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HOLCIM (AUSTRALIA) PTY LTD
GOSNELLS QUARRY FLORA AND FAUNA SURVEYS

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EXECUTIVE SUMMARY

Holcim (Australia) Pty Ltd (Holcim) required flora and fauna surveys to be carried out on their Gosnells quarry to support a native vegetation clearing application. *ecologia* Environment (*ecologia*) was engaged by Holcim to undertake a detailed flora and vegetation survey and a black cockatoo habitat assessment at the Gosnells Quarry. The survey area covers 2.54 hectares, is located approximately 20 kilometres southeast of the Perth Central Business District (CBD) in Western Australia (WA) and sits across the border of the Jarrah Forest and Swan Coastal Plains IBRA bioregions. The survey was undertaken on July 22nd, 2025.

Flora and Vegetation Assessment

A total of 44 vascular plant taxa, representing 20 families and 31 genera were recorded within the survey area. There were no Department of Biodiversity, Conservation and Attractions (DBCA) listed Priority taxa and no *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or *Biodiversity Conservation Act 2016* (BC Act) listed Threatened species recorded in the survey area. Seventeen introduced plant species were recorded, one of which is listed as a Declared Pest and Weed of National Significance (WoNS) (*Asparagus asparagoides*). A further eight species could not be identified sufficiently to determine their introduced status.

One vegetation type was described for the survey area, consisting of remnant or planted native trees over shrubs and herbs of mixed introduced status. The condition of all vegetation, which is predominantly revegetated waste dumps, in the survey area was assessed as 'Completely Degraded'.

There are no state (BC Act) or Commonwealth (EPBC Act) listed Threatened Ecological Communities (TEC) or state-listed Priority Ecological Communities (PEC) within the survey area, and the vegetation within the survey area is not considered to be significant.

Black Cockatoo Assessment

An assessment was undertaken to investigate potential breeding habitat, night roosting habitat, and foraging habitat for three black cockatoo species within the survey area.

The survey area contained scattered patches of rehabilitated eucalypt woodlands, comprising *Eucalyptus rudis* subsp. *rudis* (flooded gum), *Eucalyptus camaldulensis* (river red gum), *Eucalyptus marginata* (jarrah) and *Corymbia calophylla* (marri). All trees recorded within the survey area were <300 mm DBH and therefore not suitable as breeding habitat or roosting habitat for black cockatoos.

Black cockatoo foraging habitat within the survey area was assessed as high quality. However, given the absence of breeding or roosting trees, it is unlikely that black cockatoos are currently utilising any of the trees identified within the survey area as breeding or roosting habitat.

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Appendix D Flora and vegetation sampling site data.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Holcim (Australia) Pty Ltd (Holcim) required flora and fauna surveys to be conducted at their Gosnells quarry to support a native vegetation clearing application. *ecologia* Environment (*ecologia*) was engaged by Holcim to undertake a detailed flora and vegetation survey and a black cockatoo habitat assessment at the Gosnells Quarry. The survey area covers 2.54 hectares (ha), is located approximately 20 kilometres (km) southeast of the Perth Central Business District (CBD) in Western Australia (WA), and sits across the border of the Northern Jarrah Forest IBRA subregion of the Jarrah Forest IBRA bioregion and the Swan Coastal Plain IBRA subregion and bioregion (Map 1).

1.2 SCOPE OF WORK

Holcim required a biological survey to delineate key flora, fauna, soil and surface water values (wetlands) and potential sensitivity to impact from the proposal. The following were therefore provided as part of the biological assessment of the survey area:

- A desktop assessment to evaluate biological values of the survey area and immediate surrounds, including a review of existing physical and biological values, significant species and communities, and other relevant available data.
- A single-phase detailed flora and vegetation survey in accordance with the *Technical Guidance* (EPA, 2016b).
- Targeted searches for significant plant species and communities within representative areas of suitable habitat.
- A plant species inventory, including all native and introduced species.
- An inventory of significant plant species, and an assessment of their local and regional distribution (if present).
- Classification, characterisation, and mapping of vegetation types.
- Assessment and mapping of vegetation condition.
- An assessment of vegetation significance at a national, state, regional, and local level.
- Black cockatoo habitat assessment.

1.3 LEGISLATIVE AND REGULATORY FRAMEWORK

The Environmental Protection Authority's (EPA) environmental objectives for the factors *Flora and Vegetation* (EPA, 2016a) and *Terrestrial Fauna* (EPA, 2020) are to protect fauna, flora and vegetation so that biological diversity and ecological integrity are maintained. In this context, ecological integrity is the composition, structure, function and processes of ecosystems, and the natural range of variation of these elements. The primary objective of this flora, vegetation and fauna assessment was to provide sufficient information to assess the impact of any proposed development on the fauna, flora, and vegetation of the survey area, thereby ensuring that the EPA's objectives can be met.

The survey was designed and undertaken to comply with the following guidance documents:

- Environmental Factor Guideline: Flora and Vegetation(EPA, 2016a).
- Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment(EPA, 2020).
- Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment(EPA, 2016b).

- Referral Guidelines for 3 WA Threatened black cockatoo species: Carnaby's black cockatoo, Baudin's black cockatoo and the forest red-tailed black cockatoo(DAWE, 2022).

1.4 DEFINITIONS

1.4.1 Significant Flora

According to the *EPA Factor Guideline: Flora and Vegetation* (EPA, 2016a), plant taxa (or records) may be considered significant for reasons including, but not restricted to, the following:

- A taxon listed as Threatened under Western Australia's *Biodiversity Conservation Act 2016* (BC Act) or the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- A taxon on the Department of Biodiversity, Conservation and Attractions (DBCA) Priority Flora List.
- Locally endemic species or those associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems).
- New species or those having anomalous features that indicate a potential new species.
- Being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range).
- Unusual species, including restricted subspecies, varieties or naturally occurring hybrids.
- Being representative of taxonomic groups that no longer occur widely in the broader landscape (relictual species/populations).

1.4.2 Significant Fauna

According to the *EPA Factor Guideline: Terrestrial Fauna* (EPA, 2020), animal taxa (or records) may be considered significant for a number of reasons including, but not restricted to, the following:

- A taxon listed as Threatened under Western Australia's *Biodiversity Conservation Act 2016* (BC Act) or the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- A taxon on the Department of Biodiversity, Conservation and Attractions (DBCA) Priority Fauna List (DBCA, 2020).
- Species with restricted distributions.
- Degree of historical impact from threatening processes.
- Providing an important function required to maintain the ecological integrity of a significant ecosystem.

1.4.3 Significant Vegetation

According to *EPA Factor Guideline: Flora and Vegetation* (EPA, 2016a), vegetation may be considered significant for reasons including, but not restricted to, the following:

- Being listed as a Threatened Ecological Community (TEC) under the BC Act or the EPBC Act.
- Being listed as a Priority Ecological Community (PEC) by DBCA.
- Having a restricted distribution.
- The degree of historical impact from threatening processes.
- Playing a role as a refuge.
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

1.4.4 Introduced Plants

Weeds of National Significance

Under the Australian Weeds Strategy there are 32 introduced plant species listed as Weeds of National Significance (WONS) that are "causing major economic, environmental and/or social impacts in a number of states or territories with strong potential for further spread" (DAWR, 2017). These species require "coordinated and strategic management along with shared stakeholder investment to develop and implement best practice to prevent, eradicate, contain and/or minimise impacts in different parts of the nation" (DAWR, 2017).

Biosecurity and Agriculture Management Act 2007

The purpose of Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act) is to prevent serious animal and plant pests and diseases from entering Western Australia and becoming established, and to minimise the spread and impact of those that are already present. The Western Australian Organism List (WAOL) lists organisms that are categorised under the BAM Act into five legal categories: 'Declared Pest, Prohibited -s12', 'Declared Pest -s22(2)', 'Permitted -s11', 'Permitted, Requires Permit -r73', and 'Unlisted -s14'. A Declared Pest may be subject to control and keeping requirements once within Western Australia.

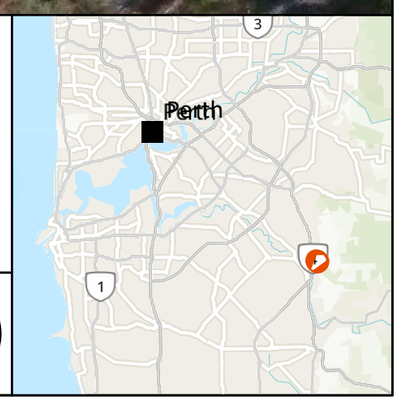
Regional Weed Prioritisation Process

At a regional level in Western Australia, introduced plant species are ranked using the Weed Prioritisation Process (DPaW, 2013). The process is intended to "highlight the species that have the highest ecological impact, most extensive potential distribution, highest invasiveness, lowest current distribution and highest feasibility of control within a regional context based on the information available at the time" (DPaW, 2013).

116.02°E 116.0206°E 116.0233°E 116.0239°E 116.0244°E 116.025°E

32.07°S 32.0706°S 32.0711°S 32.0717°S 32.0722°S

Survey area



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Project No.: 2058
Author: SN-W
Created Date: 5 August 2025
Coordinate System: GCS WGS 1984
Scale: 1:1,500 @A3

Map 1: Location of survey area.

0 10 20 40 60 80 100
Meters

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Maxar

2 DESKTOP ASSESSMENT

2.1 DESKTOP METHODOLOGY

The methodology adopted for the desktop assessment was in accordance with the *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016b)and *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*(EPA, 2020). A review of background environmental information for the survey area was undertaken, including, but not limited to, climate (Bureau of Meteorology, BOM), biogeography (IBRA 7)(DSEWPaC, 2012), soil-landscape systems (land systems)(DPIRD, 2016), the Surface Geology of Australia 1:1M spatial dataset(Geoscience Australia, 2012), the Atlas of Australian Soils(Northcote et al., 1960-1968), and pre-European native vegetation of Western Australia(Shepherd, Beeston, & Hopkins, 2002).

Searches of the databases listed in Table 1 were undertaken to determine the significant species and ecological communities previously recorded within 10 km of the survey area. The criteria listed in Table 2 were then applied to determine the likelihood of occurrence of these species and communities within the survey area. Habitat preferences were sourced, where available, from relevant taxonomic literature, FloraBase records(Western Australian Herbarium, 1998–), Threatened Species Profiles (SPRATs), or specimen data from the Australasian Virtual Herbarium (AVH) database(CHAH, 2017). The presence of potentially suitable habitat within the survey area was determined using broad landforms, soils, and vegetation associations in comparison to cited preferred habitat (if available) for each species.

Table 1: Databases queried for the desktop assessment.

Database	Search details
EPBC Act Protected Matters database	Records of matters of national significance under the EPBC Act within 10 km of the survey area.
DBCA Threatened and Priority Ecological Communities Database	TECs and PECs within 5 km of the survey area (22-0125EC).
DBCA Threatened and Priority Flora (TPFL) and WAHERB database	Significant plant records within 10 km of the survey area (40-0924FL).
Atlas of Living Australia (ALA) Database	All fauna records within 5 km of the survey area.

Table 2: Criteria used to assess the likelihood of occurrence of significant species and communities.

Rating	Criterion
Recorded	The species/community has been recorded within the survey area.
Likely	Suitable habitat is almost certainly present and there are records immediately adjacent to survey area.
Possible	Suitable habitat is likely to be present and there are records within 40 km of the survey area, or there is insufficient information available to exclude the possibility of occurrence.
Unlikely	Suitable habitat is not likely to be present and/or there are no records within 40 km of the survey area.
Does not occur	The community is an existing regionally mapped vegetation association (e.g. Shepherd et al. 2002) or land system (e.g. DPIRD 2016) which does not occur within the survey area; or The species is recognised as being locally extinct or extinct in the wild and does not occur within the survey area.

2.2 RAINFALL AND TEMPERATURE

Rainfall data from the nearest long-term Bureau of Meteorology (BOM) weather station (since 1964) were obtained from Roleystone (Station No. 9113), located 5.69 km to the southeast of the survey area. Rainfall at Roleystone over the 12 months prior to the survey was approximately 99% of mean annual rainfall (987.6 mm). Rainfall immediately preceding the survey was above average (Figure 1). Temperature data were obtained from Bickley (Station No. 9240) which is located 12.15 km to the northeast of the survey area (Figure 1). Maximum daytime temperature at Bickley is frequently above 25°C between November to March and minimum temperatures can drop below 10°C between June and October.

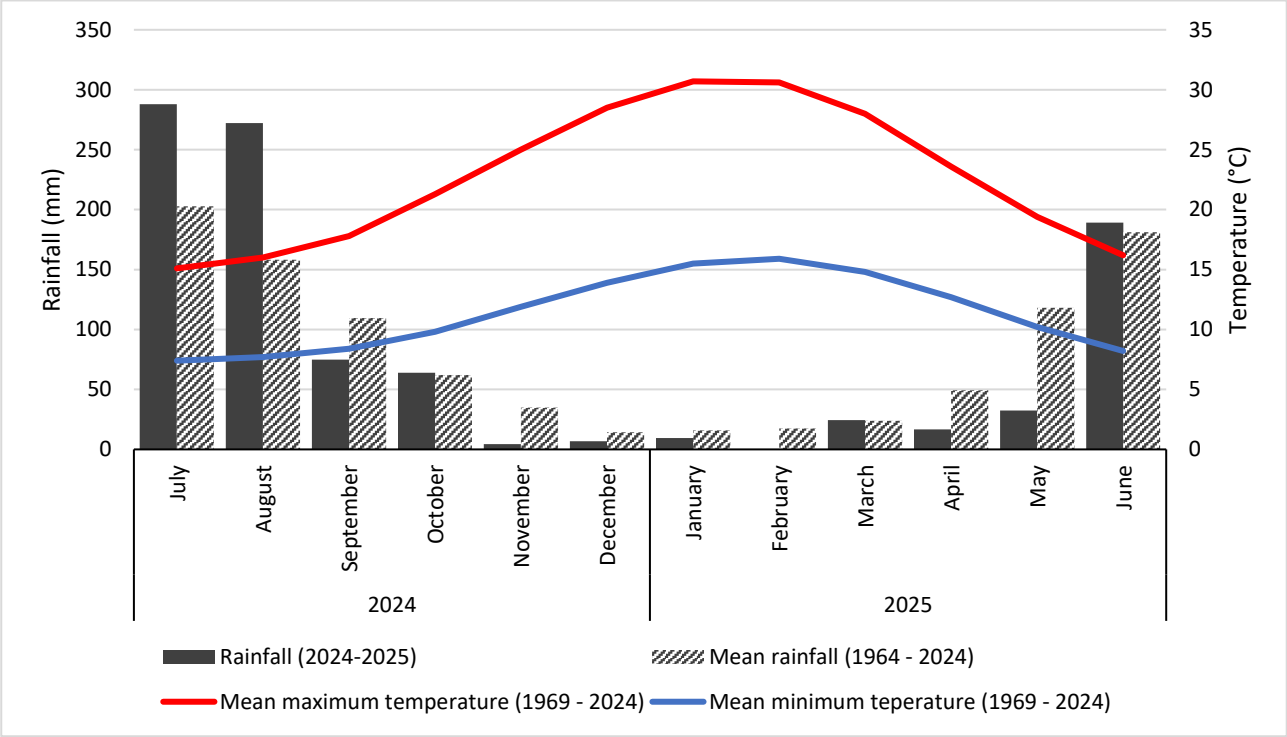


Figure 1: Monthly mean rainfall and temperature for Roleystone (rainfall) and Bickley (temperature).

2.3 INTERIM BIOGEOGRAPHIC REGIONALISATION FOR AUSTRALIA

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies the Australian continent into bioregions based on similar geology, landform, vegetation, fauna and climate characteristics(DSEWPaC, 2012). The survey area falls within the Northern Jarrah Forest subregion of the Jarrah Forest bioregion, and the Swan Coastal Plain subregion and bioregion according to IBRA 7 (Map 2).

The Northern Jarrah Forest subregion is the area east of the Darling escarpment, in which Jarrah-Marri Forest occur on lateritic gravels and Wandoo-Marri woodland occur on clayey soils (Williams & Mitchell, 2001). The climate is Warm Mediterranean, with an average rainfall of 1300 mm on the escarpment to 700 mm in the east and north, and the subregional area is 2,255,905 ha (Williams & Mitchell, 2001).

The Swan Coastal Plain subregion is a low lying coastal plain, mainly covered with woodlands. It is dominated by *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. Rainfall ranges between 600 and 1000 mm annually and the climate is Mediterranean. The subregional area is 1,333,901 ha (Mitchell, Williams, & Desmond, 2002).

2.4 SOIL-LANDSCAPE SYSTEMS, SURFACE GEOLOGY, AND SOILS

Geological features of the survey area were derived from three spatial datasets: Soil Landscape Mapping - Best Available (Version 05.01) (DPIRD-027) (DPIRD, 2022); Surface Geology of Australia 1:1 million scale dataset 2012 edition (Geoscience Australia, 2012); and the Atlas of Australian Soils (Northcote et al., 1960-1968). Two soil-landscape systems (land systems) (Table 3, Map 3), two surface geology units (Table 4, Map 4), and one soil unit (Table 5, Map 5), were associated with the survey area.

2.5 DBCA MANAGED LANDS AND NATIONALLY IMPORTANT WETLANDS

Spatial datasets were queried for DWER Environmentally Sensitive Area (ESAs) (DWER-046), Nationally Important Wetlands (DBCA-045), and DBCA Managed Lands and Waters (DBCA-011), occurring in the vicinity of the survey area. No Nationally Important Wetlands occur near the survey area (Map 6).

