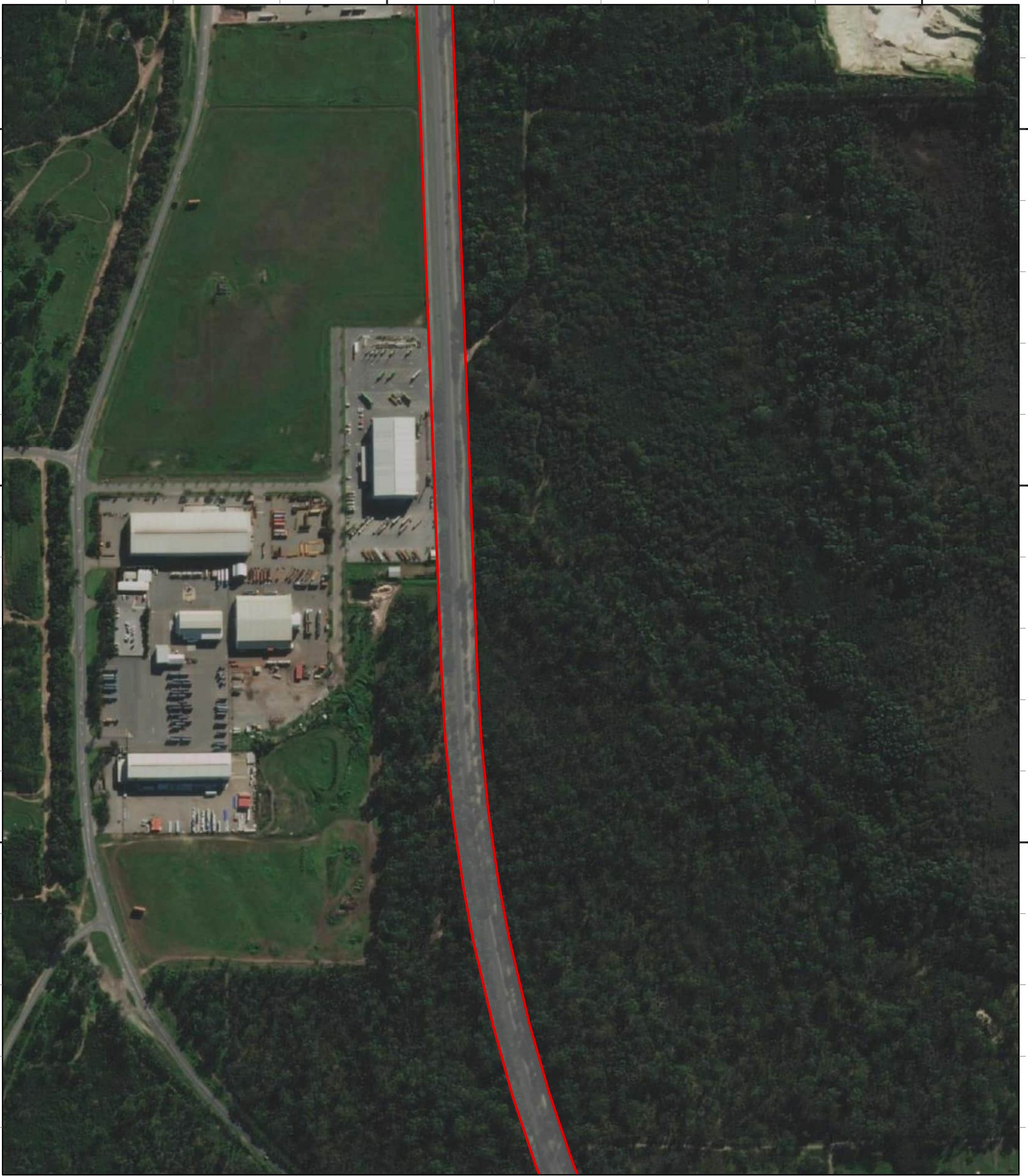
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Legend

 Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

 Nil

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.5c: Potential
Baudin's black cockatoo
foraging habitat within the
Survey Area

385400

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6428400

6428400

6428000

6428000




Legend

 Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

 Nil

 Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment
Figure 3.5d: Potential
Baudin's black cockatoo
foraging habitat within the
Survey Area



Legend

Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

Nil

Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021



Scale: 1:4,100



**BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment**

Figure 3.5e: Potential Baudin's black cockatoo foraging habitat within the Survey Area

387200

387800

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6426400

6426400

6426000

6426000



Legend

Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

High

Nil

Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment
Figure 3.5f: Potential
Baudin's black cockatoo
foraging habitat within the
Survey Area

384200

384800

6431200

6431200

6430800

6430800

6430400

6430400



Legend

 Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

 Low

 Nil

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment
Figure 3.6a: Potential
forest red-tailed black
cockatoo foraging habitat in
the Survey Area

385400

386000

6431200

6431200

6430800

6430800

6430400

6430400



Legend

 Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

 Low

 Nil

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment
Figure 3.6b: Potential
forest red-tailed black
cockatoo foraging habitat in
the Survey Area

385400

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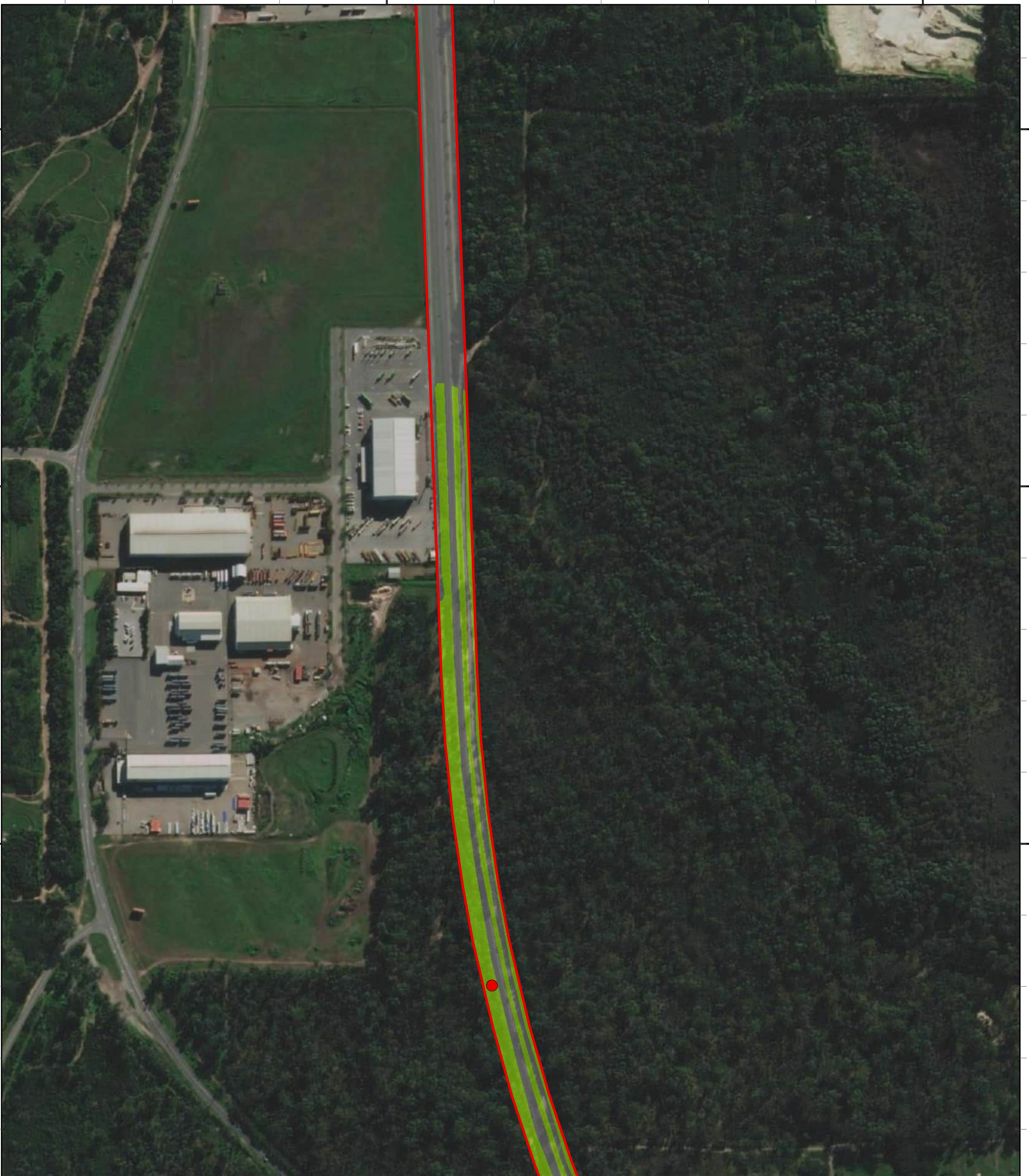
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Legend

Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

Low

Nil

Forest Red-tailed Black Cockatoo Record

Individual (alive)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.6c: Potential forest red-tailed black cockatoo foraging habitat in the Survey Area

385400

386000

6428800

6428800

6428400

6428400

6428000

6428000



Legend

Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

Low

Nil

Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

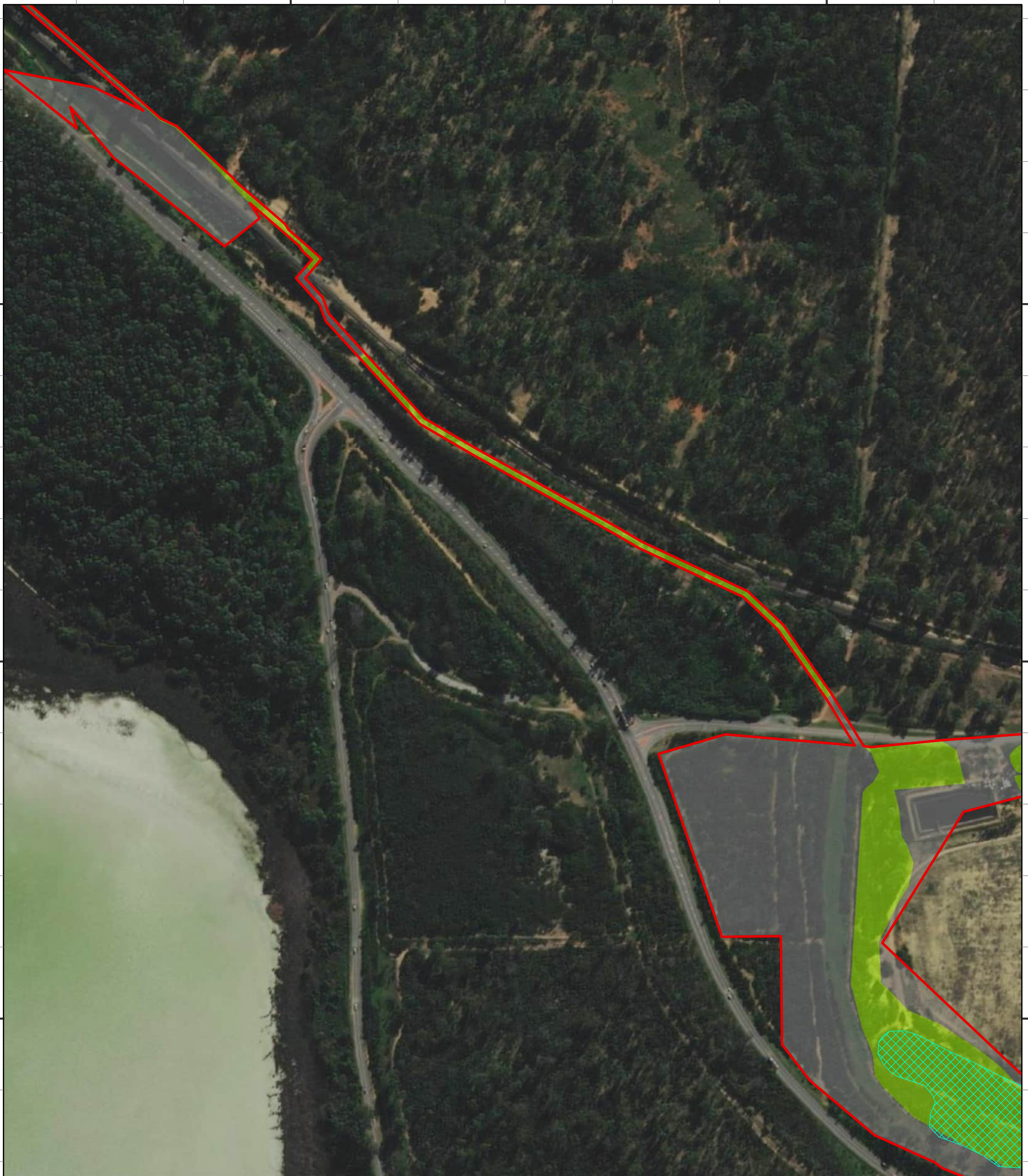
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Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment
Figure 3.6d: Potential forest red-tailed black cockatoo foraging habitat in the Survey Area



Legend

- Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

- Low
- Nil
- Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 16/12/2021

N

Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey and Black Cockatoo
Habitat Assessment

Figure 3.6e: Potential forest red-tailed black cockatoo foraging habitat in the Survey Area

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6426800

6426400

6426400

6426000

6426000



Legend

Black Cockatoo Survey Area

Black Cockatoo Potential Foraging Habitat

Very High

Low

Nil

Degraded Habitat (from Biologic (2021): TEC survey)

Forest Red-tailed Black Cockatoo Record

Chewed Nut

Individual (alive)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment
Figure 3.6f: Potential
forest red-tailed black
cockatoo foraging habitat in
the Survey Area

Potential Night Roosting Habitat

Black cockatoo roosting habitat is defined by DSEWPaC (2012a) as a communal site used by black cockatoo species during the evening, generally located in the tallest trees in an area. The species of tree is often not critical for night roosting and a suite of species are commonly used by black cockatoos (Le Roux, 2017); however, Carnaby's cockatoo will generally roost in or near riparian environments (DSEWPaC, 2012a). Night roosts can include tall trees within approximately 1 km of a central roost area of larger roost sites (>150 birds at any given time), with patches of trees usually 2-3 ha in area with smaller clumps used on any individual night for roosting (Glossop *et al.*, 2011). DSEWPaC (2012a) notes that black cockatoos may roost overnight in any native or introduced tree in the Perth metropolitan area that has suitable features.

No evidence of black cockatoo night roosting activity (i.e., clipped leaves and branches or droppings under suitable trees) was recorded during the current survey. However, the Tuart Woodland (10.8 ha), Tuart over Acacia Shrubland (12.7 ha) and Tuart and Marri Woodland (4.4 ha) are considered potential night roosting habitat for black cockatoos (27.9 ha total, 51.9 %) (Table 3.6, Figure 3.7). These habitats display characteristics of suitable night roosting habitat, including medium foliage density and habitats that are not too densely forested amongst other trees (Le Roux, 2017). Well-spaced and tall trees may offer greater protection from predators, and may allow cockatoos to enter and exit more easily (Le Roux, 2017). Le Roux (2017) noted that tuarts were well-represented in night roosting sites for Carnaby's cockatoo across the Swan Coastal Plain and were used as a roost tree across more than half of all the researched study roost sites. River red gum (*E. camaldulensis*) is also a common roost tree species for Carnaby's cockatoo on the Swan Coastal Plain (Le Roux, 2017), with Groom (2015) finding that cockatoos commonly roosted in 20+ year old smooth-barked eucalypts; a small number of these trees were also recorded within the Tuart Woodland habitat type of the Survey Area. The Banksia Shrubland (0.4 ha, 0.7%) and Acacia Shrubland (14.2 ha, 26.4%) habitats may provide some limited roosting potential within the Survey Area due to the occasional mature eucalypt tree present (Table 3.6).