Table 3: Land systems associated with the survey area (DPIRD-027).

Land system	Description	Extent within survey area (ha)	Extent within survey area (%)
Forrestfield (D Range) F2 phase	Foot and low slopes < 10%. Well drained gravelly yellow or brown duplex soils with sandy topsoil. Woodland of *E. marginata, E. calophylla* and some *B. grandis*	2.10	82.6
Forrestfield (D Range) F6 phase	Crests and knolls and upper slopes 3-15% with common lateritic outcrop. Soils are shallow moderately well drained gravelly brownish or earthy sands	0.44	17.4

Table 4: Surface geology associated with the survey area (Geoscience Australia 2012).

Map symbol	Surface geological unit	Description	Extent within survey area (ha)	Extent within survey area (%)
Ag	felsic intrusives 74292	Undifferentiated felsic intrusive rocks, including monzogranite, granodiorite, granite, tonalite, quartz monzonite, syenogranite, diorite, monzodiorite, pegmatite. Locally metamorphosed, foliated, gneissic. Local abundant mafic and ultramafic inclusions	2.35	92.4
Qrc	colluvium 38491	Colluvium and/or residual deposits, sheetwash, talus, scree; boulder, gravel, sand; may include minor alluvial or sand plain deposits, local calcrete and reworked laterite	0.19	7.6

Table 5: Atlas of Australian Soil units associated with the survey area (Northcote *et al*. 1960-1968).

Map code	Description	Extent within survey area (ha)	Extent within survey area (%)
Sp2	Gently sloping bench or terrace--the Ridge Hill Shelf: chief soils are hard acidic yellow soils (Dy2.61) containing ironstone gravels. Associated are brown sands (Uc4.2) often containing ironstone gravels at depth and forming a western fringe to the bench; and some (Dy3.4) soils on dissected areas. As mapped, areas of units Wd6 and Gb16 may be included	2.54	100



Survey area

IBRA Subregion

Northern Jarrah Forest

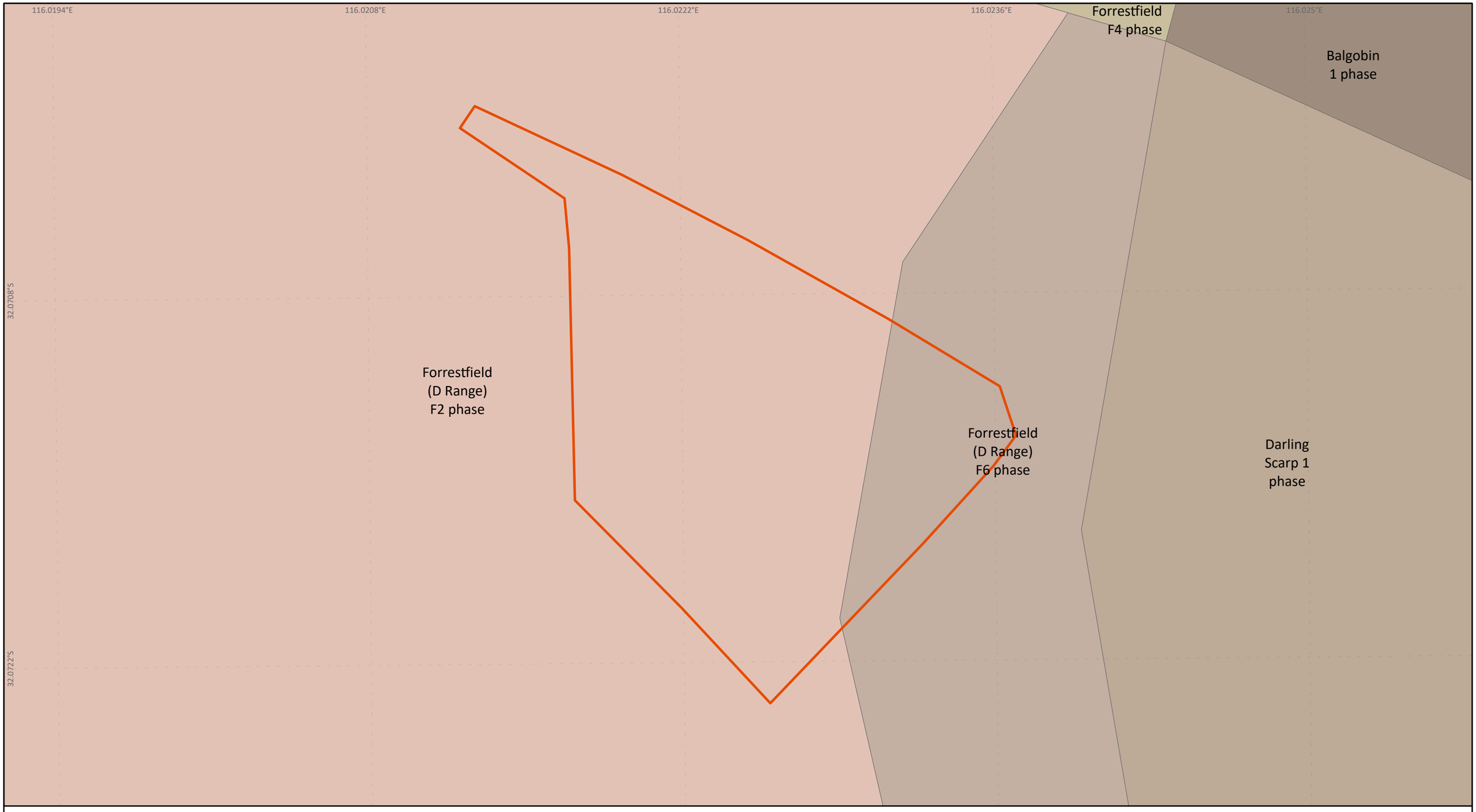
Swan Coastal Plain

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Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:5,000 @A3

Map 2: IBRA subregions within the survey area.

0 100 200 300 400
Meters



Survey area

Land systems

- Balgobin 1 phase
- Darling Scarp 1 phase
- Forrestfield (D Range) F2 phase
- Forrestfield (D Range) F6 phase
- Forrestfield F4 phase

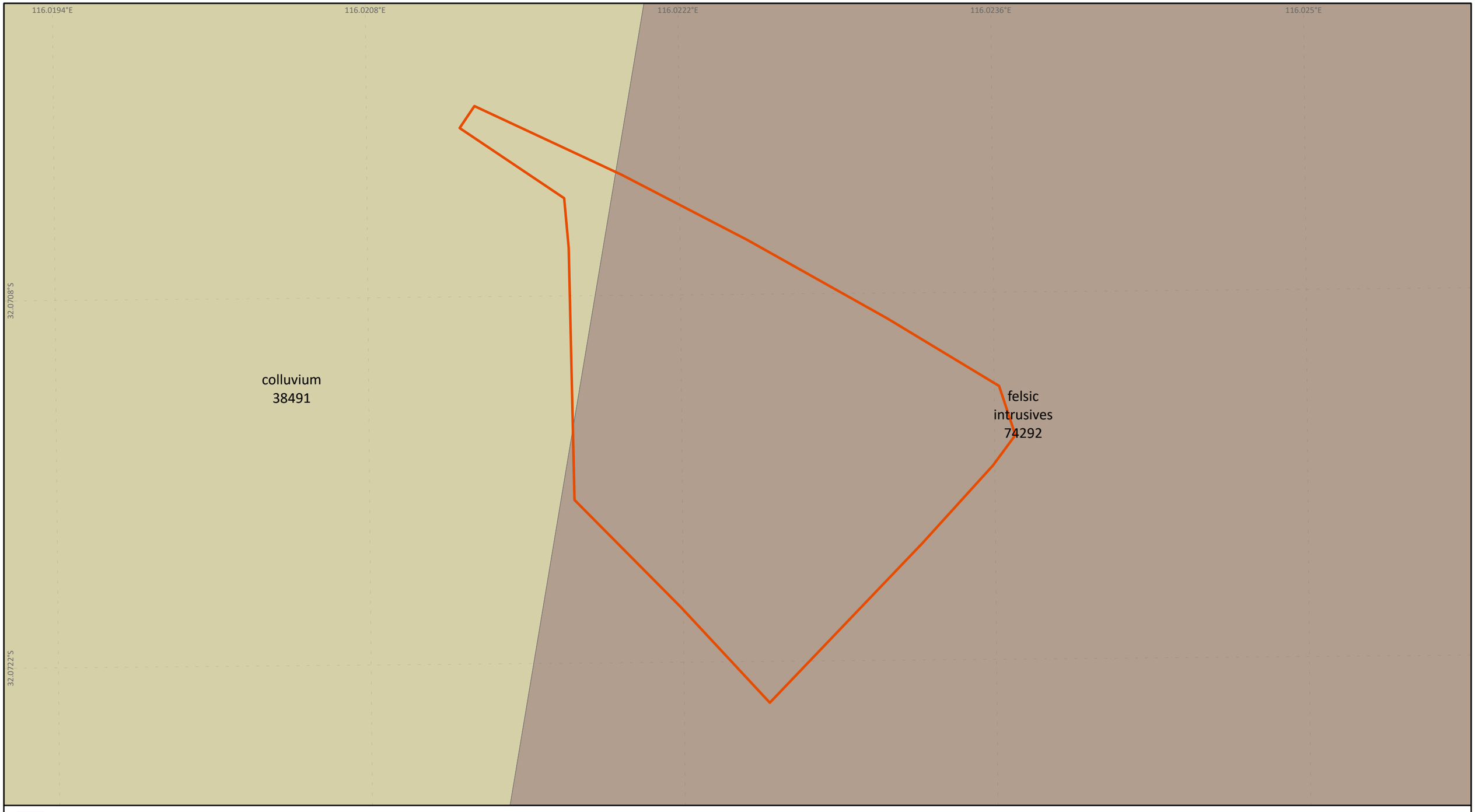
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Project No.: 2058
Author: SN-W
Created Date: 5 August 2025
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:1,500 @A3

Map 3: Land systems (DPIRD, 2016).

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

0 10 20 40 60 80 100
Meters



Survey area

Surface geology

colluvium 38491

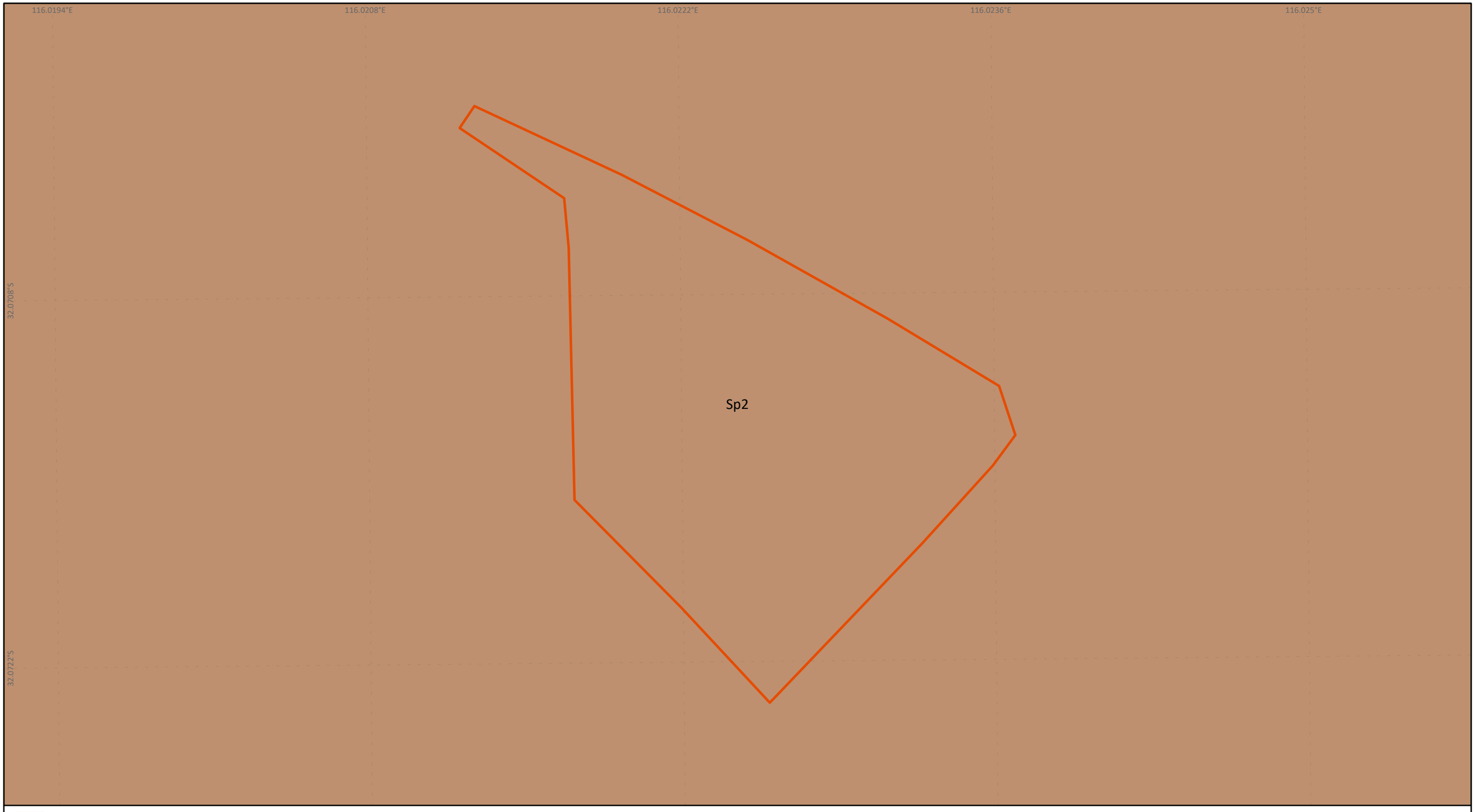
felsic intrusives 74292

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Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:1,500 @A3

Map 4: Surface geology (1:1,000,000) of the survey area (Geoscience Australia, 2012.)

0 10 20 40 60 80 100
Meters



Survey area

Soil

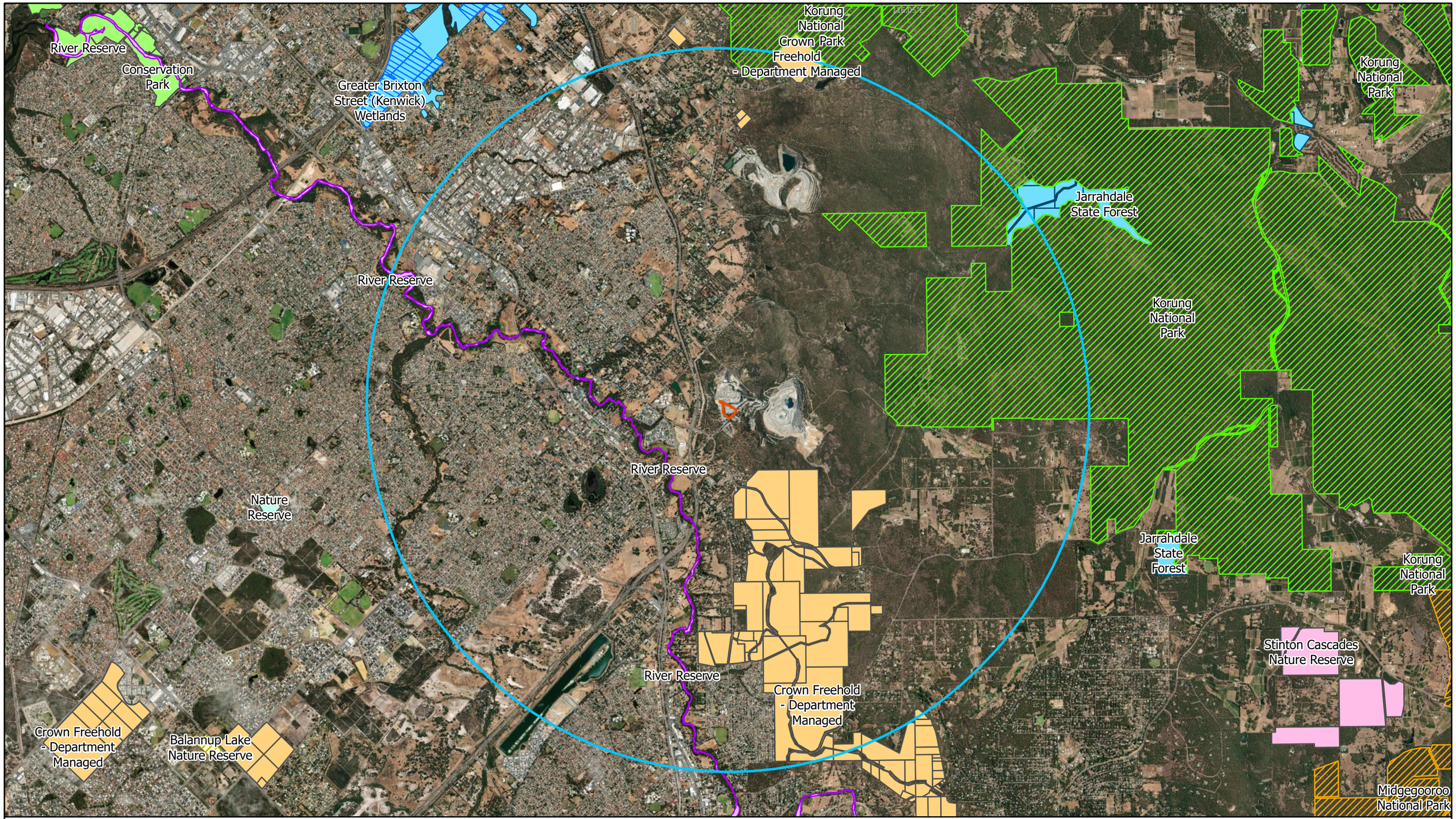
Sp2

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Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:1,500 @A3

Map 5: Atlas of Australian Soils map units associated with the survey area (Northcote et al., 1960-1968).