Black cockatoos will favour night roost sites that are within 2 km to water sources (DoEE, 2017). Although there are no permanent water sources within the Survey Area, Lake Coo롱gup is within 750 m of the southern end of the Survey Area. Black cockatoos also favour night roost sites within 1 - 6 km of quality foraging resources; in addition to the foraging resources outlined in the previous section, other areas of foraging habitat are found in the vicinity, particularly in conservation areas such as the adjacent Leda Nature Reserve (Figure 3.1). Although no roosting sites were recorded within the Survey Area boundary, the presence of recently active black cockatoo roosts in the immediate vicinity (Figure 3.1) adds significance to the potential roosting trees within the Survey Area, as they may be used in the future. Overall, the characteristics of the habitat types within the Survey Area and surrounds provide the potential for black cockatoos to utilise the Survey Area for night roosting.

Table 3.6: Potential night roosting habitat present in the Survey Area

Roosting potential	Habitat type	Area (ha)
Night roosting potential	Tuart Woodland	10.8
	Tuart and Marri Woodland	4.4
	Tuart over Acacia Shrubland	12.7
Subtotal		27.9 ha (51.9%)
Limited roosting potential	Banksia Shrubland	0.4
	Acacia Shrubland	14.2
Subtotal		14.6 (27.1%)
No roosting potential	Disturbed	11.3
Subtotal		11.3 ha (21.0%)
Grand Total		53.8 ha

384200

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Legend

Black Cockatoo Survey Area

Black Cockatoo Potential Night Roosting Habitat

Night Roosting Potential

Limited Potential

No Roosting Potential

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021

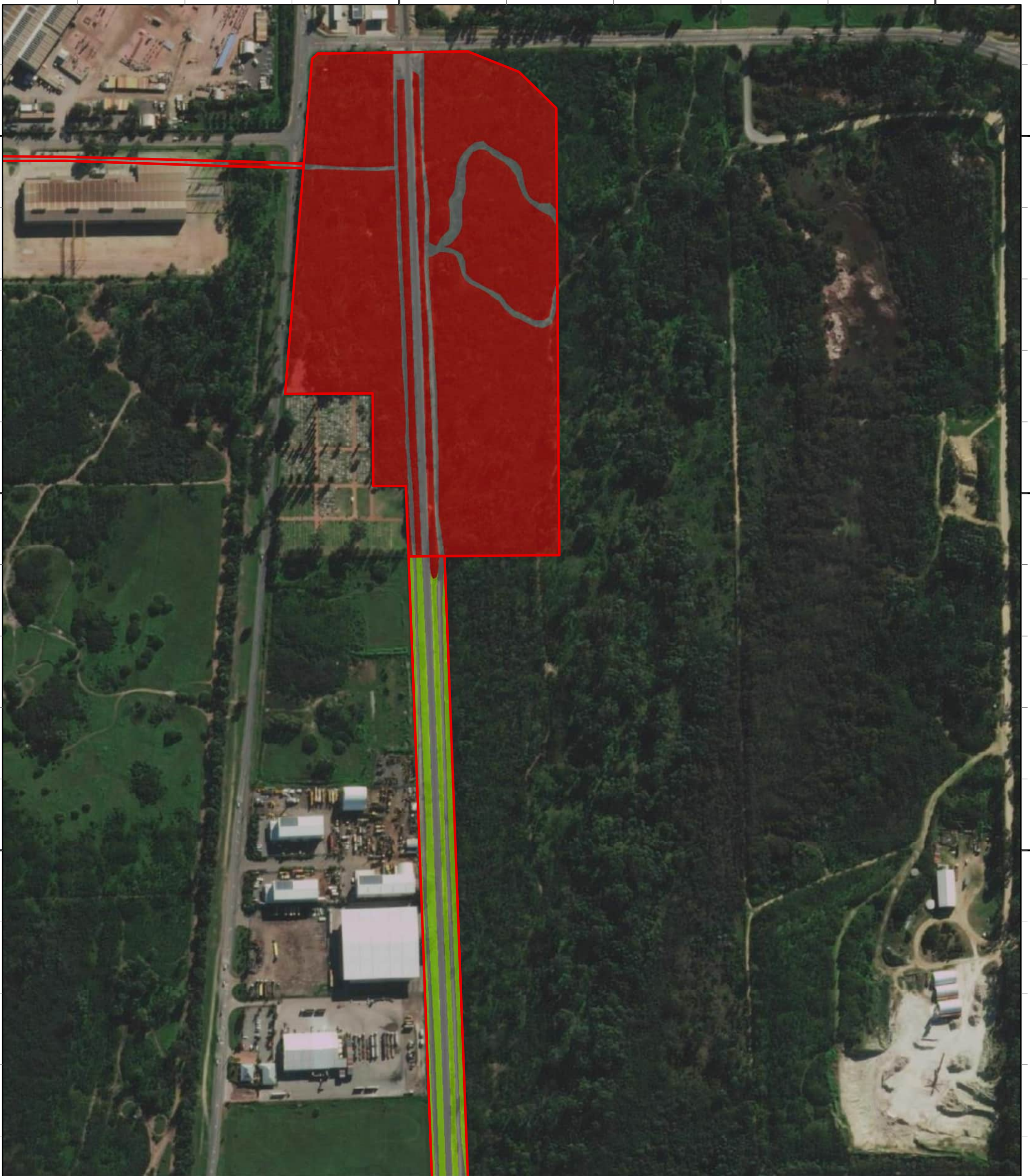


Scale: 1:4,100



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Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.7a: Potential black cockatoo roosting habitat in the Survey Area



Legend

Black Cockatoo Survey Area

Black Cockatoo Potential Night Roosting Habitat

Night Roosting Potential

Limited Potential

No Roosting Potential

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.7b: Potential black cockatoo roosting habitat in the Survey Area

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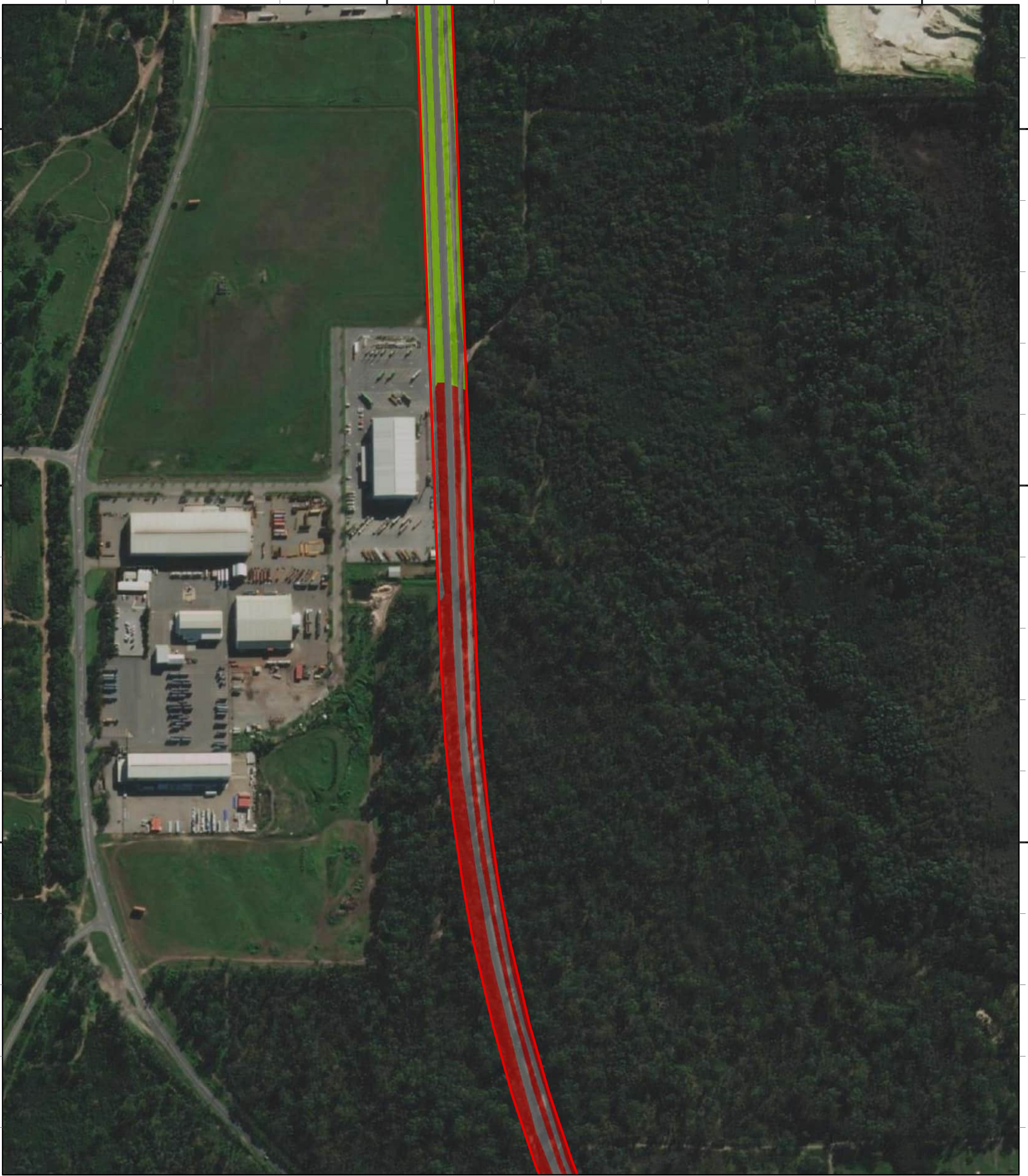
6430000

6429600


6429600

6429200

6429200




Legend

 Black Cockatoo Survey Area

Black Cockatoo Potential Night Roosting Habitat

 Night Roosting Potential

 Limited Potential

 No Roosting Potential

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/11/2021



Scale: 1:4,100



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Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.7c: Potential black cockatoo roosting habitat in the Survey Area




- Legend**
- Black Cockatoo Survey Area
 - Black Cockatoo Potential Night Roosting Habitat**
 - Night Roosting Potential
 - Limited Potential
 - No Roosting Potential
 - Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 16/12/2021

N

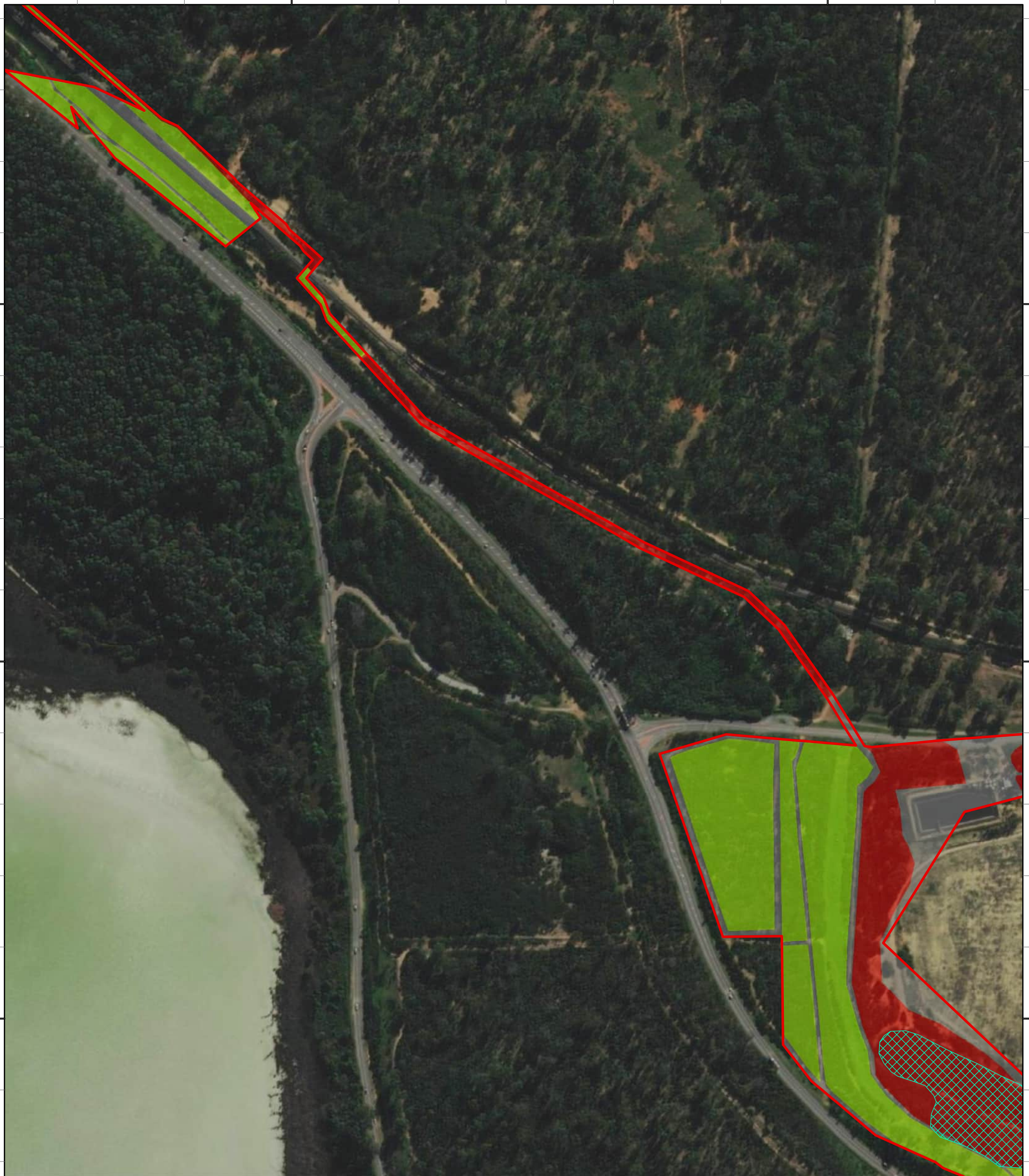


Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.7d: Potential black cockatoo roosting habitat in the Survey Area



Legend

- Black Cockatoo Survey Area

Black Cockatoo Potential Night Roosting Habitat

- Night Roosting Potential
- Limited Potential
- No Roosting Potential
- Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 16/12/2021

N

biologic
 Environmental Survey

Scale: 1:4,100



BHP NICKEL WEST
Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.7e: Potential black cockatoo roosting habitat in the Survey Area

387200

387800

6427200

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6426800

6426400

6426400

6426000

6426000



Legend

Black Cockatoo Survey Area

Black Cockatoo Potential Night Roosting Habitat

Night Roosting Potential

Limited Potential

No Roosting Potential

Degraded Habitat (from Biologic (2021): TEC survey)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021



Scale: 1:4,100



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Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.7f: Potential black cockatoo roosting habitat in the Survey Area

Potential Breeding Habitat

A total of 295 potential breeding trees were recorded within the Survey Area during the survey. These trees were species known to support black cockatoo breeding and of a suitable DBH (500 mm for all tree species present), with the most common species being tuart (*Eucalyptus gomphocephala*) ($n = 225$). A summary of potential breeding trees recorded with greater than 500 mm DBH within the Survey Area are shown in Table 3.7 and Figure 3.8. The details of each individual tree recorded is provided in Appendix F.

Table 3.7: Number of potential breeding trees with suitable DBH (500 mm for all tree species present) recorded in the Survey Area

Tree species	Number of trees	DBH range (mm)	Number of hollows observed
Tuart (<i>Eucalyptus gomphocephala</i>)	223	500 - 2000	23 (from 13 trees)
Unknown (Dead)	48	500 - 1900	56 (from 29 trees)
Marri (<i>Corymbia calophylla</i>)	14	510 - 980	1 (from 1 tree)
Jarrah (<i>Eucalyptus marginata</i>)	7	500 - 920	1 (from 1 tree)
River Red Gum (<i>Eucalyptus camaldulensis</i>)	3	610 - 680	0
Total	295	500 - 2000	81 (from 44 trees)

Overall, 81 hollows were recorded during the field survey from 44 trees. Most hollows observed were present in tuart ($n = 23$) and stag (dead) trees ($n = 56$). Although Carnaby's cockatoo breeds primarily in smooth-barked eucalypts such as wandoo (*E. wandoo*) and salmon gum (*E. salmonophloia*), breeding has also been previously reported in tuart (Cale, 2003). Prior to 2016, the only records of Carnaby's cockatoo breeding on the Swan Coastal Plain were in tuart trees near Lake Clifton (BirdLife Australia, 2016). The importance of stag (dead) trees for breeding is also widely recognised for black cockatoos (DoEE, 2017; Johnstone, 2006; Johnstone *et al.*, 2011). One hollow-bearing tree in the Survey Area was marri; this is the primary nesting tree used by forest red-tailed black cockatoo (Johnstone *et al.*, 2013a). One hollow was present in a jarrah tree; however, it is recognised that this species, in general, provides only around ten percent of black cockatoo hollows (Johnstone *et al.*, 2010; Kirkby, 2018). This is because although jarrah produce more hollows, they are of significantly smaller size than in marri (Whitford, 2002).

Following further consideration of attributes such as entry diameter (>100 mm), hollow angle, tree species, presence of competitors, and potential depth, 53 hollows overall were considered to have some potential to support black cockatoo breeding in the future (nest hollow "stock"), classified as either "Suitable" or "Possibly Suitable" (Table 3.8). These hollow-bearing trees were primarily located in the two "woodland" habitat types; the Tuart Woodland and Tuart and Marri Woodland; however, some potentially suitable hollows were scattered in the Acacia Shrubland habitat. Bees were recorded in five hollows and as such were considered unsuitable for black cockatoos at the time of survey, although they may become suitable should these competitors vacate the hollows. No hollows were observed to have chew marks around the perimeter of the hollow from "prospecting" or breeding cockatoos. A summary of the hollows recorded during the current survey and their potential suitability are given in Table 3.8, below, with complete details of the trees and hollows recorded provided in Appendix F.

Although the hollows present in the Survey Area are likely to not currently be occupied by black cockatoos for nesting, the importance of veteran and stag trees are recognised in their potential to support and develop hollows in the future, as it can take more than 200 years for a tree to develop suitable hollows (DoEE, 2017; Johnstone *et al.*, 2011). Although modelled distributions show the Survey Area lies within the non-breeding range for Carnaby's cockatoo and Baudin's cockatoo (DoEE, 2017), as discussed in Section 3.2, BirdLife Australia (2021a) have noted that four artificial hollows within 12 km of the Survey Area recorded breeding attempts by Carnaby's cockatoo during the 2020 breeding season. Forest red-tailed black cockatoos are known to breed on the Swan Coastal Plain in the metropolitan region (BirdLife Australia, 2016, 2021b). Overall, due to the number of potential breeding hollows present and previous breeding attempts within 12 km, the Survey Area has the potential to support black cockatoo breeding for Carnaby's cockatoo and forest red-tailed black cockatoo in the future. The presence of foraging resources both within the Survey Area and in the local area (e.g., Leda Nature Reserve), and the presence of water resources within 2 km, support the breeding potential, as black cockatoos rely on proximity of foraging resources to breeding hollows to successfully raise chicks (DoEE, 2017).

Table 3.8 Summary of hollow suitability across tree species and hollow type within the Survey Area

Overall Suitability	Hollow type	Tree species	Number of hollows
Suitable	Chimney type in main trunk	Tuart	1
		Unknown (Dead)	7
	End of branch leading into main trunk	Marri	1
		Tuart	4
		Unknown (Dead)	6
	Side entry branch hollow	Unknown (Dead)	2
	Side entry in main trunk	Unknown (Dead)	7
Top entry at broken branch at main fork	Unknown (Dead)	1	
Total			29
Possible	Chimney type in main trunk	Tuart	1
		Unknown (Dead)	2
	End of branch leading into main trunk	Tuart	4
		Unknown (Dead)	14
	Side entry in main trunk	Unknown (Dead)	3
Total			24
Not suitable	Chimney type in main trunk	Jarrah	1
		Tuart	1
		Unknown (Dead)	2
	End of branch leading into main trunk	Tuart	9
		Unknown (Dead)	9
	Side entry in main trunk	Tuart	3
Unknown (Dead)		3	
Total			28
Grand Total			81

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Legend

Black Cockatoo Survey Area

Fauna Habitat

- Acacia Shrubland
- Disturbed
- Tuart Woodland
- Tuart over Acacia Shrubland

Potential Black Cockatoo Breeding Tree

- Tuart (*Eucalyptus gomphocephala*)
- Unknown (Dead)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021

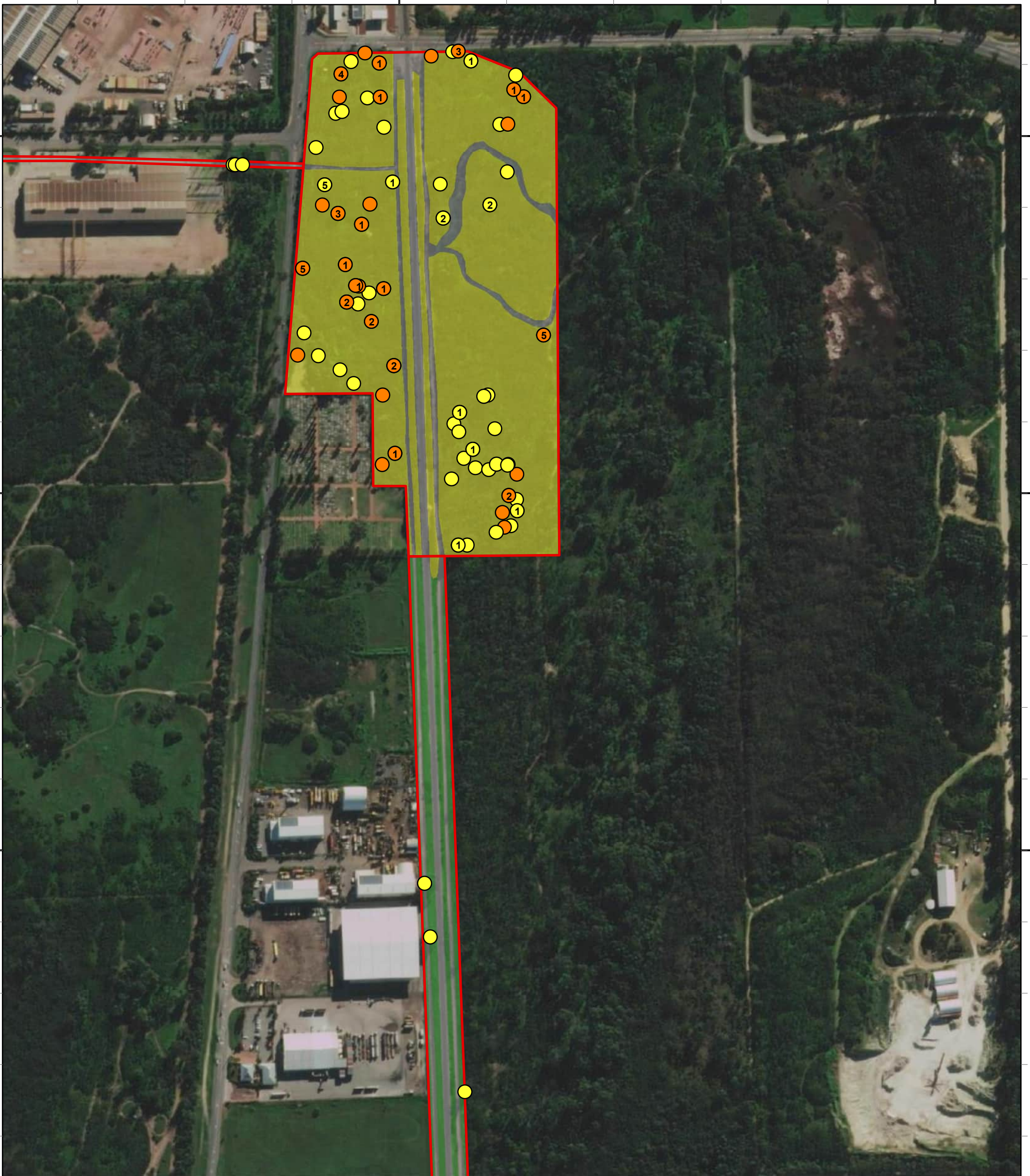


Scale: 1:4,100



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Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.8a: Potential black cockatoo breeding trees present in the Survey Area



Legend

Black Cockatoo Survey Area

Fauna Habitat

- Acacia Shrubland
- Disturbed
- Tuart Woodland
- Tuart over Acacia Shrubland

Potential Black Cockatoo Breeding Tree

- Tuart (*Eucalyptus gomphocephala*)
- Unknown (Dead)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 16/12/2021

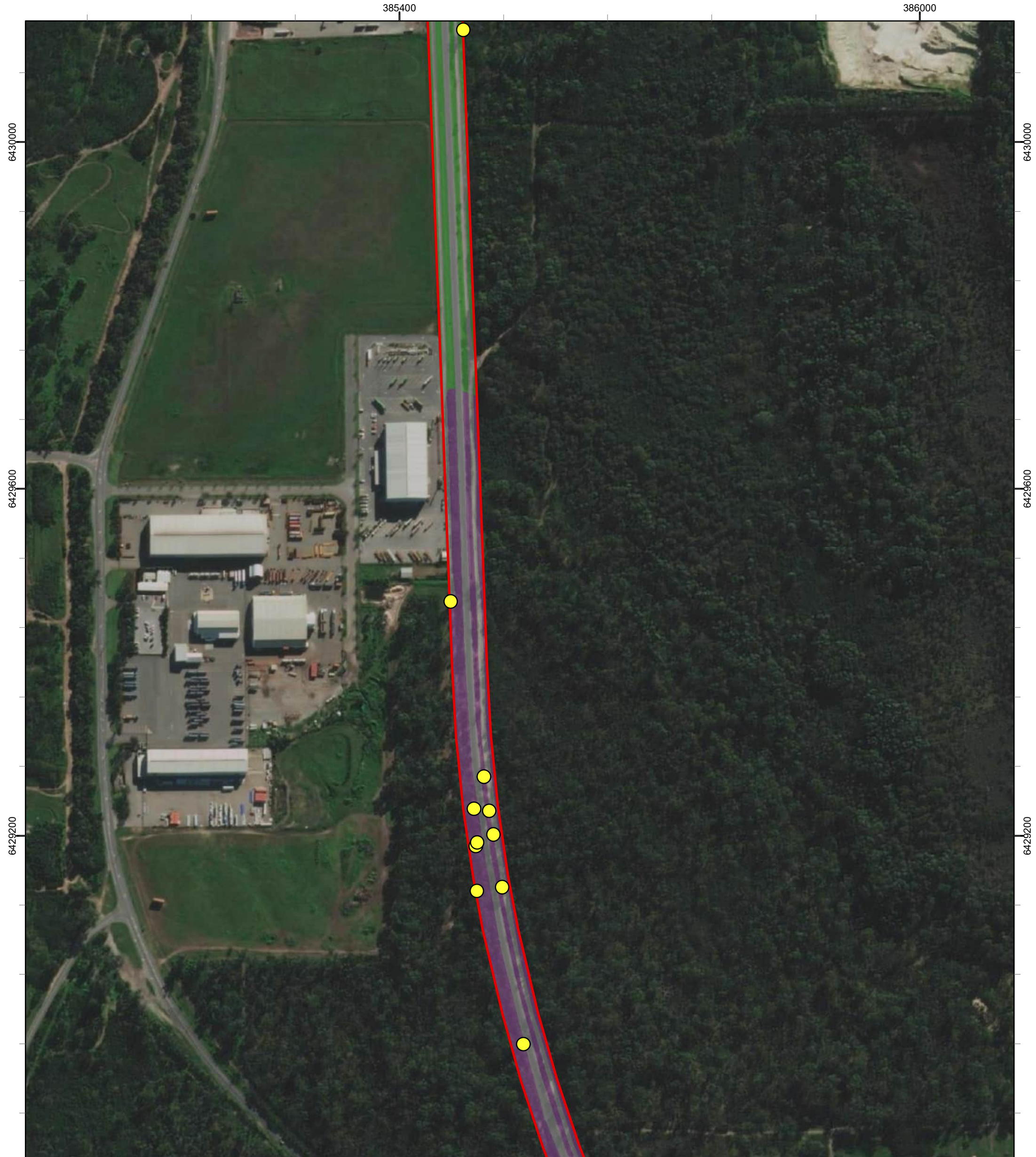


Scale: 1:4,100



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and Black Cockatoo
Habitat Assessment

Figure 3.8b: Potential black cockatoo breeding trees present in the Survey Area



Legend

Black Cockatoo Survey Area

Fauna Habitat

- Acacia Shrubland
- Disturbed
- Tuart Woodland

Potential Black Cockatoo Breeding Tree

- Tuart (*Eucalyptus gomphocephala*)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 16/12/2021

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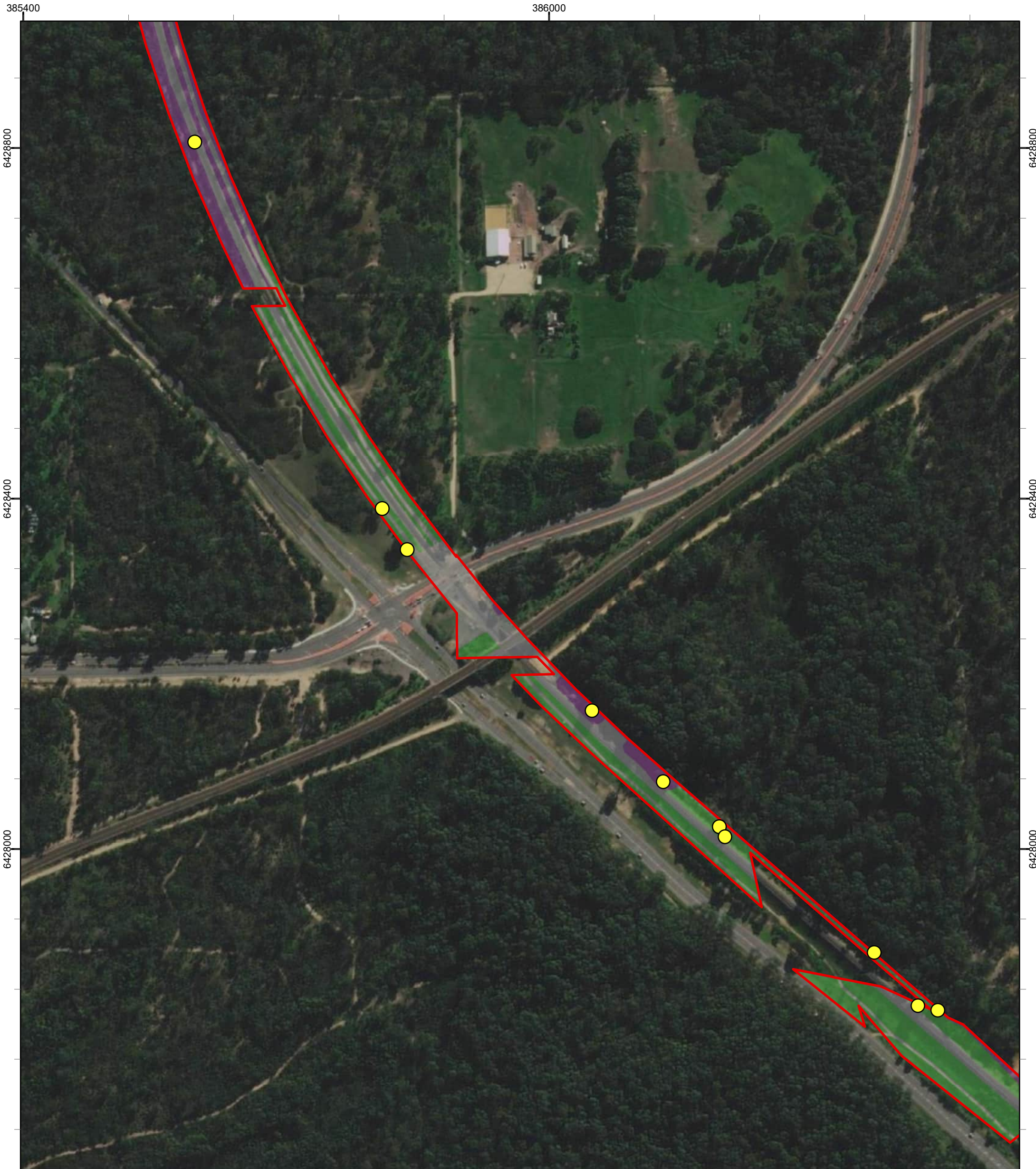
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Habitat Assessment