0 10 20 40 60 80 100
Meters



Survey area
Study area (5 km)

Important Wetlands (DBCA-045)
Brixton Street Swamps

Legislated Lands and Waters (DBCA-011)
Balannup Lake Nature Reserve
Conservation Park
Crown Freehold - Department Managed
Dundas Road Nature Reserve

Greater Brixton Street (Kenwick) Wetlands
Greenmount State Forest
Jarrahdale State Forest
Korung National Park
Lesmurdie Falls National Park

Midgegooroo National Park
Mundaring State Forest
Nature Reserve
River Reserve
Stinton Cascades Nature Reserve

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Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:50,000 @A3

Maxar

Map 6: DBCA Legislated Lands and Nationally Important Wetlands near the survey area.

0 0.5 1 2 3 4
Kilometers

2.6 FLORA

2.6.1 Floristic Diversity

A search of the Atlas of Living Australia (ALA) database (ALA, 2023) identified a total of 1,392 native vascular plant taxa and 179 introduced vascular plant taxa (including species, infraspecific taxa, and phrase name taxa), representing 109 families and 397 genera, within 5 km of the survey area (Appendix A). The most diverse families were the Fabaceae (122 taxa), Orchidaceae (90 taxa), Myrtaceae (77 taxa), Proteaceae (73 taxa), Cyperaceae (58 taxa), and Poaceae (53 taxa). The most diverse genera were *Stylidium* (35 taxa), *Acacia* (28 taxa), *Drosera* (21 taxa), *Schoenus* (21 taxa), *Hibbertia* (20 taxa), and *Hakea* (19 taxa).

2.6.2 Significant Species

DBCA database searches identified 104 significant plant taxa within 10 km of the survey area, including 25 Threatened taxa, eight Priority 1 taxa, 15 Priority 2 taxa, 33 Priority 3 taxa, 21 Priority 4 taxa, and two taxa presumed to be Extinct (Appendix C, Map 7). The PMST database search identified potentially suitable habitat for 34 EPBC Act listed (Threatened) species with 10 km of the survey area (PMST, Appendix A). The names of Threatened and Priority species have not been shown on Map 7 in accordance with DBCA's conditions of supply.

The likelihood of each taxon to occur within the survey area was assessed using the criteria outline in section 2.1. Based on the proximity of previous records and the potential presence of suitable habitat, seven taxa potentially occur within the survey area ('Likely' ratings) (Appendix C). 94 taxa were considered 'Unlikely' to occur due to the absence of suitable habitat within the survey area, or because they are known to have highly restricted distributions and have not been recorded in the vicinity of the survey area (Appendix C).

2.6.3 Introduced Species

A search of the Atlas of Living Australia database (ALA, 2023) identified 179 introduced plant species within 5 km of the survey area (Table 6). Twelve species are classified as a Declared Pests according to the BAM Act and listed on the WAOL (DPIRD, 2007-): *Asparagus asparagoides, Chrysanthemoides monilifera* subsp. *monilifera, Echium plantagineum, Galium aparine, Gomphocarpus fruticosus, Lantana camara, Moraea flaccida, Opuntia ficus-indica, Rubus rugosus, Rubus ulmifolius, Solanum linnaeanum,* and *Zantedeschia aethiopica*. Two species are classified as WONS: *Asparagus asparagoides* and *Lantana camara*=. Nineteen species have high ecological impact rating and rapid invasiveness rating according to the Weed Prioritisation Process for the region (Table 6).

Table 6: Introduced plant species recorded within 40 km of the survey area including BAM Act status and Weed Prioritisation Process rating.

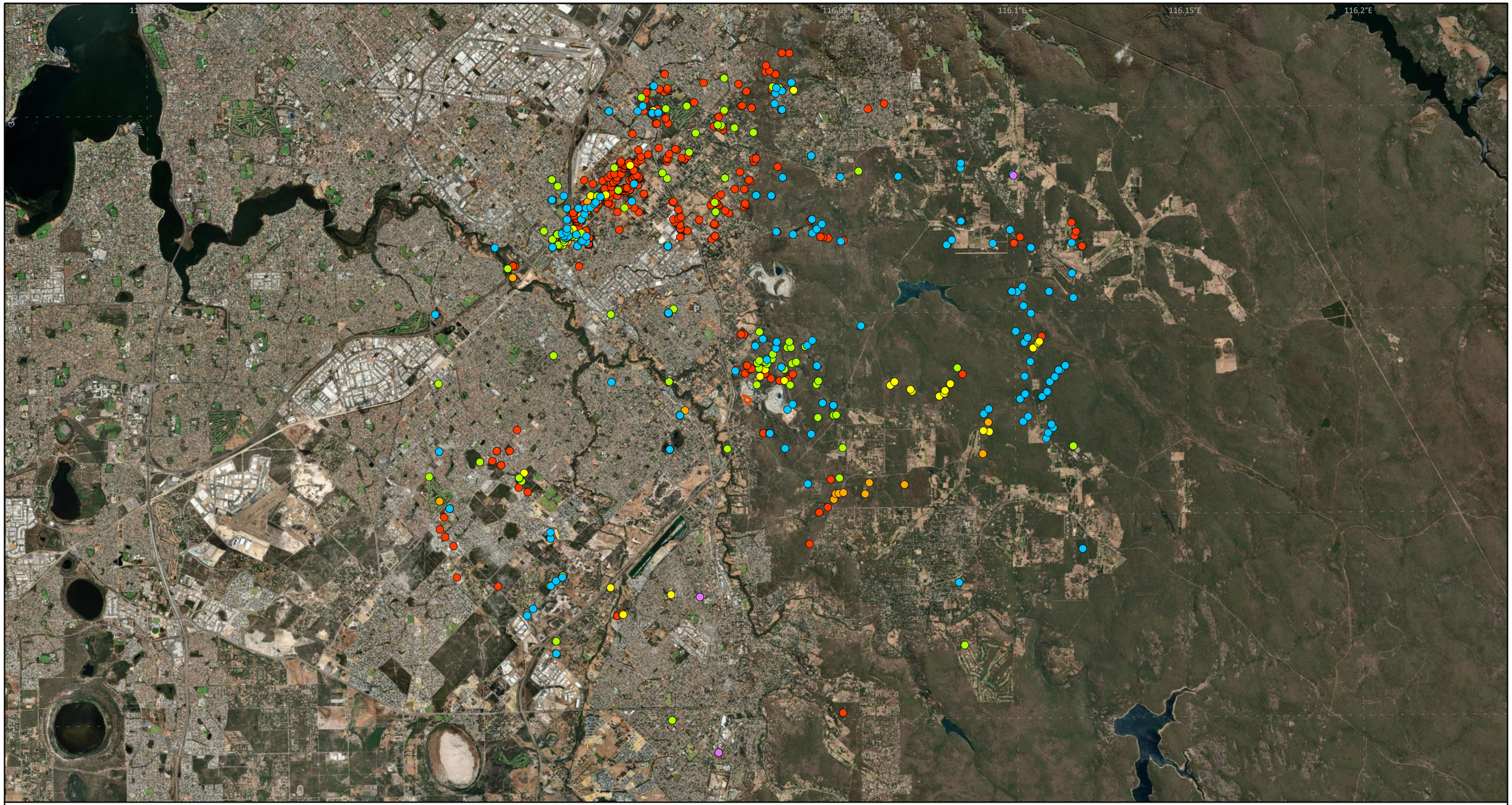
Species	Common name	BAM Act status and WONS	Ecological impact	Invasive-ness
Acacia decurrens	Black wattle	Permitted - s11	Low	Slow
Acacia iteaphylla	Flinders range wattle	Permitted - s11	Unknown	Rapid
Acacia longifolia	Sydney golden wattle	Permitted - s11	Unknown	Moderate
Acacia podalyriifolia	Queensland silver wattle	Permitted - s11	Low	Slow
Acacia pycnantha	Golden wattle	Permitted - s11	Low	Slow
Agave americana	Century plant	Permitted - s11	Low	Slow
Aira caryophyllea	Silvery hairgrass	Permitted - s11	Unknown	Rapid
Aira cupaniana	Hairgrass	Permitted - s11	Unknown	Rapid
Alisma lanceolatum	Water plantain	Permitted - s11	Unknown	Unknown
Amaryllis belladonna	Easter lily	Permitted - s11	Low	Slow
Anredera cordifolia	Madeira vine	Permitted - s11	High	Rapid
Arctotheca calendula	Capeweed	Permitted - s11	Moderate	Moderate
Arundo donax	Giant reed	Permitted - s11	Unknown	Slow
Asparagus asparagoides	Bridal creeper	Declared Pest - s22(2) (WONS)	High	Rapid
Atriplex prostrata	Hastate orache	Permitted - s11	Unknown	Rapid
Avena barbata	Bearded oat	Permitted - s11	High	Rapid
Babiana angustifolia	Baboonflower	Permitted - s11	High	Moderate
Bellardia trixago	Bartsia	Permitted - s11	Unknown	Rapid
Brachypodium distachyon	False brome	Permitted - s11	Unknown	Unknown
Briza maxima	Blowfly grass	Permitted - s11	Unknown	Rapid
Briza minor	Shivery grass	Permitted - s11	Unknown	Rapid
Bromus hordeaceus	Soft brome	Permitted - s11	High	Rapid
Callitriche stagnalis	Common starwort	Permitted - s11	Unknown	Rapid
Calothamnus quadrifidus	Freeway calothamnus	Permitted - s11	High	Unknown
Calothamnus rupestris	Mouse ears	Permitted - s11	Unknown	Rapid
Cenchrus clandestinus	Kikuyu	Permitted - s11	High	Rapid
Cenchrus macrourus	African feathergrass	Permitted - s11	High	Moderate
Centaurium erythraea	Centaury	Permitted - s11	Unknown	Rapid
Centaurium tenuiflorum	Slender centaury	Permitted - s11	Unknown	Rapid
Chamaecytisus palmensis	Tree lucerne	Permitted - s11	High	Rapid
Chamelaucium uncinatum	Geraldton wax	Permitted - s11	Unknown	Unknown
Chrysanthemoides monilifera subsp. *monilifera*	African boneseed	Declared Pest, Prohibited - s12	Unlisted	Unlisted
Corrigiola litoralis	Strapwort	Permitted - s11	Unknown	Unknown
Cortaderia selloana	Pampas grass	Permitted - s11	High	Rapid
Cotula coronopifolia	Waterbuttons	Permitted - s11	Unknown	Rapid
Cotula turbinata	Funnel weed	Permitted - s11	Unknown	Rapid

Species	Common name	BAM Act status and WONS	Ecological impact	Invasive-ness
Cynodon dactylon	Couch	Permitted - s11	High	Rapid
Cyperus brevifolius	Mullumbimby couch	Not listed	High	Moderate
Cyperus congestus	Dense flat sedge	Permitted - s11	Unknown	Moderate
Cyperus eragrostis	Umbrella sedge	Permitted - s11	Unknown	Moderate
Cyperus involucratus	Cyperus	Not listed	High	Rapid
Cyperus polystachyos	Bunchy sedge	Permitted - s11	Unknown	Moderate
Cyperus tenuiflorus	Scaly sedge	Permitted - s11	Unknown	Unknown
Osteospermum ecklonis	African daisy	Permitted - s11	Low	Slow
Dipogon lignosus	Dolichos pea	Permitted - s11	High	Moderate
Disa bracteata	South African orchid	Not listed	Unknown	Rapid
Dittrichia graveolens	Stinkwort	Permitted - s11	Unknown	Rapid
Echinochloa crus-pavonis	South american barnyard grass	Permitted - s11	Unknown	Rapid
Echium plantagineum	Paterson's curse	Declared Pest - s22(2)	Low	Moderate
Ehrharta calycina	Perennial veldtgrass	Permitted - s11	Unknown	Moderate
Ehrharta longiflora	Annual veldtgrass	Permitted - s11	Unknown	Rapid
Eleusine indica	Crowsfoot grass	Permitted - s11	Unknown	Unknown
Eragrostis curvula	African lovegrass	Permitted - s11	High	Rapid
Erodium botrys	Long storksbill	Permitted - s11	Unknown	Moderate
Euphorbia terracina	Geraldton carnation weed	Permitted - s11	High	Rapid
Ficus carica	Edible fig, common fig	Permitted - s11	High	Slow
Fumaria capreolata	Climbing fumitory	Permitted - s11	Moderate	Unknown
Fumaria muralis subsp. *muralis*	Wall fumitory	Permitted - s11	Unknown	Unknown
Galium aparine	Cleavers	Declared Pest - s22(2)	Unknown	Unknown
Galium divaricatum	Slender goosegrass	Permitted - s11	Low	Unknown
Galium murale	Bedstraw	Permitted - s11	Low	Unknown
Genista linifolia	Flaxleaf broom	Permitted - s11	Unknown	Rapid
Gladiolus caryophyllaceus	Pink gladiolus	Permitted - s11	Unknown	Unknown
Gladiolus undulatus	Wavy gladiolus	Permitted - s11	High	Moderate
Glyceria declinata	Sweetgrass	Permitted - s11	Moderate	Rapid
Gomphocarpus fruticosus	Swan plant	Declared Pest - s22(2)	Unknown	Rapid
Gomphocarpus physocarpus	Balloon cottonbush	Permitted - s11	Unknown	Rapid
Hyparrhenia hirta	Tambookie grass	Permitted - s11	High	Rapid
Hypochaeris glabra	Flatweed	Permitted - s11	Moderate	Rapid
Hypochaeris radicata	Flatweed	Permitted - s11	Moderate	Rapid
Ipomoea cairica	Mile-a-minute	Permitted - s11	High	Slow
Isolepis marginata	Coarse clubrush	Permitted - s11	Low	Rapid
Isolepis prolifera	Budding clubrush	Permitted - s11	Unknown	Rapid
Ixia maculata	Yellow ixia	Permitted - s11	Low	Moderate
Ixia polystachya	Variable ixia	Permitted - s11	Low	Moderate

Species	Common name	BAM Act status and WONS	Ecological impact	Invasive-ness
Jacaranda mimosifolia	Blue jacaranda	Permitted - s11	Unknown	Unknown
Juncus acutus	Sharp rush	Permitted - s11	High	Rapid
Juncus acutus subsp. *acutus*	Sharp rush	Permitted - s11	High	Rapid
Juncus articulatus	Jointed rush	Permitted - s11	Unknown	Unknown
Juncus bufonius	Toadrush, toad rush	Permitted - s11	Low	Rapid
Juncus capitatus	Capitate rush	Permitted - s11	Low	Rapid
Juncus microcephalus	Weedy rush	Permitted - s11	Low	Rapid
Kickxia spuria	Fluellen	Permitted - s11	Low	Rapid
Lactuca serriola	Prickly lettuce	Permitted - s11	Low	Rapid
Lagurus ovatus	Hare's tail grass	Permitted - s11	Unknown	Moderate
Lantana camara	Common lantana	Declared Pest (WONS), Prohibited - s12	Unlisted	Unlisted
Lavandula stoechas	Topped lavender	Permitted - s11	Low	Moderate
Linum trigynum	French flax	Permitted - s11	Low	Unknown
Lolium rigidum	Ryegrass	Permitted - s11	Moderate	Rapid
Lonicera japonica	Japanese honeysuckle	Permitted - s11	Unknown	Slow
Lotus angustissimus	Slender birdsfoot trefoil	Permitted - s11	Unknown	Rapid
Lotus subbiflorus	Hairy birdsfoot trefoil	Permitted - s11	Unknown	Rapid
Lupinus angustifolius	Narrowleaf lupin	Permitted - s11	Moderate	Unknown
Lupinus cosentinii	Sandplain lupin	Permitted - s11	Moderate	Moderate
Lupinus luteus	Yellow lupin	Permitted - s11	Moderate	Unknown
Lysimachia arvensis	Scarlet pimpernel	Permitted - s11	Unknown	Rapid
Lythrum hyssopifolia	Lesser loosestrife	Permitted - s11	Unknown	Rapid
Malva parviflora	Small-flowered mallow	Permitted - s11	Unknown	Unknown
Melaleuca armillaris	Bracelet honey-myrtle	Permitted - s11	Moderate	Moderate
Melaleuca nesophila	Freeway melaleuca	Permitted - s11	Low	Slow
Monopsis debilis	Monopsis	Permitted - s11	Low	Rapid
Monopsis debilis var. *depressa*	Pansy lobelia	Permitted - s11	Low	Rapid
Moraea flaccida	One-leaf cape tulip	Declared Pest - s22(2)	High	Moderate
Moraea lewisiae	Moraea	Permitted - s11	Unknown	Unknown
Moraea setifolia	Thread iris	Permitted - s11	Unknown	Unknown
Nemesia strumosa	Cape jewels	Permitted - s11	Unlisted	Unlisted
Nothoscordum gracile	False onion weed	Permitted - s11	Unknown	Unknown
Oenothera drummondii	Coastal evening primrose	Permitted - s11	Low	Unknown
Oenothera glazioviana	Tall evening primrose	Permitted - s11	Low	Rapid
Oenothera jamesii	Evening primrose	Permitted - s11	Low	Slow
Oenothera stricta	Common evening primrose	Permitted - s11	Low	Rapid
Olea europaea subsp. *europaea*	Olive	Permitted - s11	High	Moderate
Opuntia ficus-indica	Prickly pear	Declared Pest - s22(2)	Unlisted	Unlisted
Orobanche minor	Broom rape	Permitted - s11	Unknown	Rapid

Species	Common name	BAM Act status and WONS	Ecological impact	Invasive-ness
Oxalis caprina	Small white oxalis	Permitted - s11	Unknown	Unknown
Oxalis glabra	Fingerleaf oxalis	Permitted - s11	Moderate	Moderate
Oxalis hirta	Hairy wood-sorrel	Permitted - s11	Unlisted	Unlisted
Oxalis pes-caprae	Soursob	Permitted - s11	High	Slow
Oxalis purpurea	Purple oxalis	Permitted - s11	High	Slow
Parentucellia latifolia	Red bartsia	Permitted - s11	Unknown	Rapid
Paspalum dilatatum	Paspalum	Permitted - s11	High	Rapid
Paspalum distichum	Water couch	Permitted - s11	High	Unknown
Paspalum urvillei	Vasey grass	Permitted - s11	Unknown	Unknown
Pelargonium capitatum	Rose pelargonium	Permitted - s11	High	Rapid
Pentameris airoides	False hairgrass	Permitted - s11	Unknown	Unknown
Petrorhagia dubia	Velvet pink	Permitted - s11	Unknown	Rapid
Phalaris angusta	Phalaris	Permitted - s11	Unknown	Unknown
Phalaris arundinacea	Reed canary grass	Permitted - s11	Unknown	Unknown
Phytolacca octandra	Inkweed, red ink plant	Permitted - s11	Unknown	Moderate
Plantago lanceolata	Ribwort plantain	Permitted - s11	High	Unknown
Podalyria sericea	Cape satin bush	Permitted - s11	Unknown	Unknown
Polygala myrtifolia	Myrtleleaf milkwort	Permitted - s11	Moderate	Moderate
Polypogon monspeliensis	Annual barbgrass	Permitted - s11	Moderate	Unknown
Portulaca oleracea	Pigweed	Permitted - s11	Low	Unknown
Puccinellia ciliata	Puccinellia	Permitted - s11	High	Moderate
Raphanus raphanistrum	Wild radish	Permitted - s11	Unknown	Rapid
Ricinus communis	Castor oil plant	Permitted - s11	Unknown	Unknown
Romulea flava var. *minor*	Guildford grass	Permitted - s11	High	Unknown
Romulea rosea	Guildford grass	Permitted - s11	High	Unknown
Romulea rosea var. *australis*	Guildford grass	Permitted - s11	High	Unknown
Rorippa nasturtium-aquaticum	Watercress	Permitted - s11	High	Rapid
Rubus rugosus	Wild raspberry	Declared Pest - s22(2)	High	Moderate
Rubus ulmifolius	Blackberry	Declared Pest - s22(2)	High	Moderate
Rumex conglomeratus	Clustered dock	Permitted - s11	Unknown	Unknown
Rumex crispus	Curled dock	Permitted - s11	Unknown	Unknown
Rumex vesicarius	Ruby dock	Permitted - s11	High	Rapid
Setaria parviflora	Slender pigeon grass	Permitted - s11	Low	Moderate
Solanum linnaeanum	Apple of sodom	Declared Pest - s22(2)	Moderate	Moderate
Solanum nigrum	Black berry nightshade	Permitted - s11	Unknown	Moderate
Sonchus asper	Rough sowthistle	Permitted - s11	Moderate	Rapid
Sonchus oleraceus	Common sowthistle	Permitted - s11	Moderate	Rapid
Sparaxis bulbifera	Sparaxis	Permitted - s11	High	Rapid
Spergula arvensis	Corn spurrey	Permitted - s11	Unknown	Unknown

Species	Common name	BAM Act status and WONS	Ecological impact	Invasive-ness
Stachys arvensis	Stagger weed	Permitted - s11	Unknown	Rapid
Stenotaphrum secundatum	Buffalo grass	Permitted - s11	High	Moderate
Tolpis barbata	Tolpis	Permitted - s11	Unknown	Rapid
Tribolium uniolae	Haas grass	Permitted - s11	High	Moderate
Trifolium angustifolium var. *angustifolium*	Narrowleaf clover	Permitted - s11	Unknown	Unknown
Trifolium arvense var. *arvense*	Haresfoot clover	Permitted - s11	Unknown	Unknown
Trifolium campestre	Hop trefoil	Permitted - s11	Unknown	Unknown
Trifolium campestre var. *campestre*	Hop clover	Permitted - s11	Unknown	Unknown
Trifolium dubium	Suckling clover	Permitted - s11	Unknown	Unknown
Trifolium resupinatum var. *majus*	Shaftal clover	Permitted - s11	Unknown	Unknown
Trifolium striatum	Knotted clover	Permitted - s11	Unknown	Unknown
Tritonia gladiolaris	Tritonia	Permitted - s11	Unknown	Unknown
Tropaeolum majus	Nasturtium	Permitted - s11	Low	Slow
Ursinia anthemoides	Ursinia	Permitted - s11	Unknown	Rapid
Vallisneria australis	Ribbon weed	Permitted - s11	Unknown	Unknown
Vellereophyton dealbatum	White cudweed	Permitted - s11	Moderate	Rapid
Verbascum virgatum	Green mullein	Permitted - s11	Low	Moderate
Verbesina encelioides	Crownbeard	Permitted - s11	Unlisted	Unlisted
Vicia sativa	Common vetch	Permitted - s11	Unknown	Slow
Vinca major	Blue periwinkle	Permitted - s11	High	Slow
Vulpia myuros	Rat's-tail fescure	Permitted - s11	Unknown	Rapid
Wahlenbergia capensis	Cape bluebell	Permitted - s11	Unknown	Rapid
Watsonia knysnana	Watsonia	Permitted - s11	High	Moderate
Watsonia marginata	Watsonia (pink)	Permitted - s11	High	Moderate
Watsonia meriana	Bubil watsonia	Permitted - s11	High	Moderate
Zantedeschia aethiopica	Arum lily	Declared Pest - s22(2)	High	Moderate



Survey area

Conservation status

- T
- P1
- P2
- P3
- P4
- X

ecologia ENVIRONMENT

Project No.: 2058
Author: AS
Created Date: 20 August 2025
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:100,000 @A3

Map 7: Significant plant species recorded within 10 km of the survey area (40-9024FL).

Earthstar Geographics

0 1 2 4 6 8
Kilometers

2.7 VEGETATION

2.7.1 Pre-European Vegetation

The Western Australian Land Use and Vegetation Data Project produced a 1:250,000 scale digital spatial dataset of the pre-European native vegetation of Western Australia, compiled from previous vegetation mapping exercises, primarily by J.S. Beard from 1964 to 1981, with updates reflecting the National Vegetation Information System (NVIS) standards (Shepherd et al., 2002). Two vegetation associations (3 and 4) are mapped within the survey area (Table 7, Map 8).

The National Objectives and Targets for Biodiversity Conservation 2001-2005 (DEH, 2001) recognise that the retention of 30% or more of the pre-clearing extent of an ecological community is necessary if Australia's biological diversity is to be protected, as this is the threshold below which species loss appears to accelerate exponentially (EPA, 2000). Based on the Statewide Vegetation Statistics dataset (Government of Western Australia, 2018), the current extent of both vegetation associations in the Northern Jarrah Forest subregion are above this threshold (Table 7). According to Principle (e) of the native vegetation clearing guidelines (DER, 2014), areas within constrained areas (i.e., Perth Metropolitan, Peel and Greater Bunbury Region Schemes) are recognised for their past land use planning decisions and hence have retention objectives to "at least 10%". Due to the survey area falling within the Perth Metropolitan region and the current percentage of vegetation 4 protected for conservation within the Jarrah Forest IBRA region being 27.09%, this vegetation association is not classified as 'Vulnerable'.

2.7.2 Threatened and Priority Ecological Communities

The desktop assessment identified ten EPBC Act or BC Act listed TECs occurring within 10 km of the survey area. Of these TECs, two were assessed to potentially occur within the survey area ('Possible') due to vegetation condition and floristic communities recorded during previous surveys in the area: 'SCP3b' and 'SCP3c'. The remaining eight TECs were assessed as 'Unlikely' to occur due to the probable absence of the required indicator species, required landforms or land systems, and poor vegetation condition.

Four PECs were identified within 10 km of the survey area, one of which has a buffer which intersects with the survey area: 'Banksia Woodlands of the Swan Coastal Plain ecological community'. Previous surveys by *ecologia* in an adjacent area did not identify any *Banksia* woodlands; therefore, it should not occur within the survey area (Table 8, Map 9).

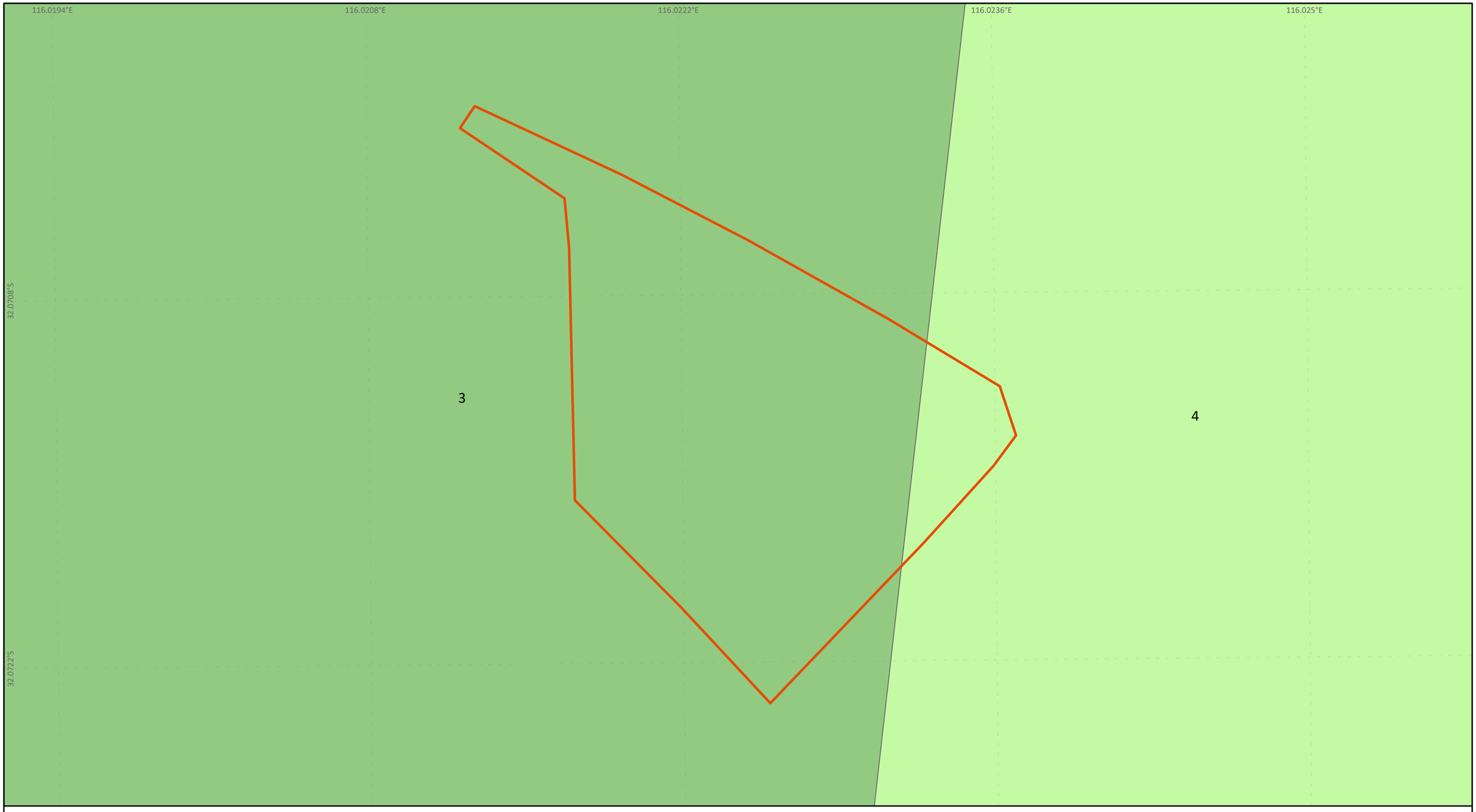
Table 7: Pre-European vegetation associations mapped with the survey area (Shepherd et al., 2002).

Shepherd et al. (2002) vegetation association	Description	Pre-European extent within Hamersley IBRA region (ha)	Percentage remaining within Hamersley IBRA region	Current percentage protected for conservation within Hamersley IBRA region	Extent within survey area (ha)
3	Medium forest; jarrah-marri	2,390,592	67.10	16.11	2.31 (12.7%)
4	Medium woodland; marri & wandoo	1,022,713	27.09	4.36	0.23 (1.2%)

Table 8: Significant ecological communities within 10 km of the survey area.

Community ID	Community name	State category	Commonwealth category	Pre-survey likelihood of occurrence	Justification
SCP20a	*Banksia attenuata* woodlands over species rich dense shrublands (floristic community type 20a as originally described in Gibson et al. 1994)	BCA Critically Endangered	Endangered	Unlikely	*Banksia* woodlands unlikely to be present. Vegetation condition recorded during previous survey of an adjacent area was highly degraded.
SCP20b	*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20b as originally described in Gibson et al. 1994)	BCA Critically Endangered	Endangered	Unlikely	*Banksia* woodlands unlikely to be present. Vegetation condition recorded during previous survey of an adjacent area was highly degraded.
Banksia WL SCP	Banksia Woodlands of the Swan Coastal Plain ecological community	Priority 3	Endangered	Unlikely	The PEC buffer intersects with survey area, but vegetation assessed during previous surveys indicates no *Banksia* species are likely present within the survey area.
Central Granite Shrublands (Com 5, Markey)	Central Northern Darling Scarp Granite Shrubland Community	Priority 4	–	Unlikely	Landform is not present in survey area.
SCP3a	*Corymbia calophylla – Kingia australis* woodlands on heavy soils (floristic community type 3a as originally described in Gibson et al. 1994)	BCA Critically Endangered	Endangered	Unlikely	*Corymbia calophylla* is likely to be present within the survey area, but previous surveys indicate that the vegetation condition will be likely too poor to qualify for the TEC. Wetlands as described in the TEC habitat requirements are unlikely to occur within the survey area.
SCP3b	*Corymbia calophylla — Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain (floristic community type 3b as originally described in Gibson et al. 1994)	BCA Endangered	–	Possible	*Corymbia calophylla* and *Eucalyptus marginata* are likely to be present within the survey area, but previous surveys

Community ID	Community name	State category	Commonwealth category	Pre-survey likelihood of occurrence	Justification
					indicate that the vegetation condition will be too poor to qualify for the TEC.
SCP3c	*Corymbia calophylla* — *Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain (floristic community type 3c as originally described in Gibson et al. 1994)	BCA Endangered	Endangered	Possible	*Corymbia calophylla* is likely to be present within the survey area, but previous surveys indicate that the vegetation condition will be likely too poor to qualify for the TEC.
SCP07	Herb rich saline shrublands in clay pans (floristic community type 7 as originally described in Gibson et al. 1994)	BCA Endangered	Critically Endangered	Unlikely	Landform is not present in survey area.
SCP08	Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. 1994)	BCA Endangered	Critically Endangered	Unlikely	Landform is not present in survey area.
SCP21c	Low lying *Banksia attenuata* woodlands or shrublands	Priority 3	Endangered	Unlikely	*Banksia* woodlands unlikely to be present.
Seasonal clay wetlands of the SW (groups 1-3)	Seasonal rainfall filled wetlands with impeding substrate of the Swan Coastal Plain and Jarrah Forest in transitional rainfall zones	Priority 1	Critically Endangered	Unlikely	Landform is not present in survey area.
SCP20c	Shrublands and woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20c as originally described in in Gibson et al. 1994)	BCA Critically Endangered	Endangered	Possible	TEC description describes *Banksia* dominant woodlands, which were not recorded during previous surveys and should not occur within the survey area.
Muchea Limestone	Shrublands and woodlands on Muchea Limestone of the Swan Coastal Plain	BCA Endangered	Endangered	Unlikely	Landform is not present in survey area.
SCP10a	Shrublands on dry clay flats (floristic community type 10a as originally described in Gibson et al. 1994)	BCA Endangered	Critically Endangered	Unlikely	Landform is not present in survey area.