Figure 3.8c: Potential black cockatoo breeding trees present in the Survey Area

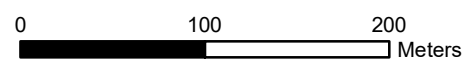


Legend

- Black Cockatoo Survey Area
- Acacia Shrubland
- Disturbed
- Tuart Woodland

Potential Black Cockatoo Breeding Tree

- Tuart (*Eucalyptus gomphocephala*)

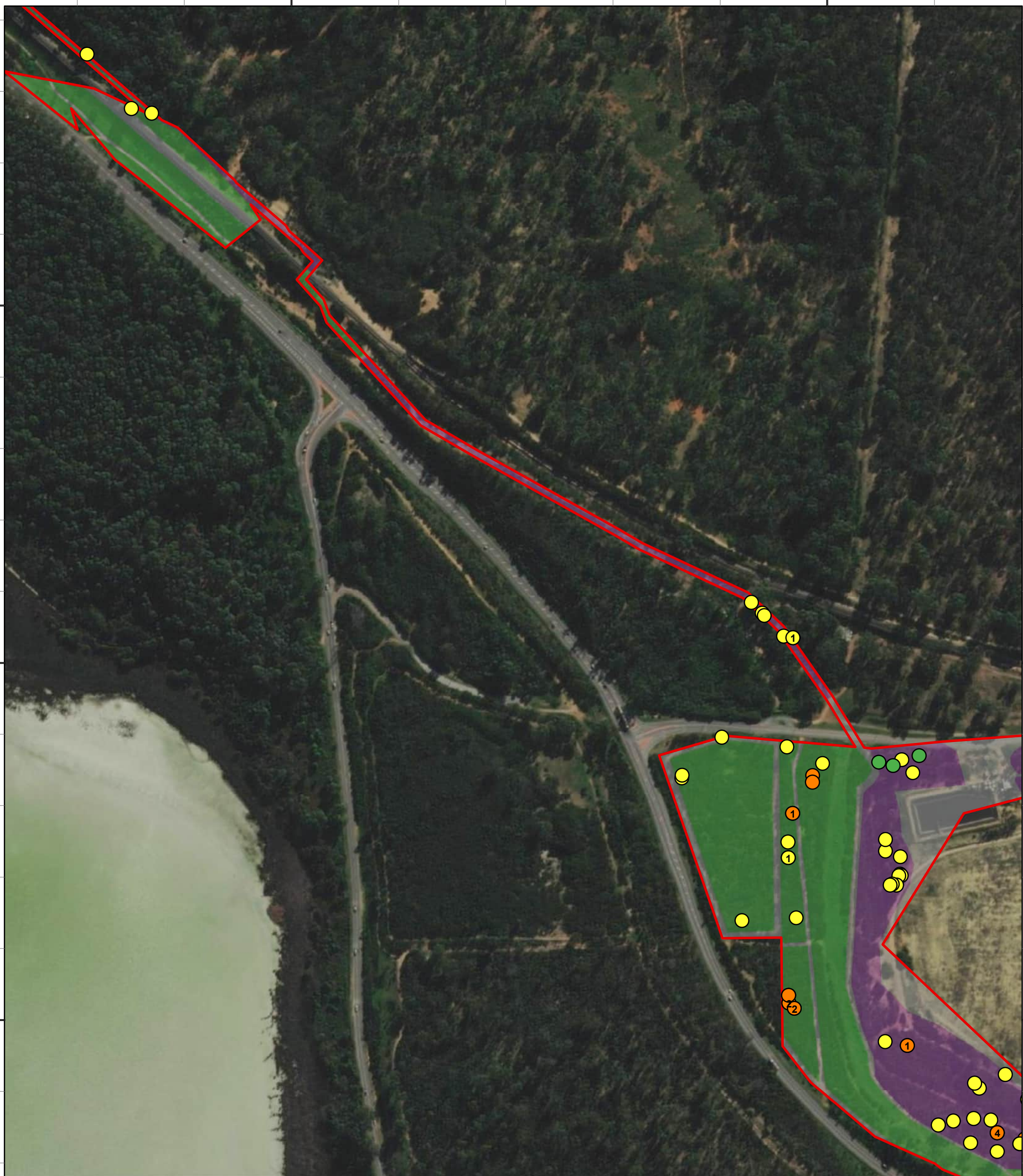


Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 16/12/2021



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Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.8d: Potential black cockatoo breeding trees present in the Survey Area



Legend

Black Cockatoo Survey Area

Fauna Habitat

- Acacia Shrubland
- Disturbed
- Tuart Woodland

Potential Black Cockatoo Breeding Tree

- River Red Gum (*Eucalyptus camaldulensis*)
- Tuart (*Eucalyptus gomphocephala*)
- Unknown (Dead)

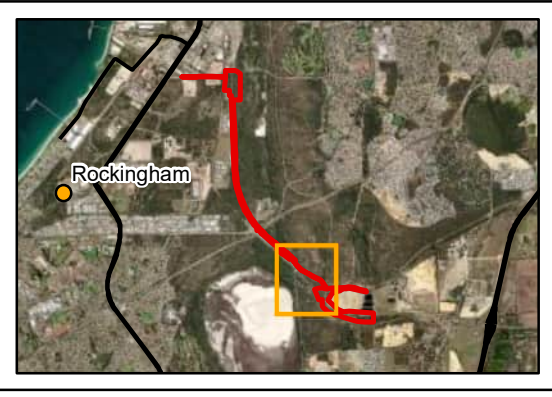
0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 16/12/2021

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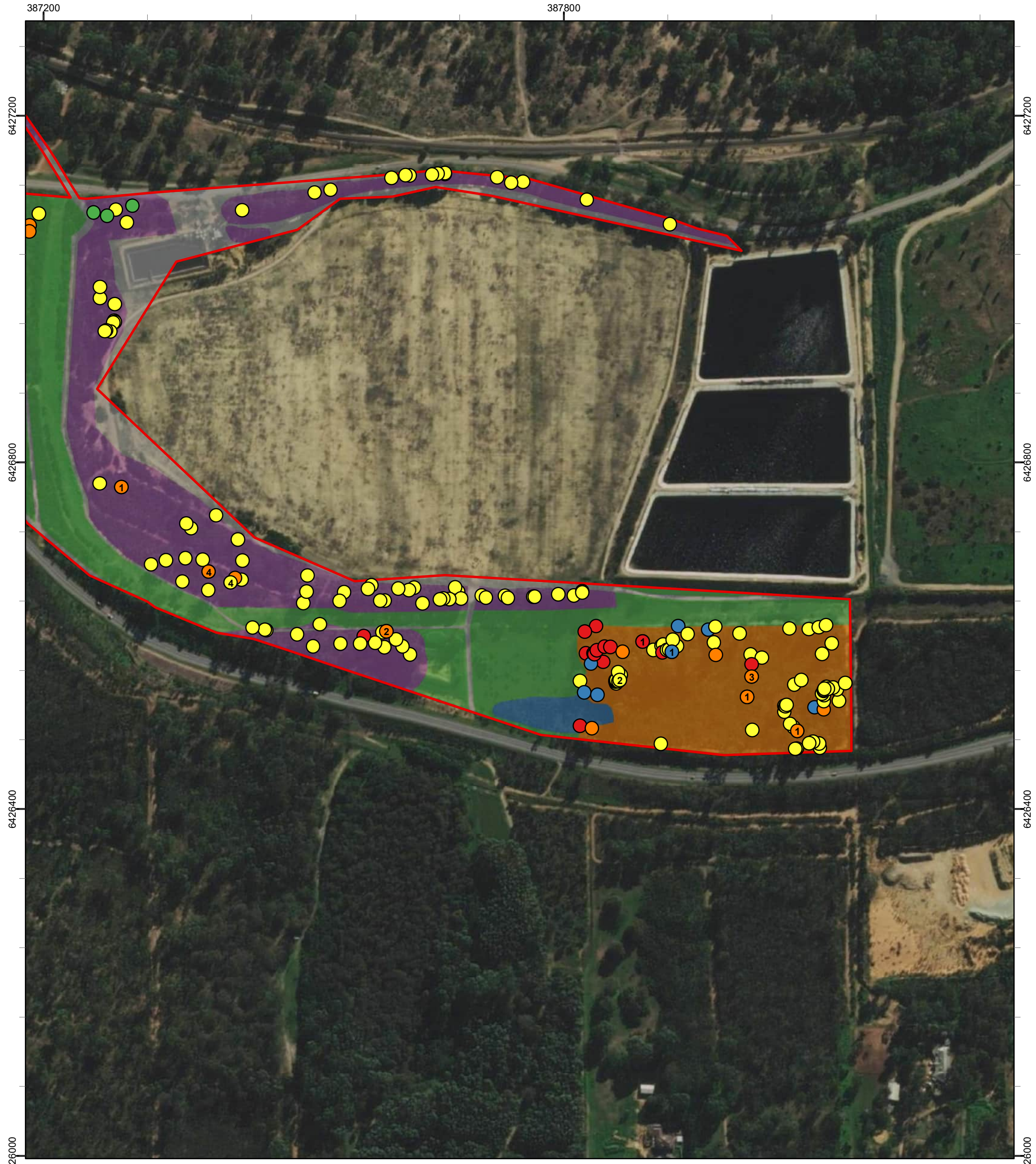
biologic
 Environmental Survey

Scale: 1:4,100



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and Black Cockatoo
Habitat Assessment

Figure 3.8e: Potential black cockatoo breeding trees present in the Survey Area



Legend

Black Cockatoo Survey Area

Fauna Habitat

- Acacia Shrubland
- Banksia Shrubland
- Disturbed
- Tuart Woodland
- Tuart and Marri Woodland

Potential Black Cockatoo Breeding Tree

- Jarrah (*Eucalyptus marginata*)
- Marri (*Corymbia calophylla*)
- River Red Gum (*Eucalyptus camaldulensis*)
- Tuart (*Eucalyptus gomphocephala*)
- Unknown (Dead)

0 100 200 Meters

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994 Created 16/12/2021

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biologic
 Environmental Survey

Scale: 1:4,100



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Kwinana Pre-clearing Survey;
Targeted Flora Survey
and Black Cockatoo
Habitat Assessment

Figure 3.8f: Potential black cockatoo breeding trees present in the Survey Area

3.4.2 Other Fauna of Significance

Quenda Isoodon fusciventer

Known habitat and distribution

The quenda *Isoodon fusciventer* is classified as Priority 4 by the DBCA. The species is distributed along coastal margins in Western Australia ranging from Yanchep to Cape Le Grand and inland to Wyalkatchem and Hyden (Pentland, 1999). The habitat for the species is described as jarrah forest and swamp habitats, in dense vegetation around wetland fringes and heathland (Cooper, 1998; Woinarski *et al.*, 2014). This species prefers dense, low shrubland to forage underneath (Woinarski *et al.*, 2014), and low grasstrees with leaves that touch the ground for diurnal nests to provide protection from predators (Lohr *et al.*, 2018). The dense vegetation surrounding waterways also provides protection and foraging opportunities. Their presence is often identified by distinctively shaped foraging pits dug searching for invertebrates, tubers, and fungi, and can range in size from “nose-pokes” in leaf litter to well-excavated holes.

Previous records

There are small concentrations of the species in the vicinity of the local lakes and wetlands (e.g. Lake Coo loongup, Lake Walyungup) and within Leda Nature Reserve (DBCA, 2021a); however, there does not appear to have been any previous records within the survey boundary. The City of Kwinana accounted for 5.6% (fifth overall) of the total quenda sightings made during the Perth quenda community survey in 2012 (Howard *et al.*, 2014), and as such the local area is significant for these populations. Howard *et al.* (2014) noted that the majority of quenda sightings are located in LGAs such as the City of Kwinana that retain a higher proportion of pre-European vegetation (38% remaining of pre-European vegetation); however, there was still a noticeable decline in quenda records within the City between 1993 and 2012.

Current survey

The current survey recorded 12 instances of diggings attributed to quenda within the Survey Area (Plate 3.3, Appendix D). One of these diggings was recorded alongside a quenda scat (very old, likely deposited more than one year prior), located on the sand behind the hole (Plate 3.3). These observations were recorded within the “woodland” habitat types present: Tuart Woodland, and Tuart and Marri Woodland. The woodland habitats present within the Survey Area are likely to be utilised primarily for foraging and dispersal events only, as there was a lack of low *Xanthorrhoea* grass tree skirts present under which diurnal nests are made (Broughton & Dickman, 1991; Lohr *et al.*, 2018). Everard and Bamford (2014) suggest that dampland heaths support the greatest density of quenda (up to 2.8 individuals/ha), followed by woodland areas of marri and *Banksia* (40 – 60% of maximum density, up to 1.7 individuals/ha) and grassland areas (10 – 20% of maximum density, up to 0.6 individuals/ha). Quenda also have the potential to use the Acacia Shrubland habitat for foraging and dispersal opportunities where the understorey is dense.



Plate 3.3: Diggings and scat attributed to quenda recorded during the field survey

4 CONCLUSION

A targeted flora survey and targeted black cockatoo habitat assessment was undertaken by Biologic to support the NVCP required to allow infrastructure maintenance at the Kwinana and Baldivis Nickel Refinery, including the existing pipeline between the two facilities. The field survey was undertaken on 29 and 30 September 2021. The field survey timing was adequate to identify any flowering significant taxa. The survey was undertaken outside the timing recommended for Carnaby’s cockatoo (January to July) (DoEE, 2017); however, the potential of the Survey Area to support breeding, night roosting, and foraging was able to be assessed during the survey period.

4.1 Targeted Conservation Significant Flora Survey

The Priority 3 taxon *Pimelea calcicola* was recorded within the Survey Area, totalling three individuals from three locations. This taxon has previously been recorded in the area surrounding the Survey Area with the nearest previous record being approximately 500m west of the Survey Area. Ground-truthing of the Survey Area revealed no other significant taxa. Following the post-field review of the Occurrence Assessment, apart from the confirmation of *Pimelea calcicola*, no other significant flora species are considered likely or possible to occur within the Survey Area.

4.2 Black Cockatoo Habitat Assessment

One species of black cockatoo (forest red-tailed black cockatoo) was observed during the field survey via both direct observation and foraging evidence. Very High- and High-quality foraging habitat for black cockatoos was identified across the woodland habitat types (Tuart Woodland, Tuart over Acacia Shrubland, and Tuart and Marri Woodland); in addition, the Banksia Shrubland habitat was assessed as High for Carnaby’s cockatoo. Although no night roosts were identified within the Survey Area, potential night roosting habitat was identified within the woodland habitat types, and both white-tailed and forest red-tailed black cockatoo night roosts have previously been identified within 5 km of the Survey Area. Overall, the foraging habitat in the Survey Area, although comprised primarily of secondary food resources such as tuart, is valued on a local level to support night roosting as potential night roost sites are within 1 - 6 km of quality foraging resources. Conserving foraging habitat for black cockatoos is considered important across the Perth metropolitan area given the lack of suitable foraging habitat remaining in this region as well as the connectivity values of remnant bushland during migration.

In total, 297 potential breeding trees were identified that are of suitable DBH and species to potentially support black cockatoo breeding. From the 44 trees containing hollows, 53 hollows were considered to have some potential to support black cockatoo breeding in the future following consideration of attributes such as angle, tree species, presence of competitors, and potential depth. These hollow-bearing trees were primarily located in the “woodland” habitat types (i.e., Tuart Woodland, Tuart over Acacia Shrubland, and Tuart and Marri Woodland); however, some potentially suitable hollows were scattered in the Acacia Shrubland habitat. Although no current breeding was identified within the Survey Area, there are four confirmed breeding attempts of Carnaby’s cockatoo in artificial hollows within 12 km of the Survey Area. Overall, the Survey Area has the potential to support black cockatoo breeding for Carnaby’s cockatoo

and forest red-tailed black cockatoo, in addition to providing potential night roosting habitat and foraging resources for these species.