Survey area

Vegetation association

3,Medium forest; jarrah-marri

4,Medium woodland; marri & wandoo

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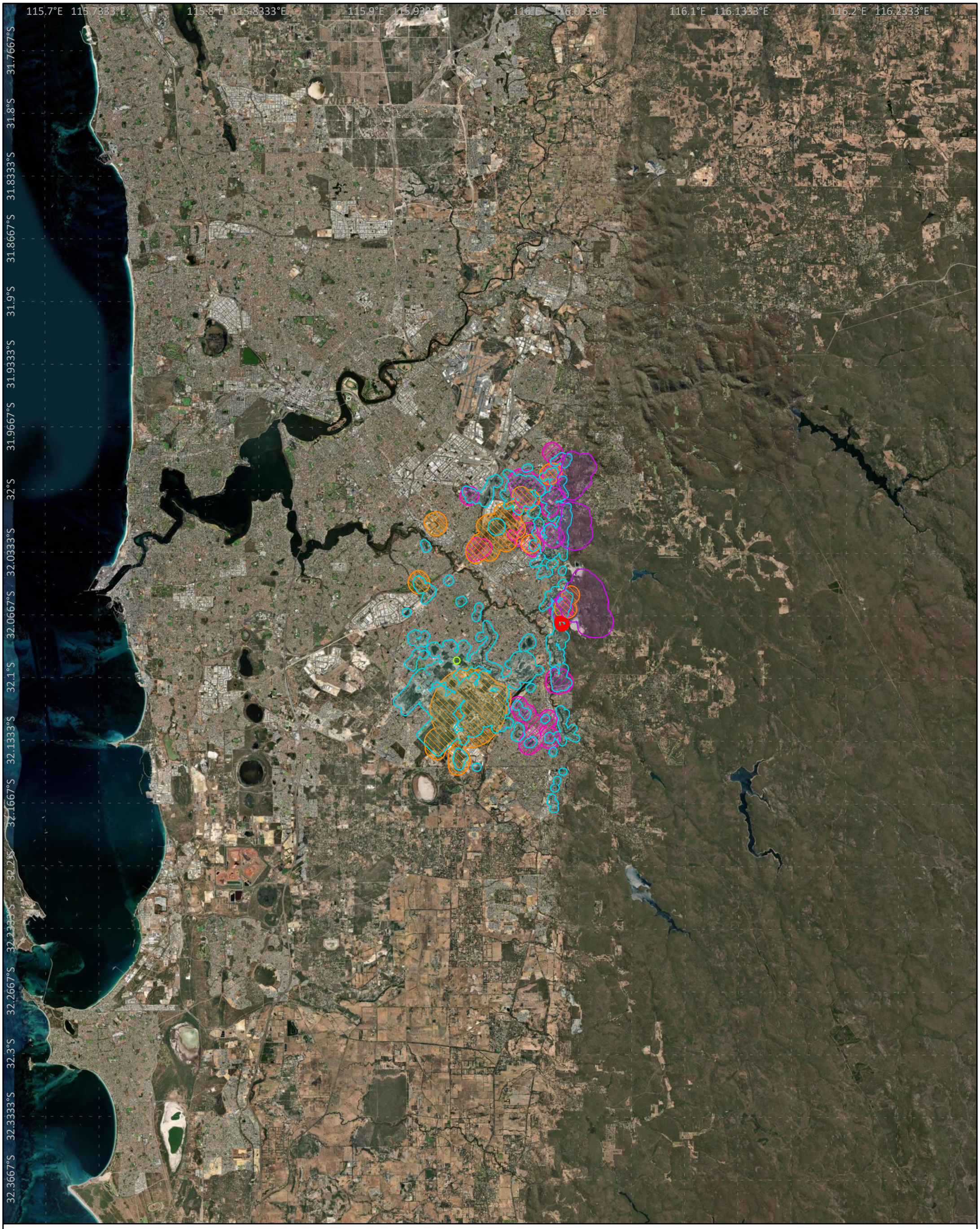
Project No.: 2058
Author: SN-W
Created Date: 5 August 2025
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:1,500 @A3

Map 8: Pre-European vegetation associations (Shepherd et al. 2002).

Maxar

0 10 20 40 60 80 100

Meters



Survey area

State Category

BCA Critically Endangered

BCA Endangered

Priority 1

Priority 3

Priority 4

ecologia ENVIRONMENT

Project No.: 2058
Author: AS
Created Date: 20 August 2025
Coordinate System: GDA 1994 Perth Coastal Grid 1994
Projection: Transverse Mercator

Map 9: Significant ecological communities within 10 km of the survey area (22-0125EC).

Earthstar Geographics

0 3.3 6.5 13

Kilometers

2.8 BLACK COCKATOO HABITAT

The Department of Agriculture, Water and the Environment referral guidelines for three Threatened black cockatoo species (DAWE, 2022) provide the modelled distributions for Carnaby's cockatoo, Baudin's cockatoo and forest red-tailed black cockatoo in the southwest of Western Australia. The survey area (collectively both areas assessed during the field survey) occurs within the distribution of all three Threatened black cockatoo species.

2.8.1 Species habitat profiles

Carnaby's cockatoo (*Zanda latirostris*)

Conservation status: EPBC & BC Act Endangered

Distribution and habitat: The Carnaby's cockatoo, also known as the short-billed black cockatoo, is a large, black cockatoo with white tail panels, white cheek patches and a short bill (Threatened Species Network). It is endemic to the south-west of Western Australia, ranging from the lower Murchison River in the north, throughout the south-west corner, and east to Cape Arid (Ron E. Johnstone & Storr, 1998).

Ecology: They are usually seen in pairs, triplets or small flocks. In the non-breeding season, they occur in large flocks of up to 10,000 birds that wander in search of food, particularly in banksia woodland and pine plantations on the northern Swan Coastal Plain (R. E. Johnstone, Johnstone, & Kirby, 2007). The cockatoos breed mainly in the Wheatbelt, in large hollows usually high in eucalypt, Karri or Marri trees, and then move west following breeding to feed in coastal and near-coastal areas from late December to July (Morcombe, 2010; Shah, 2006). They forage mainly in shrubland or kwongan heath, eucalypt woodland and pine plantations, feeding on the seeds, nuts and flowers of a large variety of proteaceous species such as *Banksia, Dryandra, Grevillea* and *Hakea,* as well as *Eucalyptus, Pinus* and *Allocasuarina* (Ron E. Johnstone & Storr, 1998; Shah 2006).

The life history of this cockatoo makes it extremely vulnerable to threats resulting from human activities and introduced competitors because pairs bond for life, require large tree hollows for breeding and only produced one chick per year (Shah, 2006). The number of Carnaby's cockatoos left in the wild is estimated at 8,000 – 10,000 individuals (Burnham, Barrett, Blythman, & Scott, 2010), with an estimated total population decline of over 50% in the past 45 years (Shah, 2006).

Factors contributing to their decline include:

- Habitat fragmentation and clearing of semi-arid sandplains, particularly in the northern and eastern areas of the Wheatbelt. Most habitats suitable for breeding and feeding in the Wheatbelt have been cleared entirely.
- Clearing of heathland surrounding breeding sites has reduced the survival rate of fledglings by decreasing the available food sources for the young (DPaW, 2013a; D.A. Saunders, 1986).
- Poaching of eggs and young by collectors and animal dealers; breeding hollows become unsuitable for future breeding attempts through damage of hollows and trees when young and eggs are taken (DPaW, 2013a).
- The introduction and spread of invasive species such as the galah (*Eolophus roseicapillus*) on the Swan Coastal Plain, corellas (*Cacatua sanguinea* and *C. tenuirostris*), and feral bee (*Apis mellifera*). The species compete with and exclude Carnaby's cockatoos from traditional nest hollows (D.A. Saunders, 1979; Shah, 2006).

Baudin's cockatoo (*Zands baudinii*)

Conservation status: EPBC & BC Act Endangered.

Distribution and habitat: Baudin's cockatoo is also known as the long-billed black cockatoo (Higgins, 1999). It is a large, black cockatoo with white tail panels, white ear patches and a bill with a long, fine tip to the upper mandible. In appearance it is very similar to Carnaby's cockatoo, and was only recognised as separate species in 1974 (D.A. Saunders, 1974). The species is endemic to the south-west of Western Australia, where it is found in or near forested areas. Being a forest specialist, its range follows the distribution of its main food species, the Marri tree (*Corymbia calophylla*), a eucalypt native to the jarrah and karri forest.

Ecology: After breeding, birds congregate in large flocks that move north-east, searching for food (Ron E. Johnstone & Storr, 1998; D.A. Saunders, 1974). During this time, foraging flocks may enter commercial orchards where they feed on the seeds and juice of apples and pears (Chapman, 2007; Chapman & Massam, 2005; D.A. Saunders, 1974; D.A. Saunders, Rowley, & Smith, 1985). Because of this habit, many birds are shot illegally by orchardists, and this process is considered the principal threat to the species (Higgins, 1999; McKenzie, May, & McKenna, 2003; D.A. Saunders, 1974). On average, breeding pairs only produce one chick every 2 years; hence, it is unlikely that enough chicks are produced each year to offset the high adult mortality from shooting (Chapman, 2007; Ron E. Johnstone & Storr, 1998).

Threats: Destruction of habitat due to logging and clearing for agriculture has reduced this species' range by 25% while it has reduced in density over a further 25% (Garnett, Szabo, & Dutson, 2011). Baudin's black-cockatoo only breeds in densely forested areas in the Southern Jarrah Forest bioregion (JF2) (Higgins, 1999; McKenzie et al., 2003; D.A. Saunders, 1974), with the northern-most breeding events recorded near Serpentine, 40 km south of Perth (Ron E. Johnstone & Kirkby, 2008).

Forest red-tailed black cockatoo (*Calyptorhynchus banksia*)

Conservation status: EPBC & BC Act Vulnerable.

Distribution and habitat: The forest red-tailed black cockatoo once occurred between Albany, Augusta and Perth, and north along the Swan Coastal Plain to Dandaragan (Ron E. Johnstone, 1997), but also declined by 25 – 30% in range and a further 14% in density as a result of clearing of the margins of the forests for agriculture in the early 1900s (Garnett et al., 2011; Mawson & Johnstone, 1997). The population was projected to decline by a further 30% or more between 2005 and 2015 (Department of Conservation and Land Management, 2006).

The forest red-tailed black cockatoo inhabits the dense Jarrah (*Eucalyptus marginata*), Karri (*E. diversicolor*) and Marri (*Corymbia calophylla*) forests receiving more than 600 mm average rainfall annually (D.A. Saunders & Ingram, 1995; D. A. Saunders et al., 1985). Although most records are in Jarrah-Marri forests, the forest red-tailed black-cockatoo has been observed in a range of other forest and woodland types, including blackbutt (*E. patens*), wandoo (*E. wandoo*), Tuart (*E. gomphocephala*), Albany Blackbutt, Yate (*E. cornuta*), and Flooded Gum (*E. rudis*) (Abbott, 1998).

Habitats in which the forest red-tailed black cockatoo occurs often have an understorey of banksia (*Banksia* spp.)., snottygobble (*Persoonia longifolia*) and sheoak (*Allocasuarina fraseriana*), with scattered blackbutt and Wandoo (Ron E. Johnstone & Kirkby, 1999).

The forest red-tailed black-cockatoo occurs within the same habitat as Baudin's cockatoo, and as with Baudin's cockatoo, it nests in large hollows of marri, jarrah and karri (Ron E. Johnstone & Kirkby, 1999). The subspecies has also been sighted nesting in wandoo and bullich (*E. megacarpa*).

Ecology: The life span of forest red-tailed black-cockatoos is predicted to be 25 – 50 years. The cockatoos are thought to begin breeding when they are 4 – 6 years old, fledgling only one chick (Ron E. Johnstone & Storr, 1998). It is probable that less than 10% of the population of forest red-tailed black

cockatoos are capable of breeding in any one year and birds may only breed every 2 – 3 years, with low breeding success (Ron E. Johnstone & Kirkby, 2006).

Like all black cockatoos, the forest red-tailed black cockatoo is monogamous and pairs probably from a lifetime bond (Higgins, 199; Sith & Saunders, 1986). The breeding period spans from September to April, with eggs typically laid in October/November (Ron E. Johnstone, 1997; Ron E. Johnstone & Storr, 1998), or March/April in years with good autumn rains. Nests are made4 in large tree hollows in Marri, Jarrah, wandoo and Bullich trees that are at least 500 – 600 mm in diameter at breast height and may be more than 130 years old (Ron E. Johnstone & Storr, 1998; Whitford, 2002; Whitford & Williams, 2002). Trees of less than 500 mm in diameter are considered to have the potential to develop hollows and are also important breeding resources for the species.

Around 90% of the subspecies' diet is made up of the seeds from marri and jarrah fruits (Ron E. Johnstone & Kirkby, 1999). Other species used for feeding include blackbutt, forest sheoak, snottygobble and the non-indigenous native spotted gum (*E. maculata*) and cape lilac (Ron R. Johnstone & Kirkby, 1999; Ron E. Johnstone & Storr, 1998). Due to the slow and patchy flowering and seeding of marri trees, Forest red-tailed black cockatoo highlights the need for foraging habitat to consist of a mosaic of tree species and age classes.

Flocks of up to 50 individuals (Abbott, 1998) spend the night roosting in trees and leave at sunrise, splitting into smaller family groups, of around 10 birds, and moving into adjacent forest. After a short period of preening and basking in the sunlight they feed for 10 – 12 hours before moving off to creeks of dams to drink. On dark, they returned to their roosts (Ron E. Johnstone & Kirkby, 1999).

Threats: Key threats to the forest red-tailed black cockatoo are habitat loss, nest hollow shortage and competition for available nest hollows from other species, and injury or death from the European honeybee (*Apis mellifera*), illegal shooting and fire (Department of Conservation and Land Management, 2006). Climatic change is an additional threat that is likely to exacerbate other threats as a result of changes to biodiversity and ecosystem function (Chambers, Hughes, & Weston, 2005).

2.8.2 Black cockatoo desktop results

The DBCA Threatened and Priority fauna database search identified 191 records of Baudin's cockatoo, 1645 records of Carnaby's cockatoo and 84 records of forest red-tailed black cockatoo, within 10 km of the survey area. A further 126 were identified as white-tailed black cockatoo as the individual observed could not be identified as either Baudin's or Carnaby's (Map 10).

Additionally, DBCA black cockatoo databases were queried for breeding and roosting records within 10 km of the survey area. No forest-red tailed black cockatoo breeding or roosting records were identified. Eight Carnaby's cockatoo roosts were identified within 10 km of the survey area, and the survey area occurs within 12 km of a Carnaby's cockatoo breeding site (Map 10).

Survey area

Study area (10 km buffer)

Carnaby's cockatoo confirmed roosts (500 m buffer)

Carnaby's cockatoo breeding area (12 km buffer)

DBCA black cockatoo records

- Baudin's cockatoo
- Carnaby's cockatoo
- Forest red-tailed black cockatoo
- White-tailed black cockatoo (Baudin's or Carnaby's)

ecologia ENVIRONMENT

Project No.: 2058
Author: SN-W
Created Date: 5 August 2025
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:99,500 @A3

Earthstar Geographics

Map 10: Black cockatoo records, roosts and breeding areas.

0 0.5 1 2 3 4 5
Kilometers

3 METHODOLOGY

3.1 FLORA AND VEGETATION ASSESSMENT

3.1.1 Field Survey

The detailed flora and vegetation assessment was conducted by two *ecologia* ecologists on 22 July 2025. The survey was completed in accordance with the *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016b), primarily by sampling vascular plant species within quadrats.

3.1.2 Quadrat Sampling

Sampling site locations were selected using a combination of aerial photography, topographic features, land system mapping, pre-European vegetation mapping, and field observations, to represent the geomorphological and floristic variation found within the survey area. Where possible, at least three sites were selected to represent each potentially distinct plant community in accordance with EPA (2016b). Sites were positioned to avoid obvious transition zones between plant communities and were preferentially placed in areas of intact mature vegetation and minimal disturbance.

Three sampling sites (two quadrats and one relevé) were assessed within the survey area (Map 11). All quadrats were 10 m x 10 m in dimension or of an equivalent area and had a north-south orientation. Quadrats were measured prior to assessment and the location of each corner was recorded. Relevés were sampled in instances where installation of suitably sized quadrats was not feasible. In this report a relevé is defined as an irregularly shaped sampling plot in which comprehensive floristic data are recorded within an area approximating a 10 m x 10 m quadrat.

The following attributes were recorded from each quadrat and relevé:

- Site code.
- GPS coordinate of all corners (central location for relevé).
- Photograph from the north-west corner (central location for relevé).
- A comprehensive species list (including introduced species) and the dominant height class (ESCAVI, 2017) and estimated percentage foliage cover (using a variant of the Domin scale) of each species (< 1%, 1-4%, 5-9%, 10-24%, 25-32%, 33-49%, 50-74%, 95-100%). If isolated tall shrub and tree species are present in the surrounding landscape and do not occur within a quadrat, then these species may be recorded as associated if they are considered important for characterising the community.
- Vegetation condition (Table 9) and description of disturbance.
- Additional information to assist vegetation characterisation, including landform, slope, soil type, surface geology, and fire history.

3.1.3 Significant Species

Targeted searches for significant plant species identified from the desktop assessment were conducted along traverses and within quadrats in areas of potential suitable habitat, and within representative areas of each of the major landforms and plant communities present within the survey area. Where significant species were observed the following parameters were recorded: location (for individual or localised plants) or population boundary (for more extensive populations, time permitting); number of plants (count, for individual or localised plants) or estimated number of plants for more extensive populations; reproductive state; plant community; and landform.

The initial likelihood of occurrence assessment for each species was reviewed following the field survey based on the level of survey effort, seasonal conditions, vegetation condition, and the presence of suitable habitat. This reassessment is presented in the desktop results.

3.1.4 Specimen Identification

Specimen identification was undertaken with reference to current taxonomic literature and herbarium reference specimens. Scientific names used in this report follow the species concepts currently adopted by the Western Australian Herbarium. Specimens that could not be adequately identified to genus or species level due to the absence of reproductive material required for positive identification were indicated with a query but were not considered to be otherwise anomalous.

3.1.5 Vegetation Classification and Characterisation

Due to the small size of the survey area and the homogeneity of the vegetation, a simple assessment of shared dominant species recorded from sampling sites was conducted to classify vegetation. Vegetation types were further characterised by similarities in surface geology, soil, landform, and frequently occurring species. The vegetation types were given descriptive names consistent with NVIS Level V – Association (ESCAVI, 2017), which include structural features and dominant or diagnostic species.

3.1.6 Vegetation Mapping

Preliminary vegetation mapping of survey area was undertaken prior to the survey and in the field using aerial imagery and data from ground-truthed sites. Vegetation types were then determined post-survey using the floristic classification methods described above and applied to these ground-truthed areas. Vegetation type boundaries were refined using aerial imagery in ESRI ArcGIS Pro. Extrapolative mapping was undertaken in areas that could not be ground-truthed and was based on observed similarities in spectral and structural features between ground-truthed sites and unvisited areas.

Vegetation condition mapping was undertaken in a similar manner, with reference to the condition recorded at sampled sites and other field observations.

Table 9: Vegetation condition scale (adapted from Trudgen 1988).

Vegetation condition	Criterion
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

3.1.7 Assessment of Potential Vegetation Significance

Vegetation types described for the survey area were assessed at National, state, regional, and local levels to assist the environmental impact assessment (EIA) process. There are 11 criteria against which vegetation is assessed, as summarised in Table 10.

Table 10: Criteria for assessment of potential vegetation significance.

Level	Criterion
National	1. Vegetation supporting populations of Threatened (EPBC Act listed) plant species. 2. Vegetation corresponding to a nationally (EPBC Act) listed Threatened Ecological Community. 3. Vegetation which includes Ramsar wetlands and Nationally Important (DIWA) wetlands.
State	4. Vegetation supporting populations of Threatened (BC Act) plant species. 5. Vegetation which corresponds to a BC Act listed Threatened Ecological Community. 6. Vegetation corresponding to a state (DBCA) listed Priority Ecological Community. 7. Vegetation occurring within a state-managed conservation estate (areas protected under the *Conservation and Land Management Act 1984*) or areas that have been formally recommended by DBCA for inclusion in the state conservation estate.
Regional	8. Vegetation that is represented by less than 30% of its pre-European extent within the relevant bioregion. This criterion was assessed using the vegetation association mapping of Shepherd et al. (2002).
Local	9. Vegetation associated with significant watercourses or permanent or ephemeral wetlands. 10. Vegetation supporting potentially new plant species. 11. Vegetation represented by small, isolated communities or vegetation with a limited local extent.



Survey area

Traverses

Site type

Quadrat

Releve

Project No.: 2058
Author: SN-W
Created Date: 5 August 2025
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:1,500 @A3

Map 11: Locations of sampling sites and traverses within the survey area.

Maxar

0 10 20 40 60 80 100

Meters

3.2 BLACK COCKATOO HABITAT ASSESSMENT

Three Threatened species of black cockatoo listed under both the EPBC Act and the BC Act occur within the south-west of Western Australia (Table 11). The Department of Agriculture, Water and the Environment (DAWE) *Referral Guideline for 3 WA Threatened Black Cockatoo Species* (DAWE, 2022) provide modelled distributions for the three species of black cockatoo, including breeding areas, with the survey area intersecting the modelled distribution of all three species.

Table 11: Status of black cockatoos occurring within the south-west.

Common name	Taxon	EPBC Act	BC Act
Forest red-tailed black cockatoo	*Calyptorhynchus banksii naso*	Vulnerable	Vulnerable
Baudin's cockatoo	*Zanda baudinii*	Endangered	Endangered
Carnaby's cockatoo	*Zanda latirostris*	Endangered	Endangered

The DAWE *Referral Guideline for 3 WA Threatened Black Cockatoo Species* (DAWE, 2022) recommend 'habitat assessments' as the primary method to inform decisions on the potential for significant impact for black cockatoos as short-term surveys for bird presence are unlikely to give a true representation of habitat use. Targeted black cockatoo habitat assessments should be undertaken in areas within the range focusing on key criteria such as foraging, roosting and breeding. Details on habitat types used by each black cockatoo species for breeding, foraging and night roosting are provided in Table 12. Known breeding and night roosting trees for black cockatoos are generally large with a diameter at breast height (DBH) of at least 500 mm, or 300 mm for salmon gum and wandoo (DAWE, 2022).

Table 12: Habitats used by black cockatoos (DAWE, 2022).

Habitat	Baudin's Cockatoo	Carnaby's Cockatoo	Forest Red-tailed Black Cockatoo
Breeding	Generally in woodland or forest, but may also breed in partially cleared woodland or forest, including isolated trees. Nest in hollows in live or dead trees (many eucalypt species may provide suitable hollows), particularly karri *(Eucalyptus diversicolor)*, marri, jarrah, wandoo, bullich *(E. megacarpa)* and tuart.	Generally in woodland or forest, but also breeds in partially cleared woodland or forest, including isolated trees. Nest in hollows in live or dead trees (many eucalypt species may provide suitable hollows), particularly salmon gum, wandoo, tuart, jarrah, flooded gum *(E. rudis)*, York gum, powderbark *(E. accedens)*, karri and marri.	Generally in woodland or forest, but may also breed in partially cleared woodland or forest, including isolated trees. Nest in hollows in live or dead trees (many eucalypt species may provide suitable hollows), particularly marri, karri, wandoo, bullich, blackbutt *(E. patens)*, tuart and jarrah.
Night roosting	Generally in or near riparian environments or other permanent water sources. Any tall trees may provide roosting habitat, but particularly jarrah, flooded gum, blackbutt, tuart and introduced eucalypts (blue gum *(E. globulus)*, lemon scented gum *(Corymbia citriodora)*.	Generally in or near riparian environments or natural and artificial permanent watersources. Any tall trees may provide roosting habitat, but particularly flat-topped yate *(E. occidentalis),* salmon gum, wandoo, marri, karri, blackbutt, tuart, introduced eucalypts and introduced pines.	Any tall trees may provide roosting habitat, but particularly tall jarrah, marri, blackbutt, tuart and introduced eucalypt trees or large trees on the edges of forests.

Habitat	Baudin's Cockatoo	Carnaby's Cockatoo	Forest Red-tailed Black Cockatoo
Foraging and common food items	Primarily seeds of marri, rarely jarrah, in woodlands and forest, and seeds of native proteaceous plant species (for example, *Banksia* spp. (includes *Dryandra* spp.) and *Hakea* 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 (*Anigozanthos flavidus*); tips of *Pinus* spp.; *Macadamia* spp., almonds and pecans; seeds of apples and pears; and persimmons.	Native shrubland, kwongan heathland and woodland on seeds, flowers and nectar of native proteaceous plant species (*Banksia* spp., *Hakea* spp. and *Grevillea* spp.), as well as *Callistemon* spp. and marri. Also seeds of introduced species including *Pinus* spp., *Erodium* spp., wild radish, canola, almonds, macadamia and pecan nuts; insects and insect larvae; occasionally apples and persimmons; and liquidambar.	Primarily seeds of jarrah and marri in woodlands and forest, and edges of karri forests, including wandoo and blackbutt. Forages on *Allocasuarina* cones, fruits of snottygobble (*Persoonia longifolia*) and mountain marri (*C. haematoxylon*). Other less important foods include blackbutt, bullich, *Allocasuarina fraseriana*, *Hakea* spp., tuart, redheart moit (*E. decipiens*) and bushy yate (*E. lehmanni*). Also some introduced eucalypts such as river red gum (*E. camaldulensis*) and rose gum (*E. grandis*). On the Swan Coastal Plain, often feeds on introduced cape lilac (*Melia azedarach*), *E. caesia, E. erythrocorys, l*emon-scented gum and kaffir plum (*Harpephyllum caffrum*).

3.2.1 Breeding Habitat

DAWE *Referral Guideline for 3 WA Threatened Black Cockatoo Species* (DAWE, 2022) define breeding habitat as habitat that contains known, suitable, or potential nesting trees, including:

- Known nesting trees: Trees (live or dead, but still standing) which contain a hollow/s where black cockatoo breeding has been recorded or which demonstrate evidence of breeding (i.e. showing evidence of use through scratches, chew marks or feathers).
- Suitable nesting trees: Trees with suitable nesting hollows present, although no evidence of use.
- Potential nesting trees: Trees that have a suitable DBH to develop a nest hollow, but do not currently have hollows. Trees suitable to develop a nest hollow in the future are 300-500mm DBH.

The DAWE referral guidelines define suitable nesting hollows as any hollow with dimensions suitable for use for nesting by black cockatoos (DAWE, 2022). Trees which contain deep, near vertical hollows with an entrance diameter of >100 mm and are >10 m high are classified as suitable for use by black cockatoos(Whitford, 2002; Whitford & Williams, 2002).

Suitability of each breeding habitat tree identified was assessed from ground level and breeding habitat trees were categorised using the definitions within Table 13**.** For trees with a suitable DBH which are functionally capable of supporting a nest hollow, the following information was recorded:

- Fauna habitat.
- Fauna species.
- Flora species.
- DBH.
- Hollow suitability category (as per Table 13).
- Location (using a Global Positioning System [GPS]).
- Photographs of any trees classified as category 1, 2 or 3.

Trees with DBH > 500 mm (>300 mm for wandoo and salmon gum) which were deemed functionally unable to support a nest hollow (e.g. trees that branch into multiple thin trunks with DBH <500 mm within a metre of breast height or trees with completely hollowed out trunks), were excluded at the discretion of the recorder.

Table 13: Breeding habitat tree categories.

Tree Category	Description
Known nesting tree	**Tree with suitable DBH which contains hollows where breeding has been recorded or evidence of breeding (scratches, chew marks or feathers)**
Suitable nesting tree (confirmed)	**Trees with suitable DBH which contains suitable nesting hollows, although no evidence of use (confirmed). Internal characteristics assessed.**
Suitable nesting tree (unconfirmed)	**Trees with suitable DBH which contains suitable nesting hollows, although no evidence of use visible from ground level. Internal characteristics not assessed.**
Potential nesting tree	**Trees with suitable DBH containing unsuitable nest hollows or no visible hollows.** Note – multiple stemmed trees that branch above DBH may not be suitable.

3.2.2 Roosting Habitat

Black cockatoo flocks show strong fidelity to night roosts. Generally, these roost trees are close to and provide access to nearby high-quality foraging sites and an important water source. According to DAWE (2022) night roosting habitat is classified as habitat that contains one, or a group of, known or potential roosting trees, including:

- Known roosting tree: a tree (generally the tallest), native or introduced, known to be used for night roosting or which demonstrates evidence of roosting. Usually close to an important water source and within an area of high-quality foraging habitat
- Potential roosting tree: a tall tree of any species within close proximity to water.

Trees with a DBH greater than 500 mm may be tall enough to provide roosting habitat for black cockatoos (Department of Sustainability Environment Water Population and Communities, 2012). Black cockatoos tend to have traditional roosting sites and these have been documented in the Great Cocky Count (Byrne, Barrett, Blythman, Finn, & Williams, 2015).

3.2.3 Foraging Habitat

Black cockatoos rely on foraging resources to provide sufficient energy for their movements across their range, and the availability of foraging habitat plays a critical role in the post-breeding period when individuals need to build condition after breeding and teach juveniles where foraging resources are located (Commonwealth of Australia, 2017).

The DAWE referral guidelines define foraging habitat as any vegetation containing plant species known to support foraging (Table 12) within the range of each black cockatoo species (DAWE, 2022).

Habitat assessments and associated field observations must be sufficient to complete the scoring tool, provide justification for scores given to each attribute and support overall appraisal of foraging habitat quality (DAWE, 2022). This tool only applies to foraging areas >1 ha in size, as clearing of foraging habitat <1 ha in size is unlikely to require referral.

The survey area was traversed on foot and food sources known to be utilised by black cockatoos were identified and quantified in both the over-storey and under-storey to complete the DAWE foraging quality scoring tool. A concurrent flora and vegetation assessment of the survey area facilitated this assessment. Specific effort was made to document sightings of black cockatoos in addition to evidence of chew marks around hollows or feeding debris (including characteristically chewed *Banksia* or pinecones and marri nuts). As feeding debris can remain on the ground for up to two years, foraging evidence can be assessed at any time of the year (DAWE, 2022).

3.3 STUDY TEAM AND LICENCES

The personnel undertaking this assessment and project roles are listed in Table 14.

Table 14: Project staff and licences.

Project staff				
Name	**Qualification**	**Role**	Project role	Experience
Shaun Grein	B.App. Sc (Biol.); Grad. Dip. Nat. Resources; MBA	Managing Director/Senior Principal Scientist	Project management, QA	30+
Sandra Ng	B.Sc (MarineBiol., Cons. & WildlifeBiol.); Dip. Biomedical Sc.	Botanist	Field survey, GIS, reporting	2+
Amelia Shepherdson	B.Sc. (Botany)	Botanist	Field survey, GIS, reporting	2+
Licences				
Sandra Ng	Flora Taking (Biological Assessment) Licence: FB62000543 (exp. 23/03/2026)			
Amelia Shepherdson	Flora Taking (Biological Assessment) Licence: FB62000723 (exp. 28/08/2025) Authorisation to Take or Disturb Threatened Species: TFL-2425-0045 (exp. 30/07/2027)			

3.4 LIMITATIONS AND CONSTRAINTS

An assessment of survey-specific issues and limitations is detailed in Table 15. There were no significant limitations identified for either survey.

Table 15: Flora and vegetation survey limitations.

Aspect	Assessment	Constraint
Availability of contextual information at a regional and local scale	Broad vegetation, land system, soil, and geology mapping data were available for the survey area, in addition to DBCA Threatened and Priority Ecological Community spatial data. This information was adequate to provide appropriate contextual information for the survey.	Nil
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed	The personnel undertaking field work and specimen identification were suitably qualified and have conducted numerous botanical surveys within the Southwest botanical province. Key personnel leading the field survey and undertaking specimen identification, data analysis, vegetation mapping, and reporting have over 2 years' experience with flora and vegetation surveys in the Jarrah Forest region.	Nil
Proportion of flora recorded and/or collected, any identification issues	All species encountered during the survey were recorded within sampling sites or opportunistically. Representative specimens of all taxa recorded in the field were collected for confirmation. Nineteen specimens (ca. 42%) could not be identified to species level due to a lack of required reproductive material; this is considered to have only minor impact on the survey as it does not affect the classification of plant communities at this scale. None of these specimens were believed to correspond to any significant species nor were any considered to be anomalous.	Minor
Was the appropriate area fully surveyed (effort and extent)	Three sampling sites were assessed. The appropriate area was sufficiently surveyed.	Nil
Access restrictions within the survey area	There were no access restrictions.	Nil
Survey timing, rainfall, season of survey	The survey was conducted on the 22 July 2025 during the primary survey season for detailed flora and vegetation surveys in the Southwest botanical province. There was higher than average rainfall immediately preceding the survey.	Nil
Disturbance that may have affected the results of survey such as fire, flood or clearing	No significant limitations identified. The survey area was not affected by any recent fire that might have affected the results of the survey.	Nil

4 RESULTS

4.1 FLORA

4.1.1 Floristic Diversity and Estimated Species Richness

A total of 44 vascular plant taxa (species and infraspecific taxa) representing 20 families and 31 genera were recorded during the survey within 3 sampling sites (quadrats and relevés) and opportunistically (Appendix B). Of these species, 7 (ca. 16%) were annuals or short-lived perennials, and 17 (ca. 39%) were introduced. The naturalised status of eight species (ca. 18%) could not be determined, as the species could not be sufficiently identified due to a lack of flowering or fruiting material. The most dominant families in terms of species richness were the Fabaceae (9 taxa), Myrtaceae (8 taxa), Asteraceae (4 taxa) and Poaceae (4 taxa). The most dominant genera were *Eucalyptus* (4 taxa) and *Acacia* (4 taxa) (Appendix B). Most genera (29) were represented by only one taxon.

4.1.2 Significant Species

Threatened and Priority listed species

Representative areas of each of the major landforms and plant communities were traversed on foot to record significant plant species. No EPBC Act or BC Act listed Threatened species were observed. No DBCA listed Priority taxa were recorded.

Atypical specimens

Several specimens collected were unable to be identified to species level due to a lack of reproductive material required for positive identification but were not considered to be otherwise anomalous. No atypical specimens were recorded.

Range extensions

Based on current Atlas of Living Australia records (including all Western Australia Herbarium records), there were no species records representing range extension of greater than 100 km from the nearest known records. There were no new bioregional range extensions recorded (i.e., new records for the Jarrah Forest and Swan Coastal Plain IBRA bioregions).

4.1.3 Introduced Species

Seventeen introduced plant species were recorded (Table 16). Sixteen are listed as 'Permitted - s11' on the WAOL(DPIRD, 2007–). There was one Declared Pest (Declared Pests -s22(2)) and one WONS recorded: *Asparagus asparagoides*. Ecological impact and invasiveness ratings have been determined for introduced species in the Southwest region using the Weed Prioritisation Process (DPaW, 2013), which are listed for these species in Table 16.

Table 16: Summary of introduced species recorded within the survey area.