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Appendix A – Conservation Codes

International Union for Conservation of Nature

Category	Definition
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LTC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

Category	Definition
Data Deficient (DD)	<p>A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.</p>
Not Evaluated (NE)	<p>A taxon is Not Evaluated when it has not yet been evaluated against the criteria.</p>

Environment Protection and Biodiversity Conservation Act 1999

Category	Definition
Threatened Flora Species	
Extinct (EX)	A native species is eligible to be included in the Extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (EW)	A native species is eligible to be included in the Extinct in the Wild category at a particular time if, at that time: <ul style="list-style-type: none"> (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CR)	A native species is eligible to be included in the Critically Endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	A native species is eligible to be included in the Endangered category at a particular time if, at that time: <ul style="list-style-type: none"> (a) it is not Critically Endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the Vulnerable category at a particular time if, at that time: <ul style="list-style-type: none"> (a) it is not Critically Endangered or Endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation Dependent (CD)	A native species is eligible to be included in the Conservation Dependent category at a particular time if, at that time: <ul style="list-style-type: none"> (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming Vulnerable, Endangered or Critically Endangered; or (b) the following subparagraphs are satisfied:

Category	Definition
	<p>(i) the species is a species of fish;</p> <p>(ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised;</p> <p>(iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory;</p> <p>(iv) cessation of the plan of management would adversely affect the conservation status of the species.</p>
Threatened Ecological Communities (TEC)	
Critically Endangered	<p>An ecological community is eligible to be included in the Critically Endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.</p>
Endangered	<p>An ecological community is eligible to be included in the Endangered category at a particular time if, at that time:</p> <p>(a) it is not Critically Endangered; and</p> <p>(b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.</p>
Vulnerable	<p>An ecological community is eligible to be included in the Vulnerable category at a particular time if, at that time:</p> <p>(a) it is not Critically Endangered nor Endangered; and</p> <p>(b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.</p>

Biodiversity Conservation Act 2016

Category	Definition
Threatened Flora Species	
Critically Endangered (CR)	Threatened species considered to be “facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines”. Published under schedule 1 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for Critically Endangered flora.
Endangered (EN)	Threatened species considered to be “facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines”. Published under schedule 2 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for Endangered flora.
Vulnerable (VU)	Threatened species considered to be “facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines”. Published under schedule 3 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for Vulnerable flora.
Extinct (EX)	Species where “there is no reasonable doubt that the last member of the species has died”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for extinct flora.
Extinct in the Wild (EW)	Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened flora species listed as extinct in the wild.

Category	Definition
Threatened Ecological Communities (TEC)	
Critically Endangered (CR)	<p>An ecological community is eligible for listing in the category of Critically Endangered ecological community at a particular time if, at that time —</p> <p>(a) it is facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines; and</p> <p>(b) listing in that category is otherwise in accordance with the ministerial guidelines.</p>
Endangered (EN)	<p>An ecological community is eligible for listing in the category of Endangered ecological community at a particular time if, at that time —</p> <p>(a) it is not a Critically Endangered ecological community; and</p> <p>(b) it is facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future, as determined in accordance with criteria set out in the ministerial guidelines; and</p> <p>(c) listing in that category is otherwise in accordance with the ministerial guidelines.</p>
Vulnerable (VU)	<p>An ecological community is eligible for listing in the category of Vulnerable ecological community at a particular time if, at that time —</p> <p>(a) it is not a Critically Endangered ecological community or an Endangered ecological community; and</p> <p>(b) it is facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines; and</p> <p>(c) listing in that category is otherwise in accordance with the ministerial guidelines.</p>
Collapsed	<p>An ecological community is eligible for listing as a collapsed ecological community at a particular time if, at that time —</p> <p>(a) there is no reasonable doubt that the last occurrence of the ecological community has collapsed; or</p> <p>(b) the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover —</p> <p style="padding-left: 40px;">(i) its species composition or structure; or</p> <p style="padding-left: 40px;">(ii) its species composition and structure.</p>

Department of Biodiversity, Conservation and Attractions Priority Definitions

Category	Definition
Priority Flora Species	
Priority 1 (P1)	<p>Poorly-known Species</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
Priority 2 (P2)	<p>Poorly-known Species</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
Priority 3 (P3)	<p>Poorly-known Species</p> <p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations 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 locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>

Category	Definition
<p>Priority 4 (P4)</p>	<p>Rare, Near Threatened and other species in need of monitoring</p> <p>(a) Rare. Species 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 species are usually represented on conservation lands.</p> <p>(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable but are not listed as Conservation Dependent.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

Category	Definition
Priority Ecological Communities (PEC)	
Priority 1 (P1)	<p>Poorly-known ecological communities</p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
Priority 2 (P2)	<p>Poorly-known Ecological Communities</p> <p>Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) 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.</p>

Category	Definition
<p>Priority 3 (P3)</p>	<p>Poorly-known Ecological Communities</p> <p>(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or;</p> <p>(iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc.</p> <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>
<p>Priority 4 (P4)</p>	<p>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.</p> <p>(i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.</p> <p>(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>

Category	Definition
<p>Priority 5 (P5)</p>	<p>Conservation Dependent Ecological Communities</p> <p>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.</p>

Appendix B – Flora Literature Review

Study Details	Methods	Results	Significant Findings	Limitations
<p>Rockingham Lakes Regional Park Management Plan.</p> <p>Overman <i>et al.</i> (2010)</p> <p>Client: City of Rockingham</p> <p>Type: Management Plan</p> <p>Location: Rockingham_Lakes Regional Park (immediately adjacent)</p> <p>Timing: 2010</p>	<ul style="list-style-type: none"> • Desktop assessment • Relevés • Targeted searching 	<ul style="list-style-type: none"> • No conservation significant taxa recorded in Survey Area 	<ul style="list-style-type: none"> • 10 Floristic community types recorded within the Survey Area 	<ul style="list-style-type: none"> • N/A
<p>Flora and Fauna Assessment of Proposed Kwinana Ethanol Bio-Refinery</p> <p>Umwelt (2006)</p> <p>Client: Primary Energy</p> <p>Type: Reconnaissance flora and Basic Terrestrial Fauna Survey</p> <p>Location: 1.4km W of northern section</p> <p>Timing: September 2006</p>	<ul style="list-style-type: none"> • Reconnaissance flora survey • Basic terrestrial fauna survey 	<ul style="list-style-type: none"> • 37 flora taxa, 21 native and 16 weeds. • 5 vegetation communities • No conservation significant taxa recorded in Survey Area 	<ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • N/A

Study Details	Methods	Results	Significant Findings	Limitations
<p>Kwinana Nickel Refinery, Flora, Vegetation and Fauna Assessment</p> <p>Biologic (2019)</p> <p>Client: BHP Nickel West</p> <p>Type: Flora, Fauna and Vegetation Survey</p> <p>Location: 400 m W of northern section</p> <p>Timing: April 2019</p>	<ul style="list-style-type: none"> Detailed flora survey Basic terrestrial fauna survey 	<ul style="list-style-type: none"> 50 flora taxa, 22 native and 20 introduced 5 vegetation units Six modified landform units Vegetation condition ranged from 'Degraded' to 'Completely Degraded' No Conservation Significant Taxa recorded in the Survey Area 	<ul style="list-style-type: none"> 3 significant environmental weeds recorded <ul style="list-style-type: none"> *<i>Asparagus asparagoides</i> *<i>Tamarix aphylla</i> *<i>Gomphocarpus fruticosus</i> 	<ul style="list-style-type: none"> N/A

Appendix C - Database Search Occurrence Assessment

Taxon	Conservation Code			Habit and Habitat	Habitat within Survey Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Pimelea calcicola</i>	P3			Erect to spreading shrub, 0.2-1 m high. Fl. pink, Sep to Nov. Sand. Coastal limestone ridges.	Yes	Adjacent	0.5 km W	Likely	Confirmed
<i>Acacia</i> sp. Binningup (G. Cockerton et al. WB 37784)	P1			Suckering clumping shrubs to 1.5 m.	Yes	Yes	2.4 km SW	Possible	Unlikely
<i>Dodonaea hackettiana</i>	P4			Erect shrub or tree, 1-5 m high. Fl. yellow-green/red, mainly Jul to Oct. Sand. Outcropping limestone.	Yes	Yes	2.2 km NE	Possible	Unlikely
<i>Jacksonia sericea</i>	P4			Low spreading shrub, to 0.6 m high. Fl. orange, usually Dec or Jan to Feb. Calcareous & sandy soils.	Yes	Yes	3 km W	Possible	Unlikely
<i>Drakaea elastica</i>		CR	EN	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red & green & yellow, Oct to Nov. White or grey sand. Low-lying situations adjoining winter-wet swamps.	No	Yes	7.4 km NE	Unlikely	Highly Unlikely
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)	P1			Shrub, 0.4-1.5 m high. Fl. yellow, May or Aug. Grey or black sand over clay. Swampy areas, winter wet lowlands	No	Yes	9.2 km E	Unlikely	Highly Unlikely
<i>Lachnagrostis nesomytica</i> subsp. <i>Paralia</i>	P1			Loosely tufted, weakly ascending, short-lived perennial or annual, herb (grass), to 0.5 m high. Fl. purple-green. Calcareous sands. Coastal dunes and swales.	No	No	7.6 km NW	Unlikely	Highly Unlikely
<i>Acacia benthamii</i>	P2			Shrub, ca 1 m high. Fl. yellow, Aug to Sep. Sand. Typically on limestone breakaways.	No	Yes	10.1 km SW	Unlikely	Highly Unlikely
<i>Austrostipa mundula</i>	P3			Perennial grass, 50 cm high x 40 cm wide.	Yes	Yes	7.3 km N	Unlikely	Highly Unlikely
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3			Many stemmed shrub to 30 cm, female plant, flowers green.	Yes	Yes	8.8 km SW	Unlikely	Highly Unlikely
<i>Carex tereticaulis</i>	P3			Monoecious, rhizomatous, tufted perennial, grass-like or herb (sedge), 0.7 m high. Fl. brown, Sep to Oct. Black peaty sand.	No	Yes	10.2 km SE	Unlikely	Highly Unlikely
<i>Dillwynia dillwynioides</i>	P3			Decumbent or erect, slender shrub, 0.3-1.2 m high. Fl. red & yellow/orange, Aug to Dec. Sandy soils. Winter-wet depressions.	No	Yes	8 km SE	Unlikely	Highly Unlikely

Taxon	Conservation Code			Habit and Habitat	Habitat within Survey Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Stylidium paludicola</i>	P3			Reed-like perennial, herb, 0.35-1 m high, Leaves tufted, linear or subulate or narrowly oblanceolate, 0.5-4 cm long, 0.5-1.5 mm wide, apex acute, margin entire, glabrous. Scape mostly glabrous, inflorescence axis glandular. Inflorescence racemose. Fl. pink, Oct to Dec. Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	No	Yes	9.6 km NE	Unlikely	Highly Unlikely
<i>Aponogeton hexatepalus</i>	P4			Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green-white, Jul to Oct. Mud. Freshwater: ponds, rivers, claypans.	No	Yes	5.9 km E	Unlikely	Highly Unlikely
<i>Parsonia diaphanophleba</i>	P4			Woody climber, to 10 m high. Fl. white/cream & pink, Jan to Feb or Apr to Jun or Sep. Alluvial soils. Along rivers.	No	Yes	9.7 km SE	Unlikely	Highly Unlikely
<i>Stylidium longitubum</i>	P4			Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. pink, Oct to Dec. Sandy clay, clay. Seasonal wetlands.	No	Yes	6.6 km NE	Unlikely	Highly Unlikely
<i>Caladenia huegelii</i>		CR	EN	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey or brown sand, clay loam.	No	Yes	6 km NE	Unlikely	Unlikely
<i>Diuris micrantha</i>		VU	VU	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct. Brown loamy clay. Winter-wet swamps, in shallow water.	No	Yes	5.8 km E	Unlikely	Unlikely
<i>Synaphea</i> sp. Serpentine (G.R. Brand 103)		CR	CR	Small clumped shrub. Long, undulating inflorescences, peduncles red.	No	Yes	6.7 km E	Unlikely	Unlikely
<i>Boronia juncea</i> subsp. <i>juncea</i>	P1			Slender or straggly shrub, pedicels and sepals glabrous. Fl. pink, Apr. Sand. Low scrub.	No	No	6.4 km NE	Unlikely	Unlikely
<i>Cyathochaeta teretifolia</i>	P3			Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. brown. Grey sand, sandy clay. Swamps, creek edges.	No	Yes	5.7 km NE	Unlikely	Unlikely

Taxon	Conservation Code			Habit and Habitat	Habitat within Survey Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Jacksonia gracillima</i>	P3			Prostrate, spreading or scrambling, shrub, spindly shrub (broom-like). Flowers in October and November	No	Yes	6.4 km NE	Unlikely	Unlikely
<i>Sphaerolobium calcicola</i>	P3			Upright, multi-stemmed, scandent or erect shrub, to 1.5 m high. Fl. orange-red, Jun or Sep to Nov. White-grey-brown sand, sandy clay over limestone, black peaty sandy clay. Tall dunes, winter-wet flats, interdunal swamps, low-lying areas.	Possible	Yes	5.6 km SW	Unlikely	Unlikely
<i>Stylidium ireneae</i>	P4			Lax perennial, herb, (0.06-)0.1-0.28 m high, Leaves oblanceolate, 0.4-2 cm long, 1-3 (-5) mm wide, apex subacute to acuminate, margin entire, glandular. Scape glandular. Inflorescence racemose. Fl. pink, Oct to Dec. Sandy loam. Valleys near creek lines, woodland, often with <i>Agonis</i> .	No	No	4.5 km E	Unlikely	Unlikely
<i>Diuris drummondii</i>		VU	VU	uberous, perennial, herb, 0.5-1.05 m high. Fl. yellow, Nov to Dec or Jan. Low-lying depressions, swamps.	Possible	Yes	11.4 km N	Highly Unlikely	Highly Unlikely
<i>Diuris purdiei</i>		EN	EN	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct. Grey-black sand, moist. Winter-wet swamps.	No	No	12.3 km NE	Highly Unlikely	Highly Unlikely
<i>Lepidosperma rostratum</i>		EN	EN	Rhizomatous, tufted perennial, grass-like or herb (sedge), 0.5 m high. Fl. brown. Peaty sand, clay	No	Yes	13.1 km E	Highly Unlikely	Highly Unlikely
<i>Synaphea</i> sp. Pinjarra Plain (A.S. George 17182)		EN	EN	Erect, clumped shrub (sub-shrub), to 0.8 m high. Fl. yellow, Sep to Nov. Grey sandy loam or clay, grey-brown clayey sand, brown clayey loam, laterite. Flats, seasonally wet areas, railroad reserves often with wet depressions or drains.	No	No	13.4 km SE	Highly Unlikely	Highly Unlikely
<i>Calectasia grandiflora</i>	P2			Rhizomatous, perennial, herb (or undershrub), to 0.65 m high, without stilt roots. Fl. blue/purple, Jun to Nov. White, grey or yellow sand, sandy clay, gravel, laterite, granite. Swampy areas, rock outcrops, flats, slopes, ridges.	No	Yes	13.7 km E	Highly Unlikely	Highly Unlikely