Species	Common name	Family	BAM Act status	Ecological impact[1]	Invasiveness[1]
Asparagus asparagoides	Bridal creeper	Asparagaceae	Declared Pest - s22(2)	High	High
Erigeron bonariensis	Flax-leaf fleabane	Asteraceae	Permitted - s11	Unknown	Unknown
Gazania linearis	Gazania	Asteraceae	Permitted - s11	Low	Unlisted
Sonchus oleraceus	Common sowthistle	Asteraceae	Permitted - s11	Moderate	Moderate
?Leucaena leucocephala	Lead tree	Fabaceae	Permitted - s11	Unlisted	Unlisted
Acacia iteaphylla	Finders Range wattle	Fabaceae	Permitted - s11	Unknown	Unknown
Acacia longifolia ?subsp. *longifolia*	Sallow wattle	Fabaceae	Permitted - s11	Unknown	Unknown
Chamaecytisus palmensis	Tree lucerne	Fabaceae	Permitted - s11	High	High
Lupinus angustifolius	Narrow-leaf lupin	Fabaceae	Permitted - s11	Moderate	Moderate
Gaudium laevigatum	Coast teatree	Myrtaceae	Permitted - s11	High	Rapid
Olea europaea subsp. *europaea*	Olive	Oleaceae	Permitted - s11	High	Unlisted
Oxalis pes-caprae	Soursob	Oxalidaceae	Permitted - s11	High	High
Pinus pinaster	Pinaster pine	Pinaceae	Permitted - s11	Moderate	Moderate
Cenchrus setaceus	Fountain grass	Poaceae	Permitted - s11	Moderate	Rapid
Eragrostis curvula	African lovegrass	Poaceae	Permitted - s11	High	High
Lysimachia arvensis	Pimpernel	Primulaceae	Permitted - s11	Unknown	Unknown
Solanum nigrum	Blackberry nightshade	Solanaceae	Permitted - s11	Unknown	Unknown

[1]Rating based on the Western Australian Weed Prioritisation Process.

4.2 VEGETATION

4.2.1 Vegetation Types

One vegetation type (CcAsOp), which consisted mainly of remnant or planted (for rehabilitation) native trees (*Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata*), over shrubs (primarily *Acacia saligna*), over introduced grasses and herbs (primarily **Oxalis pes-caprae* and *Poaceae spp.), was described from floristic data collected from three sampling sites (Map 12, Figure 2). This vegetation type covered 1.19 ha (47%) of the survey area and occurred on hills with light brown to yellow to grey sand. The remainder of the survey area was cleared (1.34 ha, 53%).

Floristic features (dominant species and frequently occurring species) and relevant attributes (landform, soils, vegetation condition, and species richness) used to characterise this vegetation type are shown in

Table 17. Raw sampling site data are shown in Appendix D.

4.2.2 Vegetation Condition

Vegetation condition according to the EPA (2016) scale was recorded at each sampling site and was assessed periodically along traverses. The vegetated parts of the survey area were assessed as 'Completely Degraded' (1.19 ha, 47%), owing to significant infestation of introduced species, past clearing, and obvious changes to vegetation structure (Map 13).

4.2.3 Significant Vegetation

Threatened and Priority Ecological Communities

There were no plant communities recorded that corresponded to any state (DBCA) or Commonwealth (EPBC Act) listed Threatened Ecological Community (TEC), nor to any state listed Priority Ecological Community (PEC).

Other Potentially Significant Vegetation

Vegetation type CcAsOp was assessed for potential national, state, regional, and local significance according to the criteria described in Table 10. This vegetation type does not have national, state, or regional significance based on the assessed criteria. It is also noted that the vegetation was not riparian and did not occur in association with a wetland.

Table 17: Summary of vegetation types within the survey area – group characterisation, associated landforms, condition, species richness, and extent.

Map code	Broad floristic formation (NVIS III)	Vegetation type name (NVIS V compatible)	Frequently occurring species	Landform and soils	Vegetation condition	Mean site species richness (range)	Extent (ha) (%)	Sites
CcAsOp	*Corymbia* low open forest	*Corymbia calophylla* low open forest; *Acacia saligna* tall sparse shrubland; **Oxalis pes-caprae* and *Poaceae spp. sparse forbland/grassland.	*Corymbia calophylla, *Acacia longifolia*, **Acacia iteaphylla, Allocasuarina fraseriana, *Oxalis pes-caprae,* *Poaceae sp.	Hill, light brown - yellow - grey sand	Completely Degraded	18 (15 - 20)	1.19 (47%)	GOS01, GOS02, GOS03
Cleared	–	–	–	–	–	–	1.34 (53%)	–



Survey area

SiteType

Quadrat

Releve

Vegetation type

CcAsOp

Cleared

ecologia ENVIRONMENT

Project No.: 2058
Author: SN-W
Created Date: 5 August 2025
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:1,500 @A3

Map 12: Vegetation types recorded within the survey area.

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

0 10 20 40 60 80 100

Meters



Survey area

Vegetation condition

Cleared

Completely Degraded

ecologia ENVIRONMENT

Project No.: 2058
Author: SN-W
Created Date: 5 August 2025
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:1,500 @A3

Map 13: Vegetation condition within the survey area.

0 10 20 40 60 80 100
Meters

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



CcAsOp: *Corymbia calophylla* low open forest; *Acacia saligna* tall sparse shrubland; *Oxalis pes-caprae* and Poaceae spp. sparse forbland/grassland.

Figure 2: Representative photograph of vegetation type CcAsOp.

4.3 FAUNA

4.3.1 Black Cockatoo Habitat Assessment

The survey area contained scattered patches of rehabilitated eucalypt woodlands, comprising *Eucalyptus rudis* subsp. *rudis* (flooded gum), *Eucalyptus camaldulensis* (river red gum), *Eucalyptus marginata* (jarrah) and *Corymbia calophylla* (marri).

4.3.1.1 Breeding Habitat

All trees within the survey area were <300 mm DBH and are therefore not suitable as breeding habitat.

4.3.1.2 Roosting Habitat

All trees within the survey area were <500 mm DBH and therefore not suitable as roosting habitat.

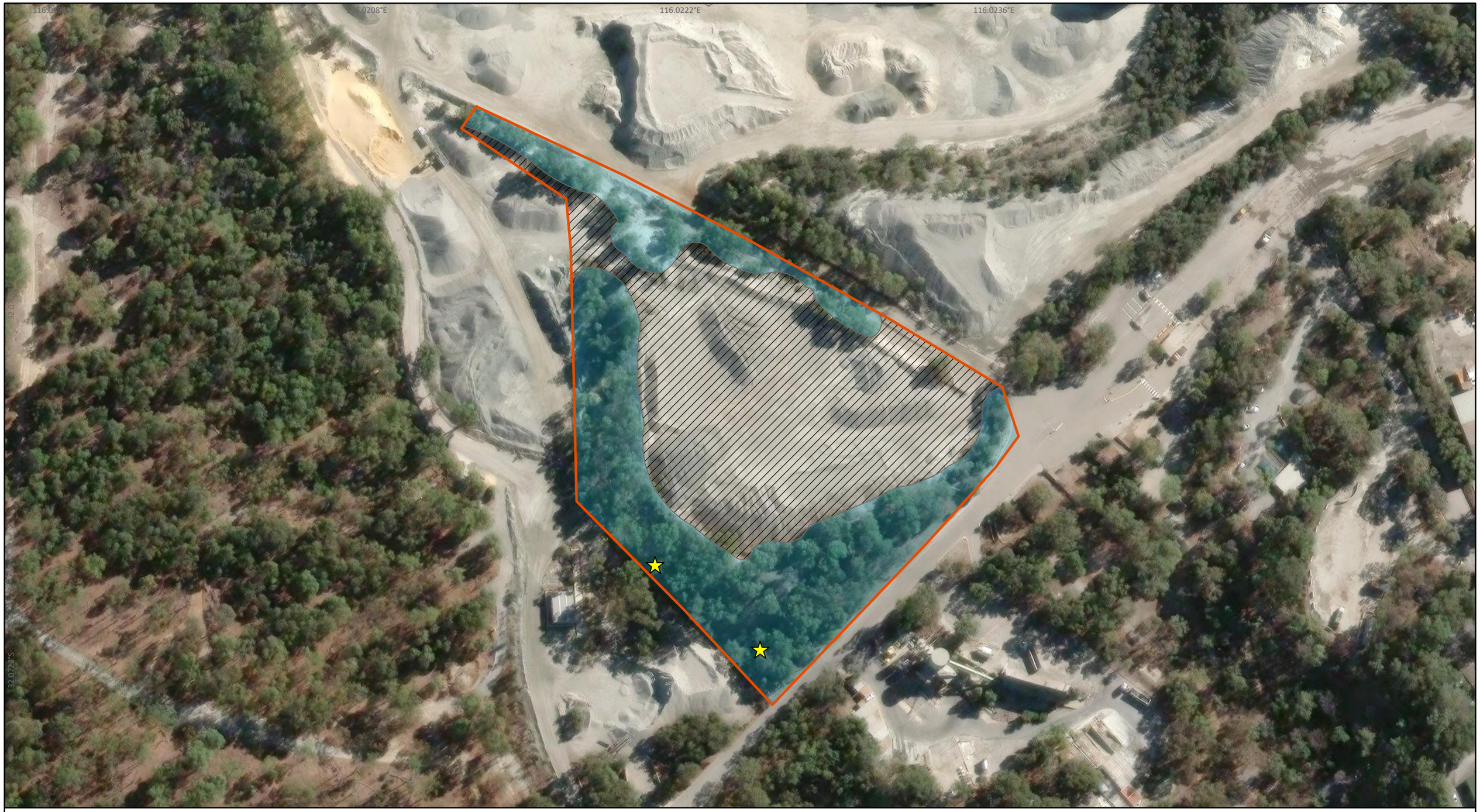
4.3.1.3 Foraging Habitat

The vegetation within the study area contained suitable foraging resources for all species of black cockatoo and was assessed as 'high quality' foraging habitat. Additionally, primary and secondary evidence of black cockatoo foraging was recorded in the southern corner of the survey area.

Black cockatoo foraging habitat and foraging observations are displayed in Map 14.

4.3.1.4 Direct Observations

A pair of forest red-tailed black cockatoos were recorded overflying the southern corner of the survey area during the survey. This pair was observed to land and forage in eucalypt trees immediately adjacent to the boundary of the survey area.



Survey area
Foraging

Foraging
Cleared
Foraging habitat

Project No.: 2058
Author: SN-W
Created Date: 5 August 2025
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Scale: 1:1,500 @A3

Map 14: Black cockatoo foraging habitat in the survey area.

Maxar

0 10 20 40 60 80 100
Meters

5 DISCUSSION

5.1 FLORA

5.1.1 Floristic Diversity

A total of 44 vascular plant taxa were recorded within the survey area. The most dominant families were the Fabaceae, Myrtaceae, Asteraceae, Poaceae, Iridaceae, and Proteaceae; the most dominant genera were *Eucalyptus* and *Acacia*. These dominant groups are consistent with those identified for the area during the desktop assessment, and the overall species diversity and floristic composition of the survey area is typical of the condition of the vegetation and the landforms present.

5.1.2 Significant Species

In the desktop assessment, Threatened or Priority taxa were assessed as potentially occurring within the survey area based on proximity to the survey area and the presence of suitable habitat. The likelihood of occurrence of these species was reassessed following the field survey based on survey effort, the presence of suitable habitat, and vegetation condition (Appendix C). Given the size of the survey area, this level of survey effort is reasonable for determining the likely presence of significant species, especially the more conspicuous perennial taxa. Due to small size of the survey area and the degraded condition of the vegetation, all taxa previously assessed to be 'Likely' were reassessed as 'Unlikely'.

5.1.3 Introduced Species

Seventeen (17) introduced species were recorded within the survey area, one of which was a Declared Pest and WONS: *Asparagus asparagoides*. The naturalised status of 8 species could not be determined. All remaining species are widely naturalised across the Southwest region and their presence within the survey area is not considered unusual.

5.2 VEGETATION

5.2.1 Vegetation Types and Condition

Vegetation within the survey area consisted of one vegetation type: CcAsOp. This vegetation type is dominated by *Corymbia calophylla* low open forest the occur on steep sloped hills associated with the Forrestfield (D Range) F2 phase and Forrestfield (D Range) F6 phase land systems. This vegetation covers 1.19 ha (47%) of the survey area.

Vegetation within the survey area was assessed to be 'Completely Degraded' according to the EPA (2016) vegetation condition scale. This is owed to the high abundance of weed infestation and local clearing.

5.2.2 Significant Vegetation

Vegetation may be considered significant for a range of reasons including, but not limited to: being listed as a Threatened Ecological Community under the BC Act or the EPBC Act; being classified as a Priority Ecological Community by DBCA; having a restricted distribution; the degree of historical impact from threatening processes; playing a role as a refuge for Threatened species; or providing an important function required to maintain ecological integrity of a significant ecosystem (EPA, 2016b). Other environmental features, such as significant watercourses or wetlands may also be considered significant under some circumstances (DER, 2014). The vegetation within the survey area was not considered significant for any reason.

5.3 FAUNA

5.3.1 Black Cockatoo Habitat Assessment

The survey area falls within the modelled distributions of the three black cockatoo species and DBCA database searches identified records of all three species within the desktop study area. An assessment was undertaken to investigate potential breeding habitat, night roosting habitat, and foraging habitat for the three species of black cockatoo within the survey area.

Two forest red-tailed black cockatoos were recorded flying over the survey area during the field survey. This pair was observed to land and forage in eucalypts immediately adjacent to the boundary of the survey area.

The vegetation within the survey area was assessed as 'high quality' black cockatoo foraging habitat as mature marri and jarrah trees were recorded, and foraging evidence was recorded in the southern corner of the survey area.

No potential black cockatoo breeding habitat trees (DBH >500mm) or night roosting trees were recorded during the current survey. It is considered unlikely that black cockatoos are currently breeding or roosting within the survey area, nor will be doing so in the near future.

6 CONCLUSIONS

The biological surveys were conducted on 22 July 2025 and completed in accordance with *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016b)and *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*(EPA, 2020). The key findings for the survey area were:

- A total of 44 vascular plant taxa were recorded.
- Seventeen introduced species were recorded, one of which is listed as Declared Pests or WONS: *Asparagus asparagoides*. The naturalised status of a further eight species could not be determined.
- No EPBC Act or BC Act listed Threatened or DBCA listed Priority species were recorded.
- One vegetation type was record within the survey area, which did not correspond to any EPBC Act or BC Act listed TEC, nor to any DBCA listed PEC. It was not considered to be significant for any other reason.
- Two forest red-tailed black cockatoos were recorded foraging within the survey area.
- No suitable breeding or roosting trees for black cockatoos was observed within the survey area.
- The vegetation within the study area was assessed as 'high quality' foraging habitat for all species of black cockatoo.

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8 APPENDICES

Appendix A Desktop assessment database search results.

Appendix B Plant species recorded within the survey area.]

Family	Taxon	Naturalised Status	WAOL	Ecological Impact	Invasiveness
Aizoaceae	*Carpobrotus* sp.	Potentially Introduced	N/A	–	–
Apiaceae	Apiaceae sp.	Potentially Introduced	N/A	–	–
Asparagaceae	*Asparagus asparagoides*	Introduced	Declared Pest - s22(2)	High	High
Asteraceae	*Asteraceae* sp.	Potentially Introduced	N/A	–	–
Asteraceae	*Erigeron bonariensis*	Introduced	Permitted - s11	Unknown	Unknown
Asteraceae	*Gazania linearis*	Introduced	Permitted - s11	Low	Unlisted
Asteraceae	*Sonchus oleraceus*	Introduced	Permitted - s11	Moderate	Moderate
Casuarinaceae	*Allocasuarina fraseriana*	Native	Permitted - s11	Unlisted	Unlisted
Cupressaceae	*Callitris preissii*	Native	Permitted - s11	Unlisted	Unlisted
Dilleniaceae	*Hibbertia polystachya*	Native	Permitted - s11	Unlisted	Unlisted
Fabaceae	*?Leucaena leucocephala*	Introduced	Permitted - s11	Unlisted	Unlisted
Fabaceae	*Acacia iteaphylla*	Introduced	Permitted - s11	Unknown	Unknown
Fabaceae	*Acacia longifolia* ?subsp. *longifolia*	Introduced	Permitted - s11	Unknown	Unknown
Fabaceae	*Acacia pulchella* var. *pulchella*	Native	Permitted - s11	Unlisted	Unlisted
Fabaceae	*Acacia saligna*	Native	Permitted - s11	Unlisted	Unlisted
Fabaceae	*Chamaecytisus palmensis*	Introduced	Permitted - s11	High	High
Fabaceae	*Gastrolobium* sp.	Native	N/A	–	–
Fabaceae	*Kennedia ?stirlingii*	Native	Permitted - s11	Unlisted	Unlisted
Fabaceae	*Lupinus angustifolius*	Introduced	Permitted - s11	Moderate	Moderate
Iridaceae	Iridaceae sp. GOS02	Potentially Introduced	N/A	–	–
Iridaceae	Iridaceae sp. GOS03	Potentially Introduced	N/A	–	–
Malvaceae	*Thomasia ?macrocarpa*	Native	Permitted - s11	Unlisted	Unlisted
Myrtaceae	*Agonis flexuosa* var. *flexuosa*	Native	Permitted - s11	Unlisted	Unlisted
Myrtaceae	*Calothamnus ?quadrifidus*	Native	Permitted - s11	High	High
Myrtaceae	*Corymbia calophylla*	Native	Permitted - s11	Unlisted	Unlisted
Myrtaceae	*Eucalyptus ?caesia*	Native	Permitted - s11	Unlisted	Unlisted
Myrtaceae	*Eucalyptus ?camaldulensis*	Native	Permitted - s11	Unknown	Unknown
Myrtaceae	*Eucalyptus ?rudis* subsp. *rudis*	Native	Permitted - s11	Unlisted	Unlisted
Myrtaceae	*Eucalyptus marginata* subsp. *marginata*	Native	Permitted - s11	Unlisted	Unlisted
Myrtaceae	*Gaudium laevigatum*	Introduced	Permitted - s11	High	Rapid
Oleaceae	*Olea europaea* subsp. *europaea*	Introduced	Permitted - s11	High	Unlisted
Oxalidaceae	*Oxalis pes-caprae*	Introduced	Permitted - s11	High	High
Pinaceae	*Pinus pinaster*	Introduced	Permitted - s11	Moderate	Moderate

Family	Taxon	Naturalised Status	WAOL	Ecological Impact	Invasiveness
Poaceae	*Cenchrus setaceus*	Introduced	Permitted - s11	Moderate	Rapid
Poaceae	*Eragrostis curvula*	Introduced	Permitted - s11	High	High
Poaceae	Poaceae sp. GOS03A	Potentially Introduced	N/A	–	–
Poaceae	Poaceae sp. GOS03B	Potentially Introduced	N/A	–	–
Primulaceae	*Lysimachia arvensis*	Introduced	Permitted - s11	Unknown	Unknown
Proteaceae	*Banksia sessilis*	Native	Permitted - s11	Unlisted	Unlisted
Proteaceae	*Hakea undulata*	Native	Permitted - s11	Unlisted	Unlisted
Rhamnaceae	?Rhamnaceae sp.	Potentially Introduced	N/A	–	–
Rhamnaceae	*Trymalium ?ledifolium*	Native	Permitted - s11	Unlisted	Unlisted
Solanaceae	*Solanum nigrum*	Introduced	Permitted - s11	Unknown	Unknown
Thymelaeaceae	*Pimelea ?spectabilis*	Native	Permitted - s11	Unlisted	Unlisted

Appendix C Significant plant species recorded within 10 km of the survey area and likelihood of occurrence assessment.