Taxon	Conservation Code			Habit and Habitat	Habitat within Survey Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Johnsonia pubescens</i> subsp. <i>Cygnorum</i>	P2			Tufted perennial, herb, 0.15-0.25 m high. Fl. white-green, Sep. Grey-white-yellow sand. Flats, seasonally-wet sites.	No	Yes	9.8 km SE	Highly Unlikely	Highly Unlikely
<i>Angianthus drummondii</i>	P3			Erect annual, herb, to 0.1 m high. Fl. yellow, Oct to Dec. Grey or brown clay soils, ironstone. Seasonally wet flats	No	Yes	13 km E	Highly Unlikely	Highly Unlikely
<i>Babingtonia urbana</i>	P3			Erect shrub with slender drooping flowering branches. Flowers pale pink to white, in flower.	No	Yes	13.3 km NE	Highly Unlikely	Highly Unlikely
<i>Calandrinia oraria</i>	P3			Annual herb 30 cm high x 10 cm wide. Pink flowers.	Possible	Yes	12.1 km SW	Highly Unlikely	Highly Unlikely
<i>Eryngium pinnatifidum</i> subsp. <i>Palustre</i> (G.J. Keighery 13459)	P3			Annually renewed perennial to 20 cm. Blue flowers.	No	No	14.2 km SE	Highly Unlikely	Highly Unlikely
<i>Schoenus capillifolius</i>	P3			Semi-aquatic tufted annual, grass-like or herb (sedge), 0.05 m high. Fl. green, Oct to Nov. Brown mud. Claypans.	No	Yes	11.6 km S	Highly Unlikely	Highly Unlikely
<i>Schoenus</i> sp. <i>Waroona</i> (G.J. Keighery 12235)	P3			Tufted annual, grass-like or herb (sedge), 0.02-0.06 m high. Fl. brown-red-green, Oct to Nov. Clay or sandy clay. Winter-wet flats.	No	Yes	13 km E	Highly Unlikely	Highly Unlikely
<i>Stylidium aceratum</i>	P3			Fibrous rooted annual, herb, 0.05-0.09 m high, leaves spatulate. Fl. pink/white, Oct to Nov. Sandy soils. Swamp heathland.	No	Yes	12.7 km E	Highly Unlikely	Highly Unlikely
<i>Eucalyptus rudis</i> subsp. <i>cratyantha</i>	P4			Tree, 5-20 m high, bark rough, box-type. Fl. white, Jul to Sep. Loam. Flats, hillsides.	No	No	10.9 km SE	Highly Unlikely	Highly Unlikely
<i>Grevillea olivacea</i>	P4			Erect, non-lignotuberous shrub, 1-4.5 m high. Fl. red/red-pink, Jun to Sep. White or grey sand. Coastal dunes, limestone rocks.	Possible	No	13.2 km NW	Highly Unlikely	Highly Unlikely
<i>Kennedia beckxiana</i>	P4			Prostrate or twining shrub or climber. Fl. red, Sep to Dec. Sand, loam. Granite hills & outcrops.	No	No	13.9 km NE	Highly Unlikely	Highly Unlikely
<i>Lepidium puberulum</i>	P4			Erect annual, herb, 0.1-0.35 m high. Fl. white-green, Jul to Aug or Oct to Nov. Sandy soils.	Possible	No	11.5 km NW	Highly Unlikely	Highly Unlikely




Taxon	Conservation Code			Habit and Habitat	Habitat within Survey Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Tripterococcus</i> sp. Brachylobus (A.S. George 14234)	P4			Perennial herb to 0.6 m with yellow flowers.	No	Yes	14.4 km NE	Highly Unlikely	Highly Unlikely
<i>Verticordia lindleyi</i> subsp. <i>Lindleyi</i>	P4			Erect shrub, 0.2-0.75 m high. Fl. pink, May or Nov to Dec or Jan. Sand, sandy clay. Winter-wet depressions.	No	Yes	13.8 km SE	Highly Unlikely	Highly Unlikely


Appendix D – Fauna of conservation significance recorded during the current field survey

Species	Date Observed	Latitude	Longitude	Observation Type	Individuals
<i>Isoodon fusciventer</i>	29/09/2021	-32.2503	115.7825	Digging	-
<i>Isoodon fusciventer</i>	29/09/2021	-32.2492	115.7830	Digging	-
<i>Isoodon fusciventer</i>	29/09/2021	-32.2515	115.7831	Digging	-
<i>Isoodon fusciventer</i>	29/09/2021	-32.2516	115.7830	Digging	-
<i>Isoodon fusciventer</i>	29/09/2021	-32.2518	115.7826	Digging	-
<i>Isoodon fusciventer</i>	29/09/2021	-32.2527	115.7844	Digging	-
<i>Isoodon fusciventer</i>	30/09/2021	-32.2874	115.8031	Digging, Scat (old)	-
<i>Isoodon fusciventer</i>	30/09/2021	-32.2922	115.8090	Digging	-
<i>Isoodon fusciventer</i>	30/09/2021	-32.2918	115.8105	Digging	-
<i>Isoodon fusciventer</i>	30/09/2021	-32.2928	115.8110	Digging	-
<i>Isoodon fusciventer</i>	30/09/2021	-32.2896	115.8020	Digging	-
<i>Isoodon fusciventer</i>	30/09/2021	-32.2880	115.8017	Digging	-
<i>Calyptorhynchus banksii naso</i>	30/09/2021	-32.2916	115.8089	Chewed marri nut	-
<i>Calyptorhynchus banksii naso</i>	30/09/2021	-32.2873	115.8088	Individuals (flyover)	3
<i>Calyptorhynchus banksii naso</i>	30/09/2021	-32.2695	115.7844	Individuals (flyover)	4













Appendix E – Fauna habitat assessments




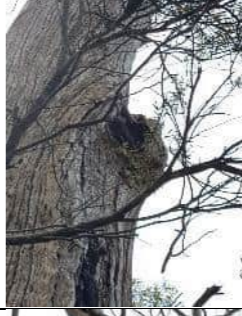

Site	Location	Habitat type	Land-form	Aspect	Slope	Soil type	Soil ava	Outcrop	Rock size	Veg litt	Vegetation types	Last fire	Disturbances	Habitat condition	Rocky cracks, crevices	Burrowing suitability	Water presence	Photo
VKWI-01	-32.288, 115.803	Acacia shrubland with tuart. Occasional <i>Banksia menziesii</i>	Sand Plain	South/East	Low	Sand	Many Small Patches	Limited Outcropping - Limestone	Pebbles (5-10cm)	Many Small Patches	Eucalypt Woodland	Old (6+ yr)	Road/ Access Track, Rubbish/ Litter, Weed Invasion	0.4	Nil	High	None	
VKWI-02	-32.251, 115.783	Acacia shrubland with tuart	Sand Plain	Flat	Flat	Sandy Loam	Scarce	Negligible	Negligible	Many Large Patches	Eucalypt Woodland, Scattered Eucalypts	Old (6+ yr)	Rubbish/ Litter, Weed Invasion	0.4	Nil	Very High	Prone to Pooling	
VKWI-03	-32.292, 115.809	Open tuart and marri. Next to banksia thicket	Sand Plain	Flat	Flat	Sandy Loam	Few Small Patches	Negligible	Negligible	Many Large Patches	Scattered Eucalypts	Old (6+ yr)	Weed Invasion	0.6	Nil	Very High	None	
VKWI-05	-32.274, 115.787	Open tuart over weeds and acacia next to railway	Undulating Low Hills	East	Moderate	Sandy Loam	Few Large Patches	Minor Outcropping - Limestone	Pebbles (5-10cm)	Few Small Patches	Scattered Eucalypts	Old (6+ yr)	Road/ Access Track, Rubbish/ Litter, Weed Invasion	0.2	Moderate	Moderate	Prone to Pooling	




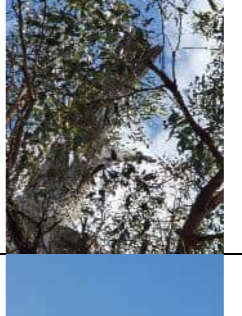


Site	Location	Habitat type	Land-form	Aspect	Slope	Soil type	Soil ava	Outcrop	Rock size	Veg litt	Vegetation types	Last fire	Disturbances	Habitat condition	Rocky cracks, crevices	Burrowing suitability	Water presence	Photo
VKWI-06	-32.281, 115.794	Tuarts with acacia and weeds. Mix of young and older trees. Next to railway	Sand Plain	Flat	Low	Sand	Many Large Patches	Negligible	Gravel (1-4cm)	Few Small Patches	Scattered Eucalypts	Recent (0 to 2 yr)	Frequent Fire, Road/ Access Track, Rubbish/ Litter, Weed Invasion	0.2	Low	Very High	Prone to Pooling	


Appendix F – Potential black cockatoo breeding trees recorded in the Survey Area

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-01	-32.2514	115.7823	Unknown (Dead)	Live	1900	20	5	Side entry in main trunk	150	No	Bees		Unlikely Bees present
								Side entry in main trunk	150	No	Unknown		Possible Small diameter but >100 mm Depth unknown Orientation suitable
								End of branch leading into main trunk	250	No	Unknown		Suitable Suitable diameter and orientation No competitors observed
								Side entry in main trunk	150	No	Unknown		Suitable Small diameter but >100 mm Suitable orientation No competitors observed
								Side entry in main trunk	200	No	Unknown		Suitable Suitable diameter and orientation No competitors observed







Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-02	-32.2505	115.7826	Tuart	Dead	920	14	5	Chimney type in main trunk	400	No	Unknown		Suitable Suitable diameter and orientation (chimney) No competitors observed
								End of branch leading into main trunk	100	No	Unknown		Not suitable Minimum diameter observed (100 mm)
								End of branch leading into main trunk	150	No	Unknown		Possible Diameter and orientation potentially suitable No competitors observed
								End of branch leading into main trunk	150	No	Unknown		Not suitable -Unfavourable orientation
								End of branch leading into main trunk	200	No	Unknown		Suitable Suitable diameter and orientation No competitors observed


Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-03	-32.2521	115.7851	Unknown (Dead)	Live	1700	17	5	Side entry in main trunk	500	No	Unknown		Suitable Suitable diameter and orientation No competitors observed
								End of branch leading into main trunk	250	No	Unknown		Possible Diameter and orientation potentially suitable No competitors observed
								Side entry branch hollow	300	No	Unknown		Suitable Suitable diameter and orientation No competitors observed
								Side entry in main trunk	150	No	Unknown		Not suitable Depth appears limited
								Side entry in main trunk	150	No	Unknown		Possible Diameter and orientation potentially suitable No competitors observed







Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-04	-32.2912	115.8043	Tuart	Live	1550	14	4	End of branch leading into main trunk	400	No	Unknown		Not suitable - Depth appears limited - Entrance appears obstructed
								End of branch leading into main trunk	200	No	Unknown		Suitable Suitable diameter and orientation No competitors observed
								End of branch leading into main trunk	300	No	Unknown		Suitable Suitable diameter and orientation No competitors observed
								End of branch leading into main trunk	300	No	Unknown		Suitable Suitable diameter and orientation No competitors observed
TKWI-05	-32.2911	115.804	Unknown (Dead)	Live	980	19	4	End of branch leading into main trunk	200	No	Unknown		Suitable Suitable diameter and orientation No competitors observed
								End of branch leading into main trunk	400	No	Unknown		Possible Potentially suitable orientation Suitable diameter No competitors observed







Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
								End of branch leading into main trunk	200	No	Unknown		Possible Depth potentially unsuitable Diameter and orientation potentially suitable No competitors observed
								End of branch leading into main trunk	250	No	Unknown		Not suitable Orientation unsuitable
TKWI-06	-32.2494	115.7828	Unknown (Dead)	Live	1410	14	4	End of branch leading into main trunk	200	No	Unknown		Not suitable Orientation unsuitable Unstable outer structure
								Chimney type in main trunk	400	No	Unknown		Suitable Suitable orientation (chimney) and diameter No competitors observed
								End of branch leading into main trunk	200	No	Unknown		Possible Potentially suitable diameter and orientation No competitors observed
								Side entry in main trunk	400	No	Unknown		Suitable Suitable orientation and diameter No competitors observed

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-07	-32.2922	115.8107	Unknown (Dead)	Live	1250	18	3	Side entry in main trunk	150	No	Unknown		Suitable Suitable orientation Potentially suitable diameter No competitors observed
								End of branch leading into main trunk	200	No	Unknown		Suitable Suitable orientation and diameter No competitors observed
								Chimney type in main trunk	300	No	Unknown		Suitable Suitable orientation and diameter No competitors observed
TKWI-08	-32.2508	115.7827	Unknown (Dead)	Live	1670	13	3	Chimney type in main trunk	250	No	Unknown		Possible Depth appears limited Potentially suitable diameter and orientation
								End of branch leading into main trunk	200	No	Unknown		Not suitable Entrance appears obstructed
								End of branch leading into main trunk	300	No	Unknown		Possible Depth and diameter potentially suitable Structure appears unstable


Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-09	-32.2492	115.7842	Unknown (Dead)	Live	750	16	3	End of branch leading into main trunk	150	No	Unknown		Possible Diameter, orientation and depth potentially suitable No competitors observed
								End of branch leading into main trunk	150	No	Unknown		Possible Diameter, orientation and depth potentially suitable No competitors observed
								End of branch leading into main trunk	300	No	Unknown		Suitable Diameter, orientation and depth potentially suitable No competitors observed
TKWI-10	-32.2922	115.8091	Tuart	Live	890	25	2	End of branch leading into main trunk	2000	No	Unknown		Not suitable Entrance appears obstructed Depth appears limited
								End of branch leading into main trunk	20	No	Unknown		Not suitable Entrance appears obstructed Depth appears limited
TKWI-11	-32.2917	115.8062	Unknown (Dead)	Dead	500	9	2	Chimney type in main trunk	200	No	Unknown		Suitable Suitable diameter and orientation (chimney) No competitors observed


Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
								End of branch leading into main trunk	150	No	Unknown		Suitable Suitable diameter and orientation No competitors observed
TKWI-12	-32.2897	115.8016	Unknown (Dead)	Dead	610	16	2	End of branch leading into main trunk	150	No	Unknown		Possible Diameter, orientation and depth potentially suitable No competitors observed
								End of branch leading into main trunk	150	No	Unknown		Not suitable Entrance appears obstructed Depth appears limited
TKWI-13	-32.2898	115.8017	Unknown (Dead)	Dead	630	15	2	End of branch leading into main trunk	200	No	Unknown		Possible Diameter, orientation and depth potentially suitable No competitors observed
								End of branch leading into main trunk	200	No	Unknown		Possible Diameter, orientation and depth potentially suitable No competitors observed
TKWI-14	-32.2517	115.7828	Unknown (Dead)	Live	1300	15	2	Side entry in main trunk	500	No	Unknown		Suitable Suitable diameter and orientation No competitors observed





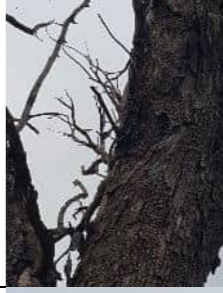

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
								End of branch leading into main trunk	700	No	Unknown		Possible Diameter, orientation and depth potentially suitable No competitors observed
TKWI-15	-32.2519	115.7831	Unknown (Dead)	Live	1150	7	2	Chimney type in main trunk	600	No	Unknown		Suitable Suitable diameter Preferred orientation (chimney) No competitors observed
								Side entry branch hollow	300	No	Unknown		Suitable Suitable diameter and orientation No competitors observed
TKWI-16	-32.2524	115.7834	Unknown (Dead)	Live	790	19	2	Side entry in main trunk	150	No	Unknown		Possible Diameter, orientation and depth potentially suitable No competitors observed
								End of branch leading into main trunk	150	No	Unknown		Not suitable Structure appears unstable Depth and diameter potentially suitable No competitors observed
TKWI-17	-32.2509	115.784	Tuart	Live	1140	18	2	Side entry in main trunk	100	No	Unknown		Not suitable Diameter at minimum size for black cockatoos Depth appears limited