Taxon	WA Status	WA Rank	Habitat	Known flowering period	Possibility of suitable habitat?
Pre-survey likelihood: Possible					
Acacia horridula	P3		Gravelly soils over granite, sand. Rocky hillsides.	May to August	No
Allocasuarina grevilleoides	P3		Sand over laterite, gravel.	—	Unlikely
Asteridea gracilis	P3		Sand, clay, gravelly soils.	September to December	Possible
Calothamnus accedens	P4		Sandy soils over laterite. Road verge.	September to January	Likely
Calothamnus graniticus subsp. *leptophyllus*	P4		Clay over granite, lateritic soils. Hillsides.	June to August	Possible
Goodenia arthrotricha	T	EN	Gravel. Granite rocks, slopes.	October to November	Possible
Paracaleana ferricola	P2		Open gravel with sandy patches. Disturbed areas.	November to December	Yes
Pre-survey likelihood: Unlikely					
Acacia anomala	T	VU	Lateritic soils. Slopes.	August to September	Possible
Acacia aphylla	T	VU	Sand, loam, clay loam. Granite outcrops, hills.	August to October	No
Acacia benthamii	P2		Sand. Typically on limestone breakaways.	August to September	Unlikely
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)	P1		Grey or black sand over clay. Swampy areas, winter wet lowlands.	May or August	Unlikely
Acacia oncinophylla subsp. *patulifolia*	P4		Granitic soils, occasionally on laterite.	August to December	No
Andersonia gracilis	T	VU	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	September to November	No
Andersonia sp. Blepharifolia (F. & J. Hort 1919)	P2		Laterite. Hilltops.	September to November	Unlikely
Anthocercis gracilis	T	VU	Sandy or loamy soils. Granite outcrops.	September to October	No
Aponogeton hexatepalus	P4		Mud. Freshwater ponds, rivers, claypans.	August to September	No
Austrostipa bronweniae	T	EN	Road verges. Yellow brown sand and brown loam. Swamps, seasonal wetlands.	October to November	Possible
Austrostipa jacobsiana	T	CR	Plain. Grey clay/loam. Seasonally wet flats.	October to November	No
Babingtonia urbana	P3		Upper slope, grey sand. Seasonally wet depressions and drainage lines.	December to March	No
Banksia kippistiana var. *paenepeccata*	P3		Lateritic gravelly soils.	October to November	Unlikely
Banksia mimica	T	VU	White or grey sand over laterite, sandy loam.	December to January	No
Banksia pteridifolia subsp. *vernalis*	P3		White/grey sand over laterite. Grows in sandy loam over gravel in low kwongan, and in sand in banksia low open woodland.	September to October	No

Taxon	WA Status	WA Rank	Habitat	Known flowering period	Possibility of suitable habitat?
Beaufortia purpurea	P3		Lateritic or granitic soils. Rocky slopes.	October to December or January to February	Unlikely
Bolboschoenus fluviatilis	P1		Littoral zone. In standing water or wet mud. Wet dark brown silt, grey sand.	November	No
Borya subulata	P4		Sandstone	June	No
Bossiaea modesta	P2		Soils derived from granite. Damp areas close to streams.	October to December	No
Byblis gigantea	P3		Sandy-peat swamps.	September to January	No
Caladenia huegelii	T	CR	Grey or brown sand, clay loam.	August to October	No
Calandrinia uncinella	P1		Wet flats, seasonal swamps. White-grey sandy loam. Clay based wetlands.	August to September	No
Calectasia grandiflora	P2		White, grey or yellow sand, sandy clay, gravel, laterite, granite. Swampy areas, rock outcrops, flats, slopes, ridges.	June to November	Possible
Calytrix breviseta subsp. *breviseta*	T		Sandy clay. Swampy flats.	October to November	No
Calytrix simplex subsp. *simplex*	P1		Ecology unknown; subsp. *oppositifolia* occurs in heath associations on grey sands with lateritic gravel, in closed heath on dark red-brown sandy loam over clay and massive laterite, and with *Eucalyptus tetragona* on sand plain.	October to November	No
Carex tereticaulis	P3		Black peaty sand.	September to October	No
Chamaescilla gibsonii	P3		Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	September	No
Comesperma griffinii	P2		Yellow or grey sand. Plains.	October	No
Comesperma rhadinocarpum	P3		Sandy soils.	October to November	Possible
Commersonia sp. Lesmurdie (A.A. Mitchell 11429)	P2		Cracking clay over basalt sill. Melaleuca woodland.	November to December	No
Conospermum undulatum	T	VU	Grey or yellow-orange clayey sand.	May to October	Unlikely
Cyanicula ixioides subsp. *ixioides*	P4		Laterite, gravel.	August to October	Unlikely
Cyanothamnus tenuis	P4		Gritty brown sandy clay over granite. Creeks, slopes.	August to November	No
Darwinia apiculata	T	EN	Lateritic soils.	October	Unlikely
Diuris brevis	P2		Flat coastal plain. Grey sand, black peaty soil.	August	No
Diuris drummondii	T	EN	Low-lying depressions, swamps.	November to December	No
Diuris purdiei	T	EN	Grey-black sand, moist. Winter-wet swamps.	September to October	No
Drakaea elastica	T	CR	White or grey sand. Low-lying situations adjoining winter-wet swamps.	October to November	No

Taxon	WA Status	WA Rank	Habitat	Known flowering period	Possibility of suitable habitat?
Drosera occidentalis	P4		White-yellow sand, clayey soils. Swamps, seasonally wet depressions and slopes.	October to January	No
Drosera oreopodion	T	CR	Clayey sand sometimes mixed with lateritic pebbles.	September to October	Possible
Drosera patens	P1		Sandy soils. Margins of winter-wet depressions, swamps and lakes.	December to February	No
Eleocharis keigheryi	T	VU	Clay, sandy loam. Emergent in freshwater: creeks, claypans. In seasonally filled clay pans and drainage lines, in water about 15 cm deep, in clayey soils.	—	No
Eremophila glabra subsp. *chlorella*	T	EN	Sandy clay. Winter-wet depressions.	July to November	No
Eriochilus glareosus	P1		Gravel scrapings. Sandy lateritic gravel.	June	Unlikely
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)	P3		Seasonally wet depressions and clay flats. Black sand.	September to November	No
Eryngium sp. Subdecumbens (G.J. Keighery 5390)	P3		Seasonally inundated claypan. Grey to grey-white clay.	—	No
Grevillea pimeleoides	P4		Gravelly soils over granite. Valleys, hillsides.	May to November	Unlikely
Grevillea thelemanniana	T	CR	Sand, sandy clay. Winter-wet low-lying flats.	May to November	No
Haemodorum loratum	P3		Grey or yellow sand, gravel.	November	Likely
Halgania corymbosa	P3		Gravelly soils, soils over granite.	August to November	No
Haloragis aculeolata	P2		Black sand or clay over limestone. Winter-wet areas.	December	No
Hydrocotyle lemnoides	P4		Swamps.	August to October	No
Isopogon autumnalis	P3		Occurs in sandy soils, often in banksia woodlands.	—	Unlikely
Isotropis cuneifolia subsp. *glabra*	P3		Sand, clay loam. Winter-wet flats.	September	No
Jacksonia gracillima	P3		Drainage areas and floodplains, sandplains. Grey sand, brown loam.	October to November	No
Johnsonia pubescens subsp. *cygnorum*	P2		Grey-white-yellow sand. Flats, seasonally-wet sites.	September	No
Lasiopetalum bracteatum	P4		Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, granite outcrops.	August to November	Possible
Lasiopetalum glutinosum subsp. *glutinosum*	P3		Granite outcrops and creeks.	September to December	No
Lepidosperma rostratum	T	EN	Peaty sand, clay.	—	No
Lepyrodia curvescens	P2		Wetlands and swamps.	September to November	No
Leucopogon sp. Busselton (D. Cooper 243)	P2		Flats, seasonally damp wetlands. Brown clayey sand, grey sand.	August to September	No

Taxon	WA Status	WA Rank	Habitat	Known flowering period	Possibility of suitable habitat?
Meionectes tenuifolia	P3		Sand or clay. Wetlands and swamps.	September to December	No
Microtis quadrata	P4		Drainage lines, swamps, seasonally wet flats. Laterite. Brown loam, grey sand.	October to December	No
Morelotia australiensis	T	VU	Flat. Light brown sand clay loam.	December	No
Myriophyllum echinatum	P3		Clay. Winter-wet flats.	October to November	No
Ornduffia submersa	P4		Pools, lakes, swamps, winter-wet depressions.	September to October	No
Pimelea rara	P4		Lateritic soils.	December or January	Unlikely
Pithocarpa corymbulosa	P3		Gravely or sandy loam. Granite outcrops.	January to April	No
Ptilotus pyramidatus	T	CR	Fringing saline wetlands. Seasonally inundated floodplains. Grey to grey-white sandy clay, sandy mud.	October to December	No
Ptilotus sericostachyus subsp. *roseus*	X	EX	—	—	Unknown
Rytidosperma racemosum var. *racemosum*	P2		Road verges. Brown loam. Laterite.	June	Possible
Schoenus benthamii	P3		White, grey sand, sandy clay. Winter-wet flats, swamps.	October to November	No
Schoenus capillifolius	P3		Brown mud. Claypans.	September to November	No
Schoenus loliaceus	P2		Sandy soils. Winter-wet depressions.	October to November	No
Schoenus natans	P4		Winter-wet depressions.	August to November	No
Schoenus pennisetis	P3		Grey or peaty sand, sandy clay. Swamps, winter-wet depressions.	August to September	No
Schoenus sp. Beaufort (G.J. Keighery 6291)	P1		Mud. Winter-wet claypans.	—	No
Schoenus sp. Waroona (G.J. Keighery 12235)	P3		Clay or sandy clay. Winter-wet flats.	October to November	No
Scholtzia sp. Bickley (W.H. Loaring s.n. PERTH 06165184)	X	EX	—	—	Unknown
Senecio leucoglossus	P4		Gravelly lateritic or granitic soils. Granite outcrops, slopes.	August to December	No
Stackhousia sp. Red-blotched corolla (A. Markey 911)	P3		Light grey gritty clay, with surface granitic cobbles, on a gentle southern upper slope.	June to September	No
Stenanthemum sublineare	P2		Littered white sand. Coastal plain.	October to December	No
Stylidium aceratum	P3		Sandy soils. Swamp heathland.	October to November	No
Stylidium longitubum	P4		Seasonal wetlands.	November	No
Stylidium striatum	P4		Brown clay loam over laterite. Hillslopes. Jarrah/marri forest, wandoo woodland.	October to November	Unlikely
Styphelia filifolia	P3		Sandplains. Yellow sand.	March to May	Unlikely
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	T	CR	Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	October	No

Taxon	WA Status	WA Rank	Habitat	Known flowering period	Possibility of suitable habitat?
Thelymitra magnifica	T	CR	Stony ridges.	October to November	No
Thelymitra stellata	T	EN	Sand, gravel, lateritic loam.	October to November	Unlikely
Thysanotus anceps	P3		White or grey sand, lateritic gravel, laterite.	October to December	Unlikely
Thysanotus cymosus	P3		Clay, granitic or lateritic sand.	September to October	No
Thysanotus glaucus	P4		White, grey or yellow sand, sandy gravel.	November to February	Possible
Tripterococcus sp. Brachylobus (A.S. George 14234)	P4		Grey, black or peaty sand. Winter-wet flats.	October to November	No
Verticordia lindleyi subsp. *lindleyi*	P4		Sand, sandy clay. Winter-wet depressions.	November to January	No

Appendix D Flora and vegetation sampling site data.

GOS01

Date	22/07/2025	**Site type**	10 m x 10 m	**Botanist**	AS
Northwest corner	50H 407674.08 mE 6451269.52 mN				
Landform	Hill	**Slope**	Steep		
Soil colour	Yellow	**Soil texture**	Sand		
Rock type	Granite	**Rock size**	Boulders	**Rock cover**	30 – 70
Vegetation condition	Completely Degraded	**Disturbance**	Cleared, weeds, litter.		
Time since fire	No evidence				



Name	Stratum	Percent cover (%)
Callitris preisii	Tree (<10 m)	10 – 24
Eucalyptus ?caesia	Tree (<10 m)	10 – 24
Calothamnus ?quadrifidus	Tree (<10 m)	5 – 9
?Leucaena leucocephala	Tree (<10 m)	1 – 4
Corymbia calophylla	Tree (<10 m)	5 – 9
Agonis flexuosa var. *flexuosa*	Tree (<10 m)	Assoc.
Apiaceae sp.	Herb (<0.5 m)	< 1
Carpobrotus sp.	Herb (<0.5 m)	5 – 9
Cenchrus setaceus	Tussock Grass (0.5-1 m)	5 – 9

GOS02

Date	22/07/2025	**Site type**	10 m x 10 m	**Botanist**	AS
Northwest corner	50H 407754.83 mE 6451160.77 mN				
Landform	Hill	**Slope**	Steep		
Soil colour	Light Brown	**Soil texture**	Sand		
Rock type	Granite	**Rock size**	Mixed	**Rock cover**	10 – 30
Vegetation condition	Completely Degraded	**Disturbance**	Cleared, weeds, litter.		
Time since fire	No evidence				



Name	Stratum	Percent cover (%)
Acacia longifolia ?subsp. *longifolia*	Tree (<10 m)	33 – 49
Allocasuarina fraseriana	Tree (<10 m)	25 – 32
Pinus pinaster	Tree (<10 m)	10 – 24
Eucalyptus ?rudis subsp. *rudis*	Tree (<10 m)	10 – 24
Acacia iteaphylla	Shrub (>2 m)	25 – 32
?Rhamnaceae sp.	Shrub (1-2 m)	1 – 4
Gaudium laevigatum	Shrub (1-2 m)	5 – 9
Pimelea ?spectabilis	Shrub (1-2 m)	5 – 9
Acacia pulchella var. *pulchella*	Shrub (0.5-1 m)	5 – 9
Hibbertia polystachya	Shrub (0.5-1 m)	1 – 4
Thomasia ?macrocarpa	Shrub (0.5-1 m)	1 – 4
Gastrolobium sp.	Shrub (0.5-1 m)	5 – 9
Asparagus asparagoides	Herb (<0.5 m)	< 1
Sonchus oleraceus	Herb (<0.5 m)	5 – 9
Iridaceae sp. GOS02	Tussock Grass (<0.5 m)	5 – 9

GOS03

Date	22/07/2025	**Site type**	Relevé	**Botanist**	AS
Northwest corner	50H 407735.57 mE 6451306.39 mN				
Landform	Hill	**Slope**	Steep		
Soil colour	Grey	**Soil texture**	Sand		
Rock type	Granite	**Rock size**	Mixed	**Rock cover**	> 70
Vegetation condition	Completely Degraded	**Disturbance**	Cleared, weeds, litter.		
Time since fire	No evidence				



Name	Stratum	Percent cover (%)
Eucalyptus ?camaldulensis	Tree (<10 m)	N/A
Eucalyptus marginata subsp. *marginata*	Tree (<10 m)	N/A
Acacia saligna	Shrub (1-2 m)	N/A
Olea europaea subsp. *europaea*	Shrub (0.5-1 m)	N/A
Asteraceae sp.	Herb (<0.5 m)	N/A
Trymalium ?ledifolium	Herb (<0.5 m)	N/A
Erigeron bonariensis	Herb (<0.5 m)	N/A
Oxalis pes-caprae	Herb (<0.5 m)	N/A
Iridaceae sp. GOS03	Herb (<0.5 m)	N/A
Lysimachia arvensis	Herb (<0.5 m)	N/A
Solanum nigrum	Herb (<0.5 m)	N/A
Lupinus angustifolius	Herb (<0.5 m)	N/A
Gazania linearis	Herb (<0.5 m)	N/A
Eragrostis curvula	Tussock Grass (0.5-1 m)	N/A
Poaceae sp. GOS03A	Tussock Grass (<0.5 m)	N/A
Poaceae sp. GOS03B	Tussock Grass (<0.5 m)	N/A