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
								End of branch leading into main trunk	150	No	Unknown		Not suitable Structure appears unstable Depth and diameter potentially suitable No competitors observed
TKWI-18	-32.2537	115.7847	Unknown (Dead)	Dead	840	13	2	End of branch leading into main trunk	200	No	Unknown		Not suitable Structure appears unstable Depth and diameter potentially suitable No competitors observed
								End of branch leading into main trunk	150	No	Unknown		Not suitable Structure appears unstable Orientation potentially unsuitable Depth and diameter potentially suitable No competitors observed
TKWI-19	-32.2507	115.7845	Tuart	Live	700	15	2	End of branch leading into main trunk	200	No	Unknown		Possible Diameter, orientation, and depth potentially suitable No competitors observed
								End of branch leading into main trunk	150	No	Unknown		Not suitable Structure appears unstable Depth and diameter potentially suitable No competitors observed
TKWI-20	-32.2902	115.803	Unknown (Dead)	Live	740	10	1	Side entry in main trunk	250	No	Unknown		Suitable Suitable diameter and orientation No competitors observed

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-21	-32.2918	115.8094	Marri	Live	510	20	1	End of branch leading into main trunk	300	No	Unknown		Suitable Suitable diameter, depth, and orientation No competitors observed
TKWI-22	-32.2919	115.8097	Jarrah	Live	920	20	1	Chimney type in main trunk	300	No	Unknown		Not suitable Depth appears limited
TKWI-23	-32.2924	115.8106	Unknown (Dead)	Live	850	20	1	End of branch leading into main trunk	300	No	Unknown		Suitable Suitable diameter, depth, and orientation No competitors observed
TKWI-24	-32.2928	115.8112	Unknown (Dead)	Live	710	6	1	Chimney type in main trunk	350	No	Unknown		Suitable Suitable diameter, depth, and orientation (chimney) No competitors observed
TKWI-25	-32.2897	115.8016	Unknown (Dead)	Dead	580	17	1	End of branch leading into main trunk	200	No	Unknown		Possible Orientation, diameter and depth potentially suitable No competitors observed
TKWI-26	-32.2878	115.8017	Unknown (Dead)	Live	500	5	1	Chimney type in main trunk	400	No	Unknown		Suitable Suitable diameter, depth, and orientation (chimney) No competitors observed

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-27	-32.2883	115.8016	Tuart	Live	720	13	1	End of branch leading into main trunk	200	No	Unknown		Possible Orientation, diameter and depth potentially suitable No competitors observed
TKWI-28	-32.2860	115.8017	Tuart	Live	1800	22	1	Chimney type in main trunk	600	No	Unknown		Possible Orientation, diameter and depth potentially suitable No competitors observed
TKWI-29	-32.2493	115.7832	Unknown (Dead)	Live	800	12	1	Top entry at broken branch at main fork	250	No	Unknown		Suitable Suitable diameter, depth, and orientation No competitors observed
TKWI-30	-32.2496	115.7832	Unknown (Dead)	Live	750	6	1	Chimney type in main trunk	500	No	Unknown		Not suitable Structure appears unstable Depth and diameter potentially suitable No competitors observed
TKWI-31	-32.2505	115.7834	Tuart	Live	830	15	1	End of branch leading into main trunk	100	No	Unknown		Not suitable Entrance appears obstructed Depth appears limited
TKWI-32	-32.2509	115.783	Unknown (Dead)	Live	780	13	1	Chimney type in main trunk	150	No	Unknown		Possible Orientation, diameter and depth potentially suitable No competitors observed

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-33	-32.2516	115.7833	Unknown (Dead)	Live	1620	7	1	Chimney type in main trunk	600	No	Unknown		Not Suitable Plants growing from top of hollow indicates no depth
TKWI-34	-32.2515	115.783	Unknown (Dead)	Live	790	15	1	End of branch leading into main trunk	100	No	Unknown		Not suitable Diameter is minimum size Orientation is non-preferred No competitors observed
TKWI-35	-32.2515	115.7829	Unknown (Dead)	Live	630	10	1	End of branch leading into main trunk	100	No	Unknown		Possible Orientation, diameter and depth potentially suitable No competitors observed
TKWI-36	-32.2532	115.7834	Unknown (Dead)	Live	740	4	1	Chimney type in main trunk	300	No	Unknown		Suitable Suitable diameter, depth, and orientation (chimney) No competitors observed
TKWI-37	-32.2513	115.7828	Unknown (Dead)	Live	840	14	1	End of branch leading into main trunk	200	No	Unknown		Possible Orientation, diameter, and depth potentially suitable No competitors observed
TKWI-38	-32.2493	115.7843	Tuart	Live	1050	14	1	Chimney type in main trunk	300	No	Bees		Not suitable Bees present

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-39	-32.2528	115.7841	Tuart	Live	750	14	1	Side entry in main trunk	100	No	Bees		Not suitable Bees present
TKWI-40	-32.2532	115.7843	Tuart	Live	1170	15	1	Side entry in main trunk	100	No	Bees		Not suitable Bees present
TKWI-41	-32.2538	115.7848	Tuart	Live	950	15	1	End of branch leading into main trunk	150	No	Unknown		Not suitable Structure appears unstable and open along sides
TKWI-42	-32.2542	115.7841	Tuart	Live	1170	20	1	End of branch leading into main trunk	300	No	Unknown		Possible Orientation, diameter, and depth potentially suitable No competitors observed
TKWI-43	-32.2497	115.7849	Unknown (Dead)	Live	680	11	1	Side entry in main trunk	100	No	Bees		Not suitable Bees present
TKWI-44	-32.2496	115.7848	Unknown (Dead)	Live	670	12	1	End of branch leading into main trunk	150	No	Unknown		Not suitable Structure appears unstable and open along sides Diameter, and depth potentially suitable No competitors observed
TKWI-45	-32.2656	115.7839	Tuart	Live	510	17	0	-	-	No	-	-	

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-46	-32.2581	115.7837	Tuart	Live	1560	19	0	-	-	No	-	-	
TKWI-47	-32.2576	115.7837	Tuart	Live	570	18	0	-	-	No	-	-	
TKWI-48	-32.2874	115.8031	Tuart	Live	540	10	0	-	-	No	-	-	
TKWI-49	-32.2875	115.8097	Tuart	Live	500	11	0	-	-	No	-	-	
TKWI-50	-32.2872	115.8087	Tuart	Live	500	14	0	-	-	No	-	-	
TKWI-51	-32.287	115.808	Tuart	Live	730	9	0	-	-	No	-	-	
TKWI-52	-32.287	115.8078	Tuart	Live	530	9	0	-	-	No	-	-	
TKWI-53	-32.287	115.8076	Tuart	Live	520	11	0	-	-	No	-	-	
TKWI-54	-32.2869	115.807	Tuart	Live	860	17	0	-	-	No	-	-	
TKWI-55	-32.2869	115.807	Tuart	Live	500	17	0	-	-	No	-	-	
TKWI-56	-32.2869	115.8069	Tuart	Live	660	17	0	-	-	No	-	-	
TKWI-57	-32.287	115.8068	Tuart	Live	650	15	0	-	-	No	-	-	
TKWI-58	-32.287	115.8066	Tuart	Live	540	16	0	-	-	No	-	-	
TKWI-59	-32.287	115.8065	Tuart	Live	570	12	0	-	-	No	-	-	
TKWI-60	-32.287	115.8063	Tuart	Live	510	8	0	-	-	No	-	-	
TKWI-61	-32.2871	115.8056	Tuart	Live	500	10	0	-	-	No	-	-	
TKWI-62	-32.2871	115.8054	Tuart	Live	530	12	0	-	-	No	-	-	
TKWI-63	-32.2873	115.8045	Tuart	Live	520	11	0	-	-	No	-	-	
TKWI-64	-32.2883	115.8029	Tuart	Live	570	11	0	-	-	No	-	-	
TKWI-65	-32.2882	115.8028	Tuart	Live	620	12	0	-	-	No	-	-	
TKWI-66	-32.2881	115.8028	Tuart	Live	500	10	0	-	-	No	-	-	
TKWI-67	-32.2884	115.8029	Tuart	Live	580	12	0	-	-	No	-	-	
TKWI-68	-32.2885	115.8029	Tuart	Live	510	12	0	-	-	No	-	-	
TKWI-69	-32.2885	115.8029	Tuart	Live	520	14	0	-	-	No	-	-	
TKWI-70	-32.2886	115.8029	Tuart	Live	890	14	0	-	-	No	-	-	
TKWI-71	-32.2885	115.8028	Tuart	Live	630	15	0	-	-	No	-	-	
TKWI-72	-32.2885	115.8028	Tuart	Live	500	15	0	-	-	No	-	-	
TKWI-73	-32.2901	115.8027	Tuart	Live	690	10	0	-	-	No	-	-	
TKWI-74	-32.2913	115.8074	Tuart	Live	540	13	0	-	-	No	-	-	
TKWI-75	-32.2914	115.8074	Tuart	Live	530	11	0	-	-	No	-	-	
TKWI-76	-32.2913	115.8077	Tuart	Live	610	14	0	-	-	No	-	-	
TKWI-77	-32.2914	115.8077	Tuart	Live	510	14	0	-	-	No	-	-	
TKWI-78	-32.2914	115.808	Tuart	Live	580	16	0	-	-	No	-	-	
TKWI-79	-32.2914	115.808	Tuart	Live	630	16	0	-	-	No	-	-	
TKWI-80	-32.2913	115.8083	Tuart	Live	510	16	0	-	-	No	-	-	
TKWI-81	-32.2914	115.8085	Tuart	Live	800	20	0	-	-	No	-	-	
TKWI-82	-32.2913	115.8086	Tuart	Live	770	17	0	-	-	No	-	-	
TKWI-83	-32.2913	115.8086	Tuart	Live	700	17	0	-	-	No	-	-	
TKWI-84	-32.2913	115.8071	Tuart	Live	550	10	0	-	-	No	-	-	
TKWI-85	-32.2913	115.8071	Tuart	Live	700	16	0	-	-	No	-	-	
TKWI-86	-32.2914	115.8071	Tuart	Live	510	16	0	-	-	No	-	-	
TKWI-87	-32.2914	115.807	Tuart	Live	720	14	0	-	-	No	-	-	
TKWI-88	-32.2914	115.8069	Tuart	Live	610	16	0	-	-	No	-	-	
TKWI-89	-32.2914	115.8069	Tuart	Live	560	16	0	-	-	No	-	-	
TKWI-90	-32.2914	115.8067	Tuart	Live	800	15	0	-	-	No	-	-	

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-91	-32.2912	115.8066	Tuart	Live	530	16	0	-	-	No	-	-	
TKWI-92	-32.2913	115.8065	Tuart	Live	600	14	0	-	-	No	-	-	
TKWI-93	-32.2913	115.8064	Tuart	Live	500	15	0	-	-	No	-	-	
TKWI-94	-32.2914	115.8062	Tuart	Live	780	16	0	-	-	No	-	-	
TKWI-95	-32.2914	115.8061	Tuart	Live	720	16	0	-	-	No	-	-	
TKWI-96	-32.2912	115.806	Tuart	Live	570	15	0	-	-	No	-	-	
TKWI-97	-32.2913	115.806	Tuart	Live	550	15	0	-	-	No	-	-	
TKWI-98	-32.2913	115.8057	Tuart	Live	790	16	0	-	-	No	-	-	
TKWI-99	-32.2914	115.8057	Tuart	Live	510	16	0	-	-	No	-	-	
TKWI-100	-32.2914	115.8052	Tuart	Live	850	15	0	-	-	No	-	-	
TKWI-101	-32.2913	115.8052	Tuart	Live	520	15	0	-	-	No	-	-	
TKWI-102	-32.2911	115.8053	Tuart	Live	500	14	0	-	-	No	-	-	
TKWI-103	-32.2909	115.8045	Tuart	Live	670	13	0	-	-	No	-	-	
TKWI-104	-32.2907	115.8044	Tuart	Live	1080	17	0	-	-	No	-	-	
TKWI-105	-32.2906	115.8038	Tuart	Live	800	18	0	-	-	No	-	-	
TKWI-106	-32.2906	115.8038	Tuart	Live	670	16	0	-	-	No	-	-	
TKWI-107	-32.2905	115.8042	Tuart	Live	530	15	0	-	-	No	-	-	
TKWI-108	-32.2917	115.8088	Marri	Live	920	17	0	-	-	No	-	-	
TKWI-109	-32.2917	115.8086	Marri	Live	520	14	0	-	-	No	-	-	
TKWI-110	-32.292	115.8087	Marri	Live	980	17	0	-	-	Yes	-	-	
TKWI-111	-32.2922	115.8086	Tuart	Live	510	16	0	-	-	No	-	-	
TKWI-112	-32.2924	115.8086	Jarraah	Live	700	14	0	-	-	No	-	-	
TKWI-113	-32.2927	115.8086	Marri	Live	680	9	0	-	-	No	-	-	
TKWI-114	-32.2927	115.8087	Unknown (Dead)	Dead	660	14	0	-	-	No	-	-	
TKWI-115	-32.2924	115.8088	Jarraah	Live	600	13	0	-	-	No	-	-	
TKWI-116	-32.2923	115.809	Tuart	Live	860	21	0	-	-	No	-	-	
TKWI-117	-32.2923	115.809	Tuart	Live	930	25	0	-	-	No	-	-	
TKWI-118	-32.2922	115.809	Tuart	Live	520	9	0	-	-	No	-	-	
TKWI-119	-32.2922	115.809	Tuart	Live	730	25	0	-	-	No	-	-	
TKWI-120	-32.2922	115.8091	Tuart	Live	620	18	0	-	-	No	-	-	
TKWI-121	-32.2922	115.8091	Tuart	Live	670	20	0	-	-	No	-	-	
TKWI-122	-32.2922	115.8091	Tuart	Live	830	20	0	-	-	No	-	-	
TKWI-123	-32.2922	115.809	Tuart	Live	1060	17	0	-	-	No	-	-	
TKWI-124	-32.292	115.8089	Marri	Live	530	14	0	-	-	No	-	-	
TKWI-125	-32.2921	115.8087	Jarraah	Live	660	10	0	-	-	No	-	-	
TKWI-126	-32.292	115.8087	Marri	Live	540	14	0	-	-	No	-	-	
TKWI-127	-32.292	115.8088	Marri	Live	540	19	0	-	-	No	-	-	
TKWI-128	-32.2919	115.8088	Marri	Live	670	22	0	-	-	No	-	-	
TKWI-129	-32.2919	115.8089	Marri	Live	540	22	0	-	-	No	-	-	
TKWI-130	-32.2919	115.809	Marri	Live	640	22	0	-	-	No	-	-	
TKWI-131	-32.2919	115.8091	Unknown (Dead)	Dead	620	16	0	-	-	No	-	-	
TKWI-132	-32.2919	115.8095	Tuart	Live	710	22	0	-	-	No	-	-	
TKWI-133	-32.2919	115.8096	Tuart	Live	710	16	0	-	-	No	-	-	
TKWI-134	-32.2919	115.8096	Tuart	Live	560	18	0	-	-	No	-	-	
TKWI-135	-32.292	115.8096	Marri	Live	580	14	0	-	-	No	-	-	

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-136	-32.2919	115.8097	Tuart	Live	690	19	0	-	-	No	-	-	
TKWI-137	-32.2919	115.8097	Tuart	Live	670	13	0	-	-	No	-	-	
TKWI-138	-32.2919	115.8098	Tuart	Live	610	25	0	-	-	No	-	-	
TKWI-139	-32.2918	115.8097	Tuart	Live	650	16	0	-	-	No	-	-	
TKWI-140	-32.2917	115.8098	Jarraah	Live	690	15	0	-	-	No	-	-	
TKWI-141	-32.2918	115.8099	Tuart	Live	760	18	0	-	-	No	-	-	
TKWI-142	-32.2917	115.8102	Jarraah	Live	830	13	0	-	-	No	-	-	
TKWI-143	-32.2917	115.8102	Tuart	Live	700	13	0	-	-	No	-	-	
TKWI-144	-32.2919	115.8102	Tuart	Live	1300	18	0	-	-	No	-	-	
TKWI-145	-32.292	115.8102	Unknown (Dead)	Live	620	13	0	-	-	No	-	-	
TKWI-146	-32.2918	115.8105	Tuart	Live	990	18	0	-	-	No	-	-	
TKWI-147	-32.292	115.8107	Tuart	Live	700	8	0	-	-	No	-	-	
TKWI-148	-32.292	115.8108	Tuart	Live	500	10	0	-	-	No	-	-	
TKWI-149	-32.2917	115.8112	Tuart	Live	650	16	0	-	-	No	-	-	
TKWI-150	-32.2921	115.8107	Marri	Live	580	11	0	-	-	No	-	-	
TKWI-151	-32.2928	115.8107	Tuart	Live	550	15	0	-	-	No	-	-	
TKWI-152	-32.293	115.8112	Tuart	Live	690	17	0	-	-	No	-	-	
TKWI-153	-32.293	115.8112	Tuart	Live	570	16	0	-	-	No	-	-	
TKWI-154	-32.2927	115.8112	Tuart	Live	620	16	0	-	-	No	-	-	
TKWI-155	-32.2927	115.8111	Tuart	Live	560	17	0	-	-	No	-	-	
TKWI-156	-32.2926	115.8111	Tuart	Live	580	11	0	-	-	No	-	-	
TKWI-157	-32.2925	115.8111	Tuart	Live	890	14	0	-	-	No	-	-	
TKWI-158	-32.2925	115.8111	Tuart	Live	650	15	0	-	-	No	-	-	
TKWI-159	-32.2925	115.8111	Tuart	Live	750	17	0	-	-	No	-	-	
TKWI-160	-32.2923	115.8112	Tuart	Live	500	12	0	-	-	No	-	-	
TKWI-161	-32.2923	115.8113	Tuart	Live	590	16	0	-	-	No	-	-	
TKWI-162	-32.2925	115.8114	Jarraah	Live	500	11	0	-	-	No	-	-	
TKWI-163	-32.2926	115.8116	Unknown (Dead)	Live	610	5	0	-	-	No	-	-	
TKWI-164	-32.2925	115.8116	Tuart	Live	790	17	0	-	-	No	-	-	
TKWI-165	-32.2924	115.8116	Tuart	Live	720	17	0	-	-	No	-	-	
TKWI-166	-32.2924	115.8115	Tuart	Live	760	12	0	-	-	No	-	-	
TKWI-167	-32.2924	115.8116	Tuart	Live	630	15	0	-	-	No	-	-	
TKWI-168	-32.2924	115.8116	Tuart	Live	830	14	0	-	-	No	-	-	
TKWI-169	-32.2923	115.8116	Tuart	Live	630	18	0	-	-	No	-	-	
TKWI-170	-32.2923	115.8116	Tuart	Live	940	18	0	-	-	No	-	-	
TKWI-171	-32.2925	115.8117	Tuart	Live	600	18	0	-	-	No	-	-	
TKWI-172	-32.2924	115.8117	Tuart	Live	880	17	0	-	-	No	-	-	
TKWI-173	-32.2923	115.8117	Tuart	Live	900	20	0	-	-	No	-	-	
TKWI-174	-32.2924	115.8116	Tuart	Live	610	20	0	-	-	No	-	-	
TKWI-175	-32.2924	115.8116	Tuart	Live	790	18	0	-	-	No	-	-	
TKWI-176	-32.2923	115.8118	Tuart	Live	770	15	0	-	-	No	-	-	
TKWI-177	-32.292	115.8115	Tuart	Live	540	17	0	-	-	No	-	-	
TKWI-178	-32.2917	115.8114	Tuart	Live	880	15	0	-	-	No	-	-	
TKWI-179	-32.2917	115.8115	Tuart	Live	530	16	0	-	-	No	-	-	
TKWI-180	-32.2919	115.8117	Tuart	Live	820	17	0	-	-	No	-	-	

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-181	-32.2917	115.8116	Tuart	Live	630	14	0	-	-	No	-	-	
TKWI-182	-32.293	115.8115	Tuart	Live	670	18	0	-	-	No	-	-	
TKWI-183	-32.2929	115.8115	Tuart	Live	710	19	0	-	-	No	-	-	
TKWI-184	-32.2929	115.8114	Tuart	Live	600	16	0	-	-	No	-	-	
TKWI-185	-32.2929	115.8114	Tuart	Live	580	15	0	-	-	No	-	-	
TKWI-186	-32.2929	115.8096	Tuart	Live	650	10	0	-	-	No	-	-	
TKWI-187	-32.2919	115.8065	Tuart	Live	570	19	0	-	-	No	-	-	
TKWI-188	-32.2919	115.8064	Tuart	Live	1050	18	0	-	-	No	-	-	
TKWI-189	-32.2918	115.8063	Tuart	Live	760	16	0	-	-	No	-	-	
TKWI-190	-32.2919	115.8062	Tuart	Live	500	14	0	-	-	No	-	-	
TKWI-191	-32.2917	115.8062	Tuart	Live	550	14	0	-	-	No	-	-	
TKWI-192	-32.2918	115.8061	Tuart	Live	500	13	0	-	-	No	-	-	
TKWI-193	-32.2917	115.8059	Marri	Live	510	16	0	-	-	No	-	-	
TKWI-194	-32.2918	115.8059	Tuart	Live	570	18	0	-	-	No	-	-	
TKWI-195	-32.2918	115.8057	Tuart	Live	1250	18	0	-	-	No	-	-	
TKWI-196	-32.2919	115.8053	Tuart	Live	1290	18	0	-	-	No	-	-	
TKWI-197	-32.2916	115.8054	Tuart	Live	870	17	0	-	-	No	-	-	
TKWI-198	-32.2917	115.8051	Tuart	Live	880	17	0	-	-	No	-	-	
TKWI-199	-32.2917	115.8047	Tuart	Live	540	17	0	-	-	No	-	-	
TKWI-200	-32.2917	115.8047	Tuart	Live	1070	16	0	-	-	No	-	-	
TKWI-201	-32.2916	115.8046	Tuart	Live	1000	22	0	-	-	No	-	-	
TKWI-202	-32.2912	115.8044	Tuart	Live	510	13	0	-	-	No	-	-	
TKWI-203	-32.2911	115.8044	Unknown (Dead)	Live	1220	13	0	-	-	No	-	-	
TKWI-204	-32.2913	115.804	Tuart	Live	1330	20	0	-	-	No	-	-	
TKWI-205	-32.2909	115.804	Tuart	Live	510	13	0	-	-	No	-	-	
TKWI-206	-32.2909	115.8038	Tuart	Live	640	14	0	-	-	No	-	-	
TKWI-207	-32.2909	115.8035	Tuart	Live	680	13	0	-	-	No	-	-	
TKWI-208	-32.2912	115.8037	Tuart	Live	570	16	0	-	-	No	-	-	
TKWI-209	-32.291	115.8033	Tuart	Live	760	12	0	-	-	No	-	-	
TKWI-210	-32.2873	115.802	Tuart	Live	740	13	0	-	-	No	-	-	
TKWI-211	-32.2874	115.8019	Unknown (Dead)	Live	500	10	0	-	-	No	-	-	
TKWI-212	-32.2875	115.8019	Unknown (Dead)	Live	500	11	0	-	-	No	-	-	
TKWI-213	-32.2871	115.8016	Tuart	Live	760	14	0	-	-	No	-	-	
TKWI-214	-32.2881	115.8016	Tuart	Live	710	14	0	-	-	No	-	-	
TKWI-215	-32.2889	115.8017	Tuart	Live	620	14	0	-	-	No	-	-	
TKWI-216	-32.2889	115.801	Tuart	Live	620	13	0	-	-	No	-	-	
TKWI-217	-32.2874	115.8003	Tuart	Live	570	14	0	-	-	No	-	-	
TKWI-218	-32.2874	115.8003	Tuart	Live	530	15	0	-	-	No	-	-	
TKWI-219	-32.287	115.8008	Tuart	Live	510	14	0	-	-	No	-	-	
TKWI-220	-32.2873	115.8027	River Red Gum	Live	620	11	0	-	-	No	-	-	
TKWI-221	-32.2873	115.803	Tuart	Live	1420	16	0	-	-	No	-	-	
TKWI-222	-32.2872	115.8032	River Red Gum	Live	680	13	0	-	-	No	-	-	
TKWI-223	-32.2873	115.8029	River Red Gum	Live	610	17	0	-	-	No	-	-	
TKWI-224	-32.2857	115.8012	Tuart	Live	2000	25	0	-	-	No	-	-	
TKWI-225	-32.2858	115.8013	Tuart	Live	1000	20	0	-	-	No	-	-	

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-226	-32.2858	115.8013	Tuart	Live	1240	20	0	-	-	No	-	-	
TKWI-227	-32.286	115.8016	Tuart	Live	600	18	0	-	-	No	-	-	
TKWI-228	-32.2775	115.79	Tuart	Live	500	13	0	-	-	No	-	-	
TKWI-229	-32.2783	115.7908	Tuart	Live	750	17	0	-	-	No	-	-	
TKWI-230	-32.2787	115.7915	Tuart	Live	630	13	0	-	-	No	-	-	
TKWI-231	-32.2789	115.7916	Tuart	Live	640	14	0	-	-	No	-	-	
TKWI-232	-32.2801	115.7934	Tuart	Live	520	17	0	-	-	No	-	-	
TKWI-233	-32.2806	115.7939	Tuart	Live	670	12	0	-	-	No	-	-	
TKWI-234	-32.2807	115.7941	Tuart	Live	570	12	0	-	-	No	-	-	
TKWI-235	-32.2503	115.7815	Tuart	Live	910	8	0	-	-	No	-	-	
TKWI-236	-32.2503	115.7815	Tuart	Live	610	7	0	-	-	No	-	-	
TKWI-237	-32.2503	115.7816	Tuart	Live	610	8	0	-	-	No	-	-	
TKWI-238	-32.2501	115.7825	Tuart	Live	960	13	0	-	-	No	-	-	
TKWI-239	-32.2498	115.7827	Tuart	Live	510	8	0	-	-	No	-	-	
TKWI-240	-32.2498	115.7828	Tuart	Live	520	10	0	-	-	No	-	-	
TKWI-241	-32.2496	115.7828	Unknown (Dead)	Live	720	15	0	-	-	No	-	-	
TKWI-242	-32.2493	115.7829	Tuart	Live	1500	14	0	-	-	No	-	-	
TKWI-243	-32.2492	115.7831	Unknown (Dead)	Live	770	11	0	-	-	No	-	-	
TKWI-244	-32.2496	115.7831	Tuart	Live	1400	16	0	-	-	No	-	-	
TKWI-245	-32.2499	115.7833	Tuart	Live	770	14	0	-	-	No	-	-	
TKWI-246	-32.2507	115.7831	Unknown (Dead)	Live	760	9	0	-	-	No	-	-	
TKWI-247	-32.2516	115.7831	Tuart	Live	780	17	0	-	-	No	-	-	
TKWI-248	-32.2517	115.7829	Tuart	Live	620	10	0	-	-	No	-	-	
TKWI-249	-32.2527	115.7832	Unknown (Dead)	Live	920	71	0	-	-	No	-	-	
TKWI-250	-32.2534	115.7832	Unknown (Dead)	Live	800	6	0	-	-	No	-	-	
TKWI-251	-32.2525	115.7829	Tuart	Live	530	10	0	-	-	No	-	-	
TKWI-252	-32.2524	115.7827	Tuart	Live	620	11	0	-	-	No	-	-	
TKWI-253	-32.2522	115.7825	Tuart	Live	800	10	0	-	-	No	-	-	
TKWI-254	-32.2522	115.7822	Unknown (Dead)	Live	980	17	0	-	-	No	-	-	
TKWI-255	-32.252	115.7823	Tuart	Live	1300	15	0	-	-	No	-	-	
TKWI-256	-32.2507	115.7825	Unknown (Dead)	Live	910	17	0	-	-	No	-	-	
TKWI-257	-32.2492	115.7838	Unknown (Dead)	Dead	770	14	0	-	-	No	-	-	
TKWI-258	-32.2492	115.7841	Tuart	Live	1030	16	0	-	-	No	-	-	
TKWI-259	-32.2505	115.7839	Tuart	Live	1260	14	0	-	-	No	-	-	
TKWI-260	-32.2527	115.7845	Tuart	Live	710	10	0	-	-	No	-	-	
TKWI-261	-32.2527	115.7844	Tuart	Live	650	11	0	-	-	No	-	-	
TKWI-262	-32.253	115.7841	Tuart	Live	760	11	0	-	-	No	-	-	
TKWI-263	-32.253	115.7841	Tuart	Live	560	12	0	-	-	No	-	-	
TKWI-264	-32.2533	115.7842	Tuart	Live	990	15	0	-	-	No	-	-	
TKWI-265	-32.2535	115.784	Tuart	Live	880	16	0	-	-	No	-	-	
TKWI-266	-32.2534	115.7843	Tuart	Live	860	14	0	-	-	No	-	-	
TKWI-267	-32.2534	115.7845	Tuart	Live	820	13	0	-	-	No	-	-	
TKWI-268	-32.2534	115.7846	Tuart	Live	810	14	0	-	-	No	-	-	
TKWI-269	-32.2534	115.7847	Tuart	Live	560	13	0	-	-	No	-	-	
TKWI-270	-32.2535	115.7848	Unknown (Dead)	Dead	640	12	0	-	-	No	-	-	

Tree ID	Latitude	Longitude	Species	Condition	DBH (mm)	Height (m)	Hollow count	Hollow type	Hollow diameter (mm)	Chew marks?	Occupancy?	Photo	Overall Suitability
TKWI-271	-32.2537	115.7848	Tuart	Live	690	12	0	-	-	No	-	-	
TKWI-272	-32.2539	115.7846	Unknown (Dead)	Live	970	16	0	-	-	No	-	-	
TKWI-273	-32.254	115.7847	Tuart	Live	680	15	0	-	-	No	-	-	
TKWI-274	-32.254	115.7847	Unknown (Dead)	Live	780	15	0	-	-	No	-	-	
TKWI-275	-32.2541	115.7846	Tuart	Live	980	11	0	-	-	No	-	-	
TKWI-276	-32.2542	115.7842	Tuart	Live	1230	18	0	-	-	No	-	-	
TKWI-277	-32.2534	115.7847	Tuart	Live	840	11	0	-	-	No	-	-	
TKWI-278	-32.253	115.7846	Tuart	Live	520	10	0	-	-	No	-	-	
TKWI-279	-32.2504	115.7847	Tuart	Live	590	9	0	-	-	No	-	-	
TKWI-280	-32.2499	115.7847	Tuart	Live	990	16	0	-	-	No	-	-	
TKWI-281	-32.2499	115.7848	Unknown (Dead)	Live	500	14	0	-	-	No	-	-	
TKWI-282	-32.2494	115.7849	Tuart	Live	840	12	0	-	-	No	-	-	
TKWI-283	-32.2716	115.7852	Tuart	Live	500	8	0	-	-	No	-	-	
TKWI-284	-32.2703	115.7847	Tuart	Live	500	15	0	-	-	No	-	-	
TKWI-285	-32.2687	115.7842	Tuart	Live	510	13	0	-	-	No	-	-	
TKWI-286	-32.2682	115.7841	Tuart	Live	730	15	0	-	-	No	-	-	
TKWI-287	-32.2682	115.7842	Tuart	Live	510	11	0	-	-	No	-	-	
TKWI-288	-32.2678	115.7841	Tuart	Live	500	8	0	-	-	No	-	-	
TKWI-289	-32.2754	115.7875	Tuart	Live	740	10	0	-	-	No	-	-	
TKWI-290	-32.2759	115.7878	Tuart	Live	780	18	0	-	-	No	-	-	
TKWI-291	-32.2681	115.7844	Tuart	Live	520	9	0	-	-	No	-	-	
TKWI-292	-32.2686	115.7845	Tuart	Live	500	11	0	-	-	No	-	-	
TKWI-293	-32.2678	115.7843	Tuart	Live	510	11	0	-	-	No	-	-	
TKWI-294	-32.2675	115.7843	Tuart	Live	500	10	0	-	-	No	-	-	
TKWI-295	-32.2597	115.7841	Tuart	Live	1220	25	0	-	-	No	-	-	